THE STREET RAILWAY REVIEW

VOLUME XV

1905

CHICAGO
KENFIELD PUBLISHING COMPANY
45-47 PLYMOUTH COURT

INDEX TO VOLUME XV.

PAGING BY MONTHS.

A

B

*Articles marked with an asterisk are accompanied by illustrations; e, editorial.

C

153200

M

N

O

P

Q

R

S

T

U

V

W

Y

STREET RAILWAY REVIEW

Vol. XV | JANUARY 15, 1905 | No. 1

Miscellaneous Equipment of the United Railroads of San Francisco.

The miscellaneous equipment of many electric roads consists of old car bodies, trucks, motors, etc., that cannot be used for any other purpose. Any old thing is considered good enough for a freight, rock, or tower car. The inspection and care devoted to this class of equipment are usually very limited in extent. The natural result is that just when one of these cars is needed the most, it has a burned out motor, a truck out of order, or the body out of repair. Time, patience and worst of all, money, is lost. Furthermore this class of equipment usually does not meet the exact requirements for which it is used. A great deal of money can be wasted in a remarkably short time by not having the proper car to haul rails, sand. rock, ties, freight, etc. In this respect the United Railroads of San Francisco has taken a decided stand and that is that if first-class equipment is good for passenger cars, it is doubly so for its miscellaneous equipment. The inspection and care of miscellaneous equipment must be as good or better than for passenger cars.

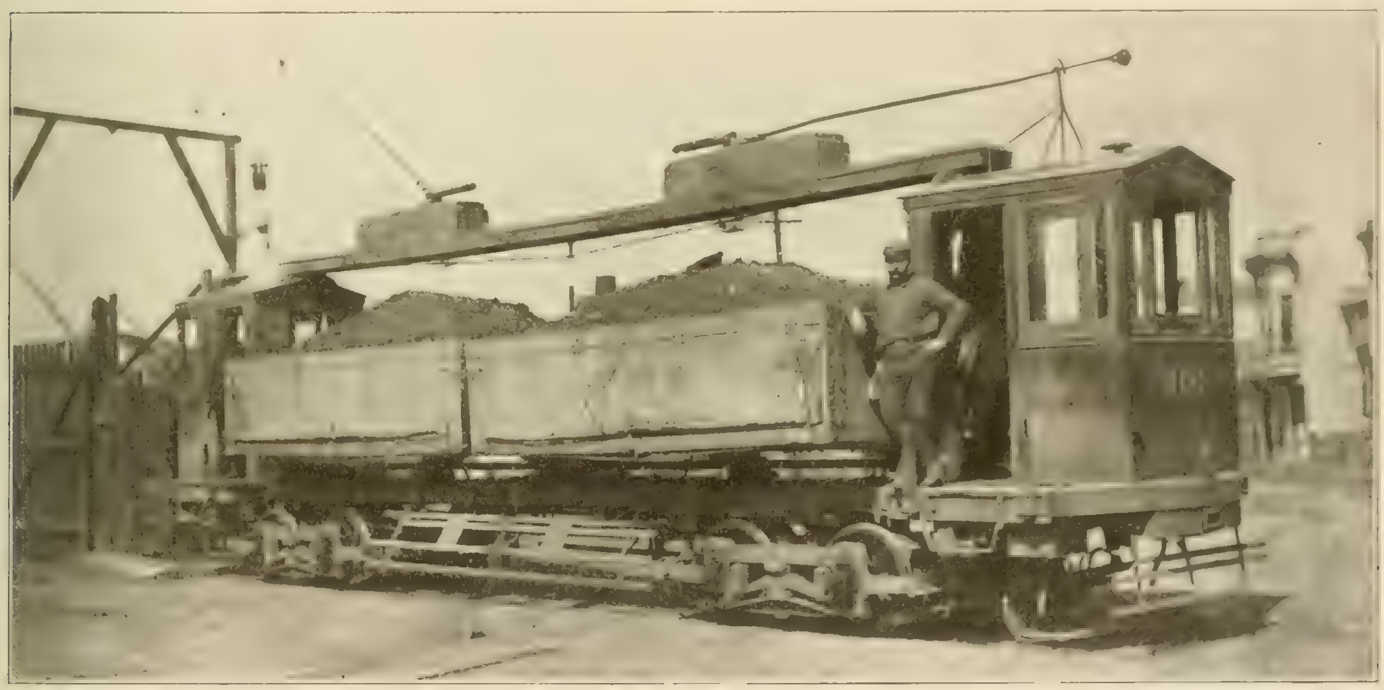
The miscellaneous equipment of the company consists of two kinds, viz.: Revenue and Non-Revenue cars. The Revenue cars are those, outside of passenger cars, from which a direct revenue is derived. Among these are 2 parlor cars, 2 observation cars, 3 funeral cars, 1 electric mail car, 2 cable mail cars, and 2 street sweepings cars.

The parlor cars are the "San Francisco" and the "Hermosa." The San Francisco is a closed car 38 ft. over bumpers, and is divided into three compartments. The middle compartment is 19 ft. long, and might be termed the parlor. The end compartments contain a buffet, ice chest, coat hooks, motorman's cab, etc., and are also used for smoking rooms. The outside of the car is painted a Brewster green, with gold striping and lettering. The interior is finished in natural oak, and is furnished with stained rattan chairs, red plush cushions, red plush curtains, lined with cream colored silk; red portieres, fancy bronze electroliers, Pullman car tables, Wilton carpet in middle section, and linoleum in open sections. The car is mounted on McGuire 39-A trucks and equipped with four G. E. 58 motors, National Electric air brakes, and lever hand brakes. The gear ratio is 22:62 and a speed of 30 miles per hour is readily attained. This car is chartered to private parties, but only on presentation of the best of references. It is also used by the officers of the company, on state occasions. It is considered quite the proper thing to charter this car for theater parties, serving a supper in the car after the theater.

The "Hermosa" parlor car was built by the St. Louis Car Co. and is an older car than the "San Francisco," but has recently been overhauled and renovated so that it is virtually as good as new. This car has one large center section and a motorman's cab on each end. It is painted Tuscan red, with gold striping and lettering. The interior is finished in cherry; with terra cotta colored velour curtains and cushions, rattan chairs, moss green Wilton carpet, fancy sideboard, etc. An ice chest is provided for on one platform. The equipment consists of four G. E. 58 motors, Brill 27-G trucks, hand and track lever brakes. An advertisement that appeared in "Transit Tidings" gives rates and general information. The car is used for sightseeing, threatre parties, etc.

The observation cars are named the "California" and the "Golden Gate."

Both were built in the company's shops. The California is 42 ft. over bumpers; it has monitor roof and drop platforms. It contains twelve 38-in. cross rattan seats on each side, and a 24-in. isle in the center. It is finished in ash in its natural color, veneered ceiling, etc., and is painted a Tuscan red with gold striping. It is [illegible]



CAR FOR HAULING STREET SWEEPINGS—UNITED RAILROADS OF SAN FRANCISCO.

Parlor Car Advertisement.

[illegible]

Handsomely upholstered. Beautifully furnished, seating 30 persons. May be chartered as a party car, at the following rates:

Within city limits,

During the day, - - - [illegible]

Minimum charge, - $10.00.

Evenings, 7 p. m. to 1 a. m. - - - [illegible]

This Company is prepared to furnish other cars at reasonable rates.

United Railroads of San Francisco,

Room 822 Rialto Building,

New Montgomery and Mission Sts., San Francisco, Cal.

G. F. Chapman, General Manager.

with four G. E. 58 motors, [illegible] special trucks, National Electric Co's. air brakes, Wood patent gates, etc.

The "Golden Gate" is of rather an odd design. It is 40 ft. long and 10 ft. wide. The seats run londitudinally and the two center rows are placed higher than the side seats, and there are five entrances on each side. There is also a narrow aisle between the two center rows. This car will seat 80 people. It is painted cream color with gold striping. The screens and gates are bronze colored. It is equipped with Brill 27-G trucks, four G. E. 1000 motors, National Electric Co's. air brakes, track brakes, etc. The accompanying advertisements show the uses of these cars. The fare for a round trip is 25 cents. Passengers are taken only at starting point.

Of the funeral cars one was built at the company's shops; one was bought; and one was changed over from a new passenger car. An engraving of the last is shown. This car is 38 ft. long, has a motorman's cab on each end, a compartment for the casket and flowers, a mourner's compartment, and a compartment for others attending the funeral. This car is painted Brewster green with gold striping. The interior is finished in mahogany. The

Observation Car Advertisement.

OBSERVATION CAR.

"Golden Gate."

Observation Cars in charge of competent guides leave Market, Post and Montgomery Streets, and Market and Second Streets, at 10 A. M. and 2 P. M. daily. Sundays included; returning at 1:30 P. M. and 5:30 P. M.

See Union Square, City Hall,

Lick Monument, Mechanics Pavilion,

St. Ignatius Church and College,

New Post Office, U. S. Mint, Southern Pacific Hospital,

Mission Dolores, Affiliated Colleges,

Cliff House, Ocean Beach, Etc., Etc.

Distance, Round Trip, 20 Miles.

THE NEW OBSERVATION CAR "CALIFORNIA."

Board one of these cars and see San Francisco.

The only trip of its kind.

Passing every principal point of interest.

Competent Guides in Charge.

Particularly Designed For Tourists.

An instructive, pleasant ride aboard a comfortable and well-equipped car.

Distance, Round Trip, 20 miles.

taken on at any point, thus reducing the expenses of funerals considerably.

In explaining the use of funeral cars it is necessary to explain the local conditions. Burials are not permitted within the city limits. Consequently all the cemeteries are situated outside of the city about 11 miles from the business center, in the adjoining county, alongside of one of the company's main lines. Spur tracks have been laid within the boundaries of most of them connecting

THE OBSERVATION CAR "GOLDEN GATE."

curtains, cushions, draperies, etc., are of olive green velour. The carpet is a dark green Wilton. All trimmings are silver plated. The equipment consists of McGuire 39-A trucks, four G. E. 58 motors, National Electric Co's. air brakes, etc. The car which was built by the company is larger than this and somewhat more elaborate in its furnishings.

Funerals are taken on at only three points in the city, making it necessary to use hearses and carriages to these points. It seems to be only a matter of time, however, before funerals will be

with the company's main line. The wagon road leading to the cemeteries is very dusty in the dry season, and almost impassable on account of mud in the rainy season. Consequently people prefer to travel in a commodious, well appointed car, which takes them to their destination in 45 minutes, instead of driving through mud or dust for several hours. The minimum charge for a funeral car is $12.50. For large funerals additional special cars are run at a reasonable figure. The expense for cars is considerably less than for car-

riages. The following "ad" is used in soliciting patronage for these cars:

FUNERAL CARS.

Elegantly equipped cars for funeral purposes, direct to all cemeteries in San Mateo County, furnished at reasonable rates. Quick service, privacy and courtesy assured. Cars start from the following points: Ferry terminus, 18th and Guerrero Streets, and 30th Street and San Jose Avenue.

Arrangements may be made with undertaker.

Another source of revenue is from Uncle Sam, and for this purpose the company operates three mail cars, one is electric and two cable. These cars are fitted up as per the Post-Office Department regulations with racks, mail bag hooks, lamps, shelves, etc. The electric mail car C is mounted on a Peckham No. 9 truck, with two G. E. 1000 motors, and track and wheel brakes. The cable cars have double trucks. These cars have a regular time schedule, collecting and delivering mail bags at certain substation post-offices and the main offices at stated periods.

Last but not least among the revenue cars are the street sweeping cars. These cars carry the street sweepings from the city dumps to certain sections of Golden Gate Park, where the sweep-

OIL SPRINKLING CAR.

ings are used for filling up low land. The sweepings are handled by teams from the streets to the dumps by the City Street Cleaning Department. The tracks for the cars are under the dumps, and the cars are thus loaded with comparatively little effort. From three to seven trips are made every day. The boxes in which the sweeping are carried each hold 8 cu. yd. By using top boards 11 cu. yd. can be carried. The boxes are fastened by

TROLLEY TOWER CAR.

[illegible] middle. At the end of [illegible], a one-third section of a gear wheel is keyed. This section of a gear meshes in a pinion keyed to a parallel shaft running into the cab. In the cab a worm and gear are attached to this second shaft. By means of [illegible] the worm gear wheel is turned. This turns the intermediate shaft with the pinion, which meshes in the section of the gear, and

DUMPING STREET SWEEPINGS.

thus turning the box with the sweepings partly over. These cars are 40 ft. over bumpers. They are mounted on extra heavy Brill 27-G trucks, and have four G. E. 1000 motors, National Electric air brakes and track brakes. The air compressors are carried in the cabs in order to protect them from dust and dirt.

The Non-Revenue Cars owned by the United Railroads are 1 oil tank car, 2 trolley tower cars, 1 store-room freight car, 7 track department freight cars, 1 oil sprinkling car, 6 wrecking cars, 1 sand car, and 1 motorman's instruction car.

The oil tank car is used to carry fuel oil from the main storage tank into which oil is run from steam railroad oil tank cars, to the auxiliary storage tanks at the various power houses. This work was formerly done with wagon tanks. As there are six power houses to be supplied with oil the cost of handling was considerable. This car takes the place of four wagon tanks.

The tank has a capacity of 4400 gallons. The oil is pumped from the tank into the auxiliary station tanks by means of a Quimby screw pump, direct connected to a G. E. 800 motor. The car has extra heavy Brill 27-G trucks, four G. E. 1000 motors and air and track brakes.

The trolley tower cars are used for general line repair and construction work. The tower can be raised and lowered by means of drum and cable. The table can be moved over the adjacent track. The cars have Peckham No. 9 trucks, with two G. E. 800 motors, and track and wheel brakes. They carry a com-

STOREROOM FREIGHT CAR.

plete line of line repair parts, trolley and span wire, a full complement of lineman's tools, forge for heating soldering irons, etc.

The store-room freight car is the busiest car on the system. As all car work is done at the car houses, it is necessary to carry all supplies from the store-room and shops to the car-houses. As shown in the engraving there is a closed section in the middle. In this are carried armatures, etc. Shelves are arranged in this section so that glass and other fragile articles can be handled without danger of being crushed by other articles. Wheels, oil barrels, castings, etc., are carried on the open section, from which they can be quickly unloaded. This car has a Peckham single truck and two G. E. 800 motors.

The track department uses seven cars for hauling material. These cars, as can be seen from the illustrations, are arranged to carry rails, poles, sand, rock, paving blocks, special work, or anything else in the line of track material. These cars are 40 ft. long. They are equipped with Peckham extra heavy 14-B-3-S trucks, four G. E. 58 motors, air brakes, etc. By leaving the side wings down, poles, rails, or special work can be hauled; 60 ft. rails are readily handled. By putting up the side wings and putting in the ends, 10 cu. yd. of rock or sand can be hauled in each box, or 20 cu. yd. to the car. Thirty tons have been carried without any strain on the equipment. These cars illustrate how money can be saved by having miscellaneous cars properly built and equipped. On one job of track construction some old single truck cars with W. P. 50 motors, and passenger car bodies, were fitted up as freight cars and were used for hauling crushed rock, etc. The maximum load that could be carried was 6 tons. At that it was nothing unusual to have the cars in the barn two or three times a day for repairs. The job had to be hurried; trackmen were idle sometimes on account of cars breaking down; five cars, with five crews to operate them, could not deliver material fast enough. When two of the special cars were put in service, the five old cars were thrown aside; 40 cu. yd. of crushed rock or sand was delivered on every trip of these cars; the trips were made in less time and at only two-fifths of the previous cost.

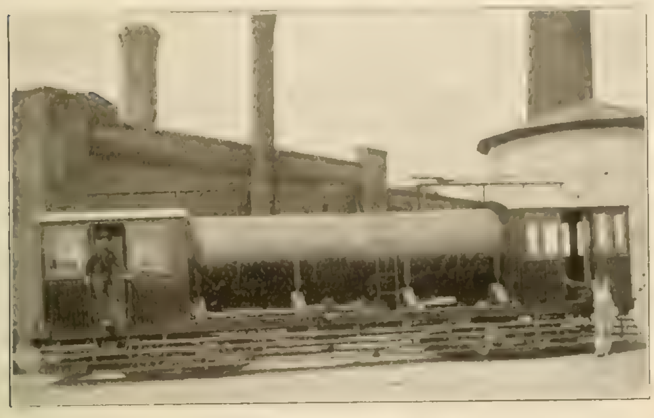
OBSERVATION CAR "CALIFORNIA."

Some of the suburban roads are very dusty, and it was thought advisable to sprinkle them with oil. A single truck oil tank car which was no longer needed for this purpose was fitted up as shown in the accompanying illustration. A pipe runs from the bottom of the tank to the rear end of the car. A T is attached to it and pipes run to the edges of the car body. Here elbows and T's are again fastened and pieces of perforated pipe are screwed into the T on each side. In order to sprinkle, the perforated pipe is pulled over so that it is at right angles to the rail on each side. Directly over the rail for about four inches there are no perforations. The perforations are 1 in. apart and 1/4 in. in diameter. By opening the valve in the pipe near the tank,

FUNERAL CAR.

and running the car at the rate of about 3 or 4 miles per hour a heavy coat of oil is left on the dust, extending 2 ft. outside of the rails.

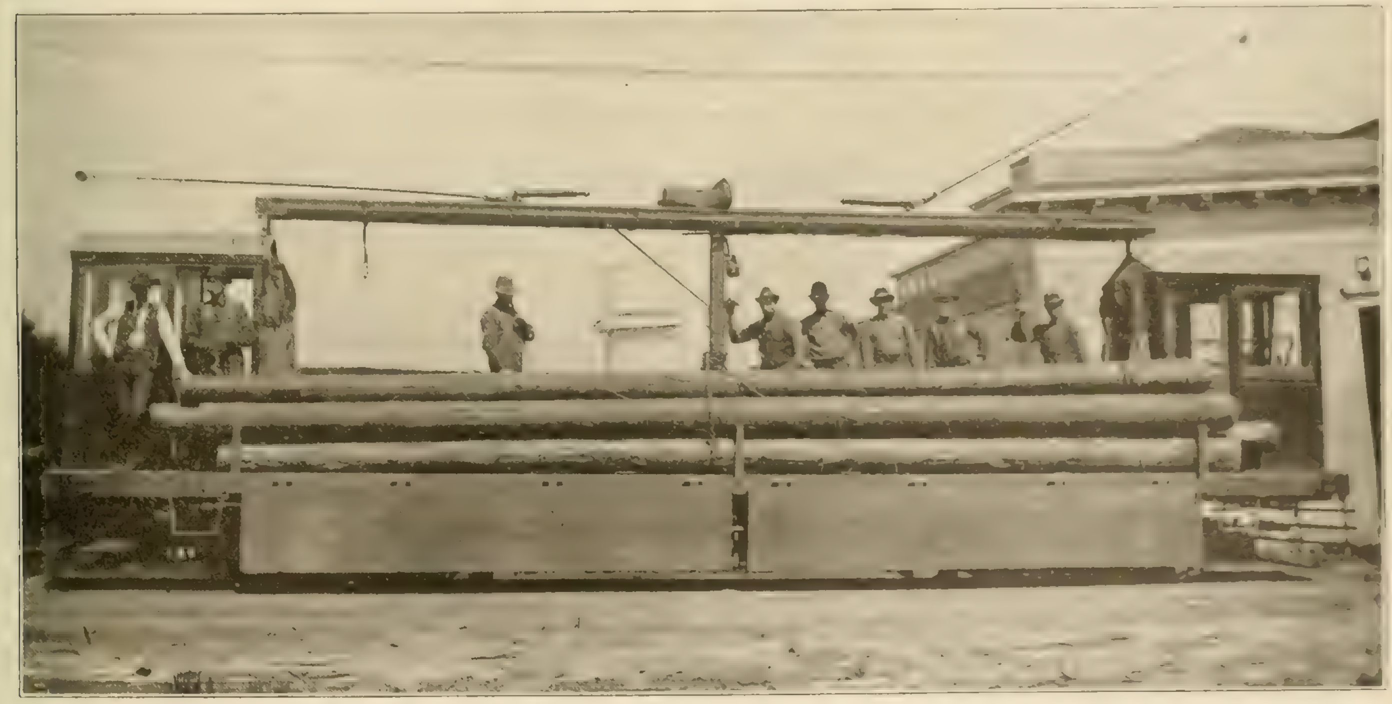
Each electrical car house is provided with a wrecking car. These were originally passenger cars, and together with sand



OIL TANK CAR.

and instruction cars are the only passenger cars used for miscellaneous work. The seats have been taken out on both open and closed sections. The cars are equipped with ladders, timbers, blocks, chains, tow ropes, draw bars, replacers, ratchet jacks, lanterns, crow bars, sledges, wrenches, pliers, and tools and small repair parts of all descriptions. They have been found to be of great value in reducing delays occasioned by broken down wagons, etc.

The instruction car is a passenger car from which the seats have been taken. A complete air brake outfit with levers, etc., is set up in the car, with wiring and apparatus exposed. Controllers, circuit breakers, etc., are also set up in this car, and so arranged that they can be taken apart and examined. This car is taken from car-house to car-house for the purpose of having car men become familiar with the apparatus on cars.



TRACK DEPARTMENT FREIGHT CAR—UNITED RAILROADS OF SAN FRANCISCO.

The Elmira (N. Y.) Water, Light & Railroad Co. is constructing an ice palace and winter resort at Rorick's Glen, on the company's lines, and will arrange for a large skating rink. The only charge that will be made will be the fare that is charged on the street cars.

Avoidable Causes of Central Station Fires.

[illegible]

Defective apparatus [illegible] fires, they are often [illegible] apparatus has been installed. Rules should be made governing this matter, just as the wiring for lights, motors, etc., is controlled by the underwriters.

Low potential transformers when used by individual concerns are ordered enclosed in a vault. Even with transformers of high potential, this precaution is not followed, in some stations. Special rules should always govern the installing of such apparatus. Oil-cooled and insulated high potential transformers are often placed in any convenient location in a fire-proof building, which, when put to the test, proves not to have been fire-proof. This sometimes results from the fact that the insulation on the cables transmits the fire to other compartments, spreading devastation. Great advancement has been made of late years along this line; but costly plants installed before late improvements were brought out frequently suffer loss from fires breaking out in most unexpected places, and causing no little expense and anxiety.

The air-cooled transformers are equally liable to injury and burnouts under continual overload, or when the attendant neglects to start the air blower until hours after the load has been put on. Under such conditions fires will frequently break out. Were such transformers installed in a building apart from the main portion of the plant, the damage could be limited to that locality and easily controlled.

Both oil-cooled and air-cooled transformers are in some instances placed in a small subway, in which all approach to a fire would be cut off at the stairway. All the apparatus contained in the subway is therefore liable to loss. These might be transformers for rotary converters supplying current for a [illegible] should a burn-out occur, the electric line would be totally disabled Should this take place during a snow storm, the results can be easily foreseen.

Bar conductors run in tile duct from switchboards to the distributing boards and transformers reduce the fire risk. The promiscuous placing of high potential fuses in vaults and subways, often within a few inches of oil pipes and other cables and inflammable material, is another source of fires. When such fuses blow, great heat is generated; and in the passage of the arc, an oil pipe has been known to have been pierced; the oil then ignited and did great damage. Such fuses can be done away with, and circuit-

breakers substituted. But these, too, must be kept in order, and so located that when in need of repair, they will not throw out melted copper or burnt carbon where it can ignite adjacent material. This relates also to high tension breakers on lines from 10,000 to 20,000 volts.

Sometimes it occurs that circuit-breakers are confined to low ceilinged rooms. It may be found that the arc cannot be ruptured by the present throw of the breaker arm. The result is that the arm of the circuit-breaker is lengthened; and probably the next time the breaker opens the arc will set fire to the wood-work above it. If there are iron girders in the vicinity, the high potential current is liable to arc to them. The barriers should be of marble.

Loose contacts in alternating current breakers occasionally become overheated and expand so as to prevent the breaker opening on short circuit. If the attendant does not kill the load on that feeder, worse things may follow elsewhere. If the feeder is not controlled by a circuit-breaker, it will be necessary to open the field current of the battery supplying that feeder or set of feeders.

It is a mistake to use rubber covered wire in an air cooling chamber below the transformers; for the fire that is liable to be started would be spread rapidly by the air from the blowers. The first cost would be greater, but it would very soon pay for itself, should proper protection for all apparatus as far as possible be made, as well as constant study for safety at all times. This applies also to the safety of operators.

Not all mistakes are centered, however, in transformers or their compartments; for dynamos have also some weaknesses. The vibration in alternating current conductors in a generator is equally liable to cause the impairing of insulation and produce a short circuit. Short circuits cause "kicks" in unsupported parts of conductors, which weaken the insulation, and eventually breakdowns occur. There have been accidents about generators for which a solution was never found, no one having apparently been able to explain why certain peculiar conditions existed. All stations have had these experiences, where the missing link has remained a mystery.

The bunching of feeder cables through long subways is liable to impart troubles to other cables. The action of a short circuit on a feeder supplied with alternating current is now well known; the cables are thrown bodily from their place. Lightning arresters are a fruitful source of fires; some more so than others. A fire in a large Canadian power house resulting in water-soaking of its large generators, started from its lightning arresters. Overloaded rotary converters will in time burn out. These machines will endure more abuse, apparently, than other generators.

Conditions are sometimes such that attendants become confused, otherwise much damage might be averted. Men who have passed a rigid examination before being put in charge of these machines have, in time of trouble, lost their heads so completely as only to add to the destruction by hasty and misdirected acts.

Much of the trouble experienced with rotary converters has been eliminated by the late construction of their controlling apparatus. Working a station to its full capacity is not without its bad results. An overheated armature or burnt out coils usually result. When a lighting transformer is overloaded, and the fuses let go occasionally, much to the annoyance of the offices, an overzealous electrician may increase the size of the fuse. The fire which may follow is apt to be very destructive.

Again, a case is recalled where the electrician had a defective circuit-breaker, which he plugged to prevent its opening, depending upon temporary fuses. About 500 h. p. at 2,300 volts was used. Very soon after plugging the breaker, an overload occurred, and a fuse let go. The arc jumped across to the other phase, and the resultant short circuit totally destroyed the entire switchboard. The short circuit was but a drop in the bucket to the power back of it; and it was only when the central power station was notified by phone to open the feeder that the attendants there were aware of anything serious having taken place.

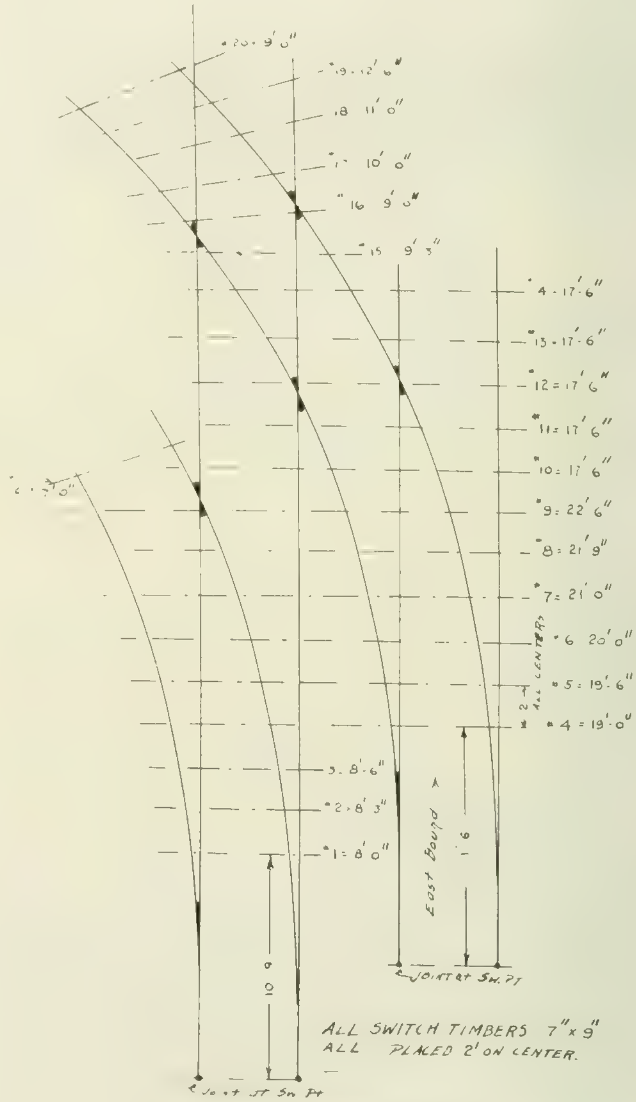
Moisture is a frequent cause of trouble in power plants, where it creeps in accidentally. Short circuits in concentric cables with a pressure of 2,200 volts result in great damage. Overloaded switches, which from poor contact get sufficiently heated to ignite a match, are sources of danger if not discovered in time to prevent a fire. Switches so operated that they enter only partially at times, are sources of danger, when the load put upon them is too great for the contact made. The result is most disastrous.

From the foregoing it will be seen that many of the most common causes of central station fires are avoidable at the expense of a little precaution at the time of installation, and of subsequent watchfulness and care.

Long Switch Timbers Under Special Work.

Special work laid in permanent pavement must of necessity be made as much of a unit as possible in order that the pavement may give the best possible wear.

It is the practice of a large road in the East to lay long chestnut



TIMBERS UNDER SPECIAL WORK

switch timbers under special work as shown in the accompanying sketch. These timbers are of course bedded in concrete where brick pavement is laid. The use of long timbers under special work has greatly reduced the cost of maintaining line and surface.

Population and Traffic.

The Indianapolis, Columbus & Southern Traction Co. was the first line to enter Indianapolis, the 10 miles between Indianapolis and Greenwood being opened in 1899. When the road was extended south to Franklin, 10 miles farther, the total population served was increased 150 per cent and the receipts were increased in almost exactly the same ratio. In September, 1903, the road was extended 10 miles farther south to Columbus, the population again being increased about 150 per cent. The last year has shown a corresponding increase in gross receipts.

Piping and Power Station Systems. III.*

BY WILLIAM L. MORRIS, M. E.

Piping Systems—Continued.

In order to make the station operation secure against all contingencies it may be arranged to have each battery of boilers distinct by itself. Each battery will have its own economizer, its own by-pass flue, stack and fan engine, the same engine driving both the blast fan and stack fan with a cutting in arrangement

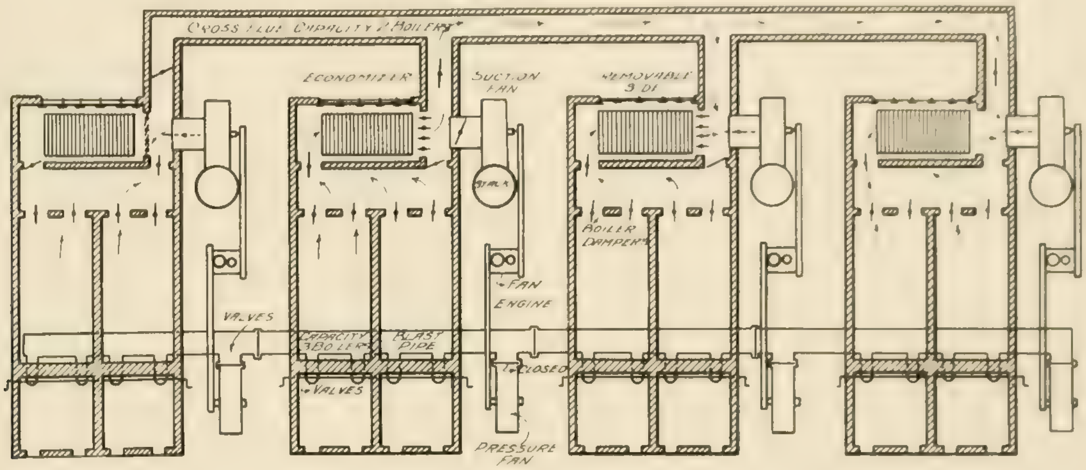


FIG. 11.

both for the air blast and the main flue, as shown in Fig. 11. By speeding up these engines two of them should have sufficient capacity for three batteries of boilers. After a careful consideration it may be decided to use the plan shown in Fig. 12, making the fan engines capable of taking care of three batteries of boilers each by speeding them up. This would make somewhat less machinery to care for and would allow either fan engine to be shut down and would make it possible to run all of the present installation or

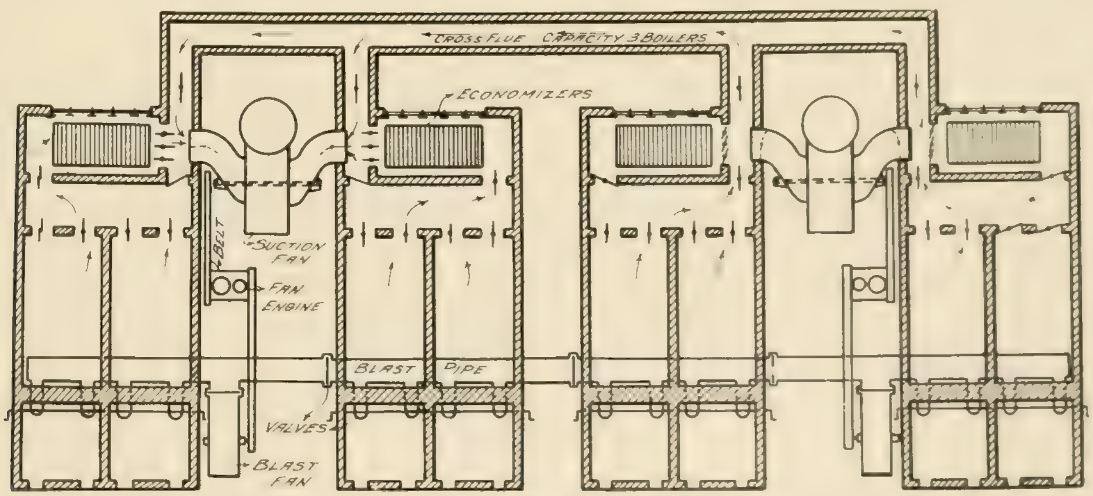


FIG. 12.

three-quarters of the future installation. This would necessitate the use of a second fan engine and stack in order to insure continuous operation of the present three-unit installation.

By placing economizers in separate groups as shown it becomes a very simple operation to clean them as this can be done when the battery of boilers [illegible] cooled down. It is wholly useless to invest money in economizers and not to make most liberal provision for cleaning them. They are sometimes allowed to fill up with deposits inside and outside so that they will not raise the temperature of the water more than 20° to 30°, while if they are cleaned both inside and out they can and have in practice raised the temperature of the water from 50° to 270°, a total of 220°. In order to cool the economizers sufficiently to permit careful and thorough cleaning no gases should be allowed to pass on the outside of any of the economizer walls while the cooling and cleaning is in progress. It may occur to the engineer that he can save in space and in first cost of installation by placing the main flue to the stack between the boiler and building wall and place the economizer on top of this, boxed in so to speak, without any possible chance to cool them off. Where else in the plant can he save from 10 to 15 per cent in the cost of fuel by doing better engineering? The saving in this detail alone will in five years' pay the entire cost for engineering of the power station. The cross connecting flue can be of light iron and left uncovered except in cases of emergency, when one of the fan engines would be out of service. The radiation of heat would be confined to the fan casing and the stack. There are many interesting details in

connection with the boiler and economizer settings, smoke flues, air pipes, etc., but as they are somewhat foreign to the piping system these details will not be further discussed.

Assume that the arrangement shown in Fig. 12 has been adopted for the station in question. There are the two fan engines to provide for and the piping system and also the stoker rams. The next question that arises is, what shall be done for boiler feed pumps? Electrically driven feed pumps are not satisfactory except when the motors can be run within a very limited range of speed If the station were very large four electrically driven pumps together with a steam pump could be used, the latter being used with any or all of the electrically driven pumps to take care of any demand less than the capacity of oue motor driven pump; one of the electrically driven pumps could be shut down when the slowing down of the steam pump still gave more water than was required. For a plant of the size in question, however, the additional maintenance of using electrically driven feed pumps is not justified. There is also needed a line of pipe to which to attach the water tube cleaner turbine, and this must be supplied from some other than the feed pump. This is imperative, for water must not be drawn from the feed main for any purpose whatever except to feed such boilers as are under pressure. This requirement must never be lost sight of in laying out a station system having an economizer or closed live steam heater between the pumps and the boilers. Not only should all other service be kept off the feed main, but the latter should at all times be under full pressure. The moment that a hose line or a connection into an empty boiler is opened from the feed line the pressure immediately drops in proportion to the size of the opening, possibly 10 or 15 lb. The temperature of the water in a live steam heater or an economizer is sufficiently high to generate steam when the pressure is lowered, and this causes a serious water hammer in the economizer, heater or pipe lines. For the same reason the blow-off from an economizer should be handled according to an established method which will be mentioned later. Broken economizer sections and leaky joints are often the results of mistreatment.

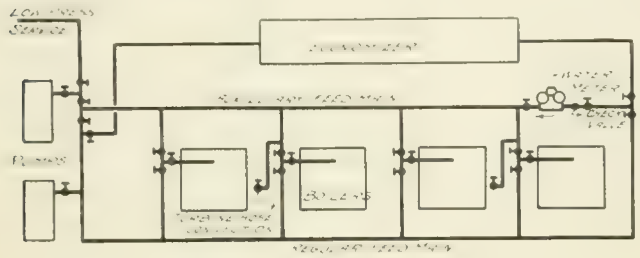


FIG. 13.

In arranging for feed pumps two will be required in any case, and while one is used for boiler feeding, the other can be used for filling in boilers, running turbines, etc. In addition to these two lines of water service it will be necessary to have a low pressure system operating, say on 25 lb. pressure, which can be used for cooling engine journals, wetting down ashes, for the plumbing fixtures, washing floors, for the make-up water, for the open heater and other similar services. In addition to this "house service" there should be a fire service system the pump for which should be able to maintain 100 lb. pressure running full speed. These four services must be available at all times, although it is not necessary nor desirable to keep the fire service pressure on all the time. The house service or low pressure lines may be taken off the fire system, using reducing valves and reliefs, and even if there be a reducing valve in the line no loss in economy of operations will be effected as long as the fire system is under the same pressure, say 25 lb. Whenever the fire system pressure is raised the pressure reducing valve and relief will protect the line against any careless manipulation of valves.

There are then various combinations of conditions all of which should be fully met by the system employed. The following are the different conditions:

(1) Feed main on,
Tube cleaner main on high pressure,
House service and fire main on low service,
With pump on each line.

(2) Feed main on,
House service low pressure, cold water,
Fire main higher pressure, for outside sprinkling.

(3) Feed main on,
House service on,
Two pumps in service.

(4) Feed main on,
House service on through reducing valves,
Fire main on for fire,
With three pumps on, two pumping into fire main.

(5) Feed pump on,
House service on through reducing valve,
Any of three pumps in service.

The third condition would be the regular operating one, leaving one pump in reserve at all times. The boiler is so important that with three pumps in the plant it would be policy to arrange all of them so they could feed boilers, making it possible to operate under condition five. It is possible that two of the three pumps may be out of condition at the same time. The two boiler feed pumps would be of the same pattern and size with compound cylinders suitable for boiler feeding, and they should be outside packed.

The fire pump should be of special pattern to fill its various duties. Probably a 500-gallon pump would have ample capacity for fire protection, and owing to its high speed it would necessarily be of the regular piston type. The cylinder ratios should be such that the regular fire pump can be used as a feed pump to deliver a small amount of water such as would be needed for boiler feeding. This pump would be regularly used as a 25-lb. pressure pump and in order to economize steam it would be necessary to compound it, possibly six to one, and use it as a compound pump for the low pressure work only. By operating the port changing slide valve the pump would be immediately changed to two high pressure cylinders for fire service or boiler feeding.

In many ways the gravity storage tank is very desirable, as it provides a storage for water while changing over the pumps and it also helps to maintain a steady pressure of water. If gravity tank water is to be used for cooling engine journals, it will necessitate the use of a much larger amount of water than otherwise, due to the tank becoming heated. If the tank be of metal and located near the roof, much trouble will be experienced from its sweating and, in order to avoid dripping, it will be necessary to use a water-tight pan under it. In order to maintain a steady pressure with a small amount of storage, it would be preferable to use a small closed expansion tank in the basement.

The three pumps would ordinarily use different water for the

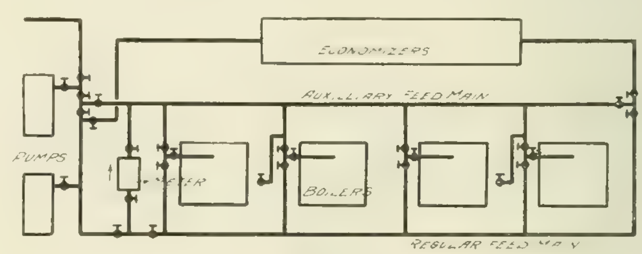


FIG. 14.

suctions, the boiler feed pump using hot water from the heater and the other pumps using cold water. The pumps must therefore have their suctions so piped that any one of the three can use the heater water or intake water.

Before laying out the piping for this pumping system it is necessary to consider what to do in regard to the heater. Shall one or two heaters be used? Before attempting to determine this question, it is necessary to consider how essential the heater is in securing continuous operation. There are condensing plants using economizers and electrically driven auxiliaries that take water from the hot well and feed directly into the economizers without having any heater at all. Now if the economizers can operate continuously without a heater, why must we provide a reserve heater for the two hours or so that it takes to clean them out? The only directly appreciable loss is the heat discharged from the exhaust pipe while cleaning; this is a very insignificant loss considering the long intervals between cleanings. Another

question in connection with the use of two heaters is how to take a uniform amount of water from each heater when using one feed pump This can be arranged by means of floats and other unreliable devices, but there does not appear to be any practicable method except by the use of two feed pumps working separately, each with a separate heater. This detail should not be lost sight of in determining the heaters.

There must also be considered whether a closed or an open heater shall be used. The only advantage of the closed heater is that the oil in the exhaust steam does not mingle in any way with the feed water. But is this sufficient to outweigh the advantages of an open heater for the service in question? In the first place, the open heater is made of cast iron instead of plate steel, making it able to stand the chemical action within it for a longer time. Another feature of the open heater is that it is not subjected to severe stresses, due to the boiler pressure, as is the case with a closed heater. The closed heater is far more difficult to clean and, in case of a condensing plant, but little benefit would be derived from it, as the closed heater would raise the temperature of the water only about one quarter as much as the open heater. If sufficient exhaust steam is delivered to an open heater to raise

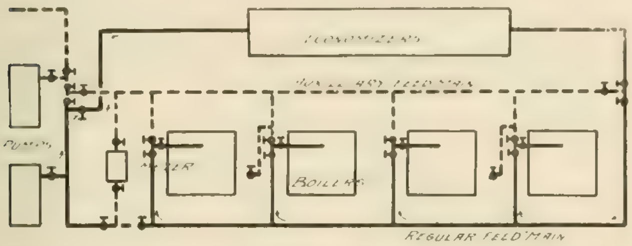


FIG. 15.

the temperature of the water 75 degrees, the same amount in a closed heater would raise it only about 17 degrees, corresponding to a loss of nearly 6 per cent of the coal consumption. For a non-condensing plant the closed heater deserves careful consideration, but it is quite out of the question for a condensing plant, as the only exhaust steam available for the heaters is that from the auxiliaries. The open heater should be amply large, not so much for the purposes of a heater, but to permit possible chemical treatment, precipitation and to provide a large filter bed. Therefore one open heater is chosen for the station under consideration.

There are other features still to be considered before laying out the pump piping. Shall a water meter be used and, if so, where shall it be located? Also how shall water be taken from the hot well and delivered to the heater? Water could be supplied to the heater by the fire pump while it is being used on the house service, but, by doing this, water would be delivered to the heater from the hot well at possibly 60 degrees instead of 90 degrees, a loss of 3 per cent. If using 90 tons of coal per day at $2 per ton, this would cause a yearly loss of about $1,000. It is essential therefore to save the 30 per cent of heat, even though it becomes necessary to use another pump, but this is objectionable, as it makes another machine to care for, watch and regulate.

A simple solution of this question is to attach to the plungers of the feed pump, in such a way that they can be readily detached, the pistons of the low pressure heater supply pump. The advantage of this arrangement is that better economy is secured, there is one less steam end to look after and there is no liability of shortage nor waste of heater water. The amount of water delivered to the heater will be the same as that taken from it. Therefore it is decided to use a double water end feed pump arranged so that the heater supply pump can be quickly disconnected in case of accident, and during a repair water would be taken from the house service line by means of the fire pump.

Next comes the water meter. This should be so arranged with respect to the piping that the total water fed to any or all of the boilers can be measured, whether fed through the economizers or with the economizers cut out. The meter should also permit the measurement of the water fed to one, two or any number of boilers desired, with the water either passing through the economizers or fed direct. The meter should also be arranged with a [illegible] one system of feed water pipes with meter, the hydraulic tube cleaner line being also, in this case, an auxiliary feed main. This system is especially suited to plants that have one economizer to serve one side of the plant. It will be noted that the feed water can be run through the economizers and any one or more of the boilers fed through the meter, the boilers not on the meter being fed through the regular feed main. The only condition that could be improved is in the case of feeding with the economizer cut out. It will be noted that when metering cold feed water, even if only for one boiler, all the other boilers would have to take cold feed water also. The system shown in Fig. 13 requires no extra piping for the meter other than the meter connections themselves. When cleaning the boiler tubes the meter is shut off as well as all feeds to the boilers, and the regular feed main is used for boiler feeding. The test usually made with economizers is to meter the water for all boilers, first with the economizers on and before cleaning them, second with the economizers off and third with the economizers on after cleaning them. This test is to determine how much can be saved by reason of cleaning them, or, in other words, to determine how often it pays to clean economizers, how well to clean them, etc.

Another arrangement of piping can be made, as shown in Fig. 14, which will provide for all conditions and which will permit metering cold water fed to one boiler and feeding through the economizers for all the other boilers. Fig. 15 shows the regular method of operation with the meter out of service and the hose main ready for use. The feed system in this illustration is shown in full lines, and the cleaner system is dotted.

(To be continued.)

Experiments on Concrete and Iron.

In the course of the construction of the East Boston tunnel the engineers of the Boston Transit Commission made some interesting experiments to determine how rusting of iron was affected by concrete. The results are reported in the Commission's Tenth Annual Report, as follows:

To Indicate Whether Iron Rusts When Imbedded in Concrete.

Nine strips of sheet iron (2 in. x 6 in.) were cleaned till their surfaces were bright and free from rust. Then they were imbedded in concrete, molded into the form of a hollow cylinder, the outside dimensions of which were 14 in. x 20 in., the walls being 3 in. thick. This cylinder, when hardened, was kept filled with water, and was placed in the tunnel. At first the water percolated through the concrete very readily, but the amount of percolation gradually diminished so that at the end of about two months the cylinder became practically watertight. At the end of two years the sheet iron strips were removed from the concrete and examined. They were found to be free from any rust, and in as bright condition as when placed in the concrete. The concrete was made in the proportions of 1 barrel of portland cement, 9 cu. ft. of stone dust, and 11 cu. ft. of broken stone.

To Indicate Whether Steel Imperfectly Cleaned Is Preserved from Further Rusting by Imbedding the Same In Concrete.

A square plate (4 x 4 x ½ in.), which had become badly rusted, was cleaned by filing till its general surface was bright, but the rust still remained in the numerous small pits. This plate was then surrounded by about 1½ in. of concrete, molded in the shape of a square block. The concrete was proportioned as follows: 1 barrel of portland cement, 9 cu. ft. of stone dust, 11 cu. ft. of broken stone.

The concrete block, when hardened, was placed in water for three or four days, then taken out and dried in air for three or four days. This process of first wetting and then drying was continued for two years, and then the plate was removed from the concrete and examined. The portion of the plate that was bright had remained unchanged. There was apparently no increase of rust in the small pits, but in some of them the color had changed from the originally reddish brown to a yellow. Professor Norton, of the Massachusetts Institute of Technology, judges this to be merely a change in the composition of the old rust, and not a formation of the new rust. Two other pieces of steel treated in the same way gave the same results.

The Boston Elevated Construction Car.

In connection with the construction car mentioned by Mr. H. M. Steward, roadmaster of the Elevated Division of the Boston Elevated Ry., in his recent paper before the New England Street Railway Club, the following additional particulars are of interest:

The construction car consists of a flat car mounted upon two Baldwin trucks with 33-in. steel tired wheels. It is 46 ft. 10¾in. long over drawbars, and is divided into two sections, comprising an open platform at each end and a closed house for the storage of track maintenance equipment. The front of the working platform is shown in the accompanying illustration. It carries a derrick equipped with a 10-ft. and 20-ft. boom, the lifting capacity of the derrick being 2,000 lb., at a radius of 20 ft. The boom is made of long leaf Georgia pine and the derrick is so mounted upon the car platform as to enable the boom, hoisting mechanism and operating platform to be freely turned to meet the requirements of the work in the Subway and upon the elevated structure. The derrick is operated by two No. 32 pneumatic portable winches, built by the Chicago Pneumatic Tool Co., the winches being so placed that the operating levers come on the opposite sides of the mast. The derrick is controlled by one man, who uses both hands in working the levers as he stands upon the operating platform. Two turnbuckles are ordinarily used to hold the derrick in a forward position. These extend from the top of the mast to the sides of the car, and are easily taken off when necessary. The operating platform is further secured from turning by a chain and pin which fastens it to the car platform.

In the operation of the construction car a flat car is usually run in front of it to receive the rails, ties, etc., which are picked up by the derrick in making repairs to the track. The two cars constitute a work train and are propelled by four G. E. 73 motors mounted on the trucks of the construction car. These motors are rated at 75-h. p. each on the hour run basis of 75 degrees C. temperature rise at full load, and they are controlled by either of two G. E. L 4 standard controllers, one being mounted at each end of the housed part of the car. A commutating switch which throws all four motors in series for running at a speed of 4 or 5 miles per hour is installed in the interior of the car. This switch also throws them into two series-parallel pairs. The car is 8 ft. 8¾ in. wide over all, and is used only on the elevated division. It is construction car. The flat car also has automatic brakes, so that both cars are braked.

A tool box containing sledges, hammers, wrenches and other track tools is set on one side of the construction car's open platform behind the derrick, and on the opposite side is an oil and waste box.

The housed portion of the car is about 30 ft. long. It contains a large assortment of tools and supplies. Longitudinal seats

VIEW OF INTERIOR—REAR OF CAR.

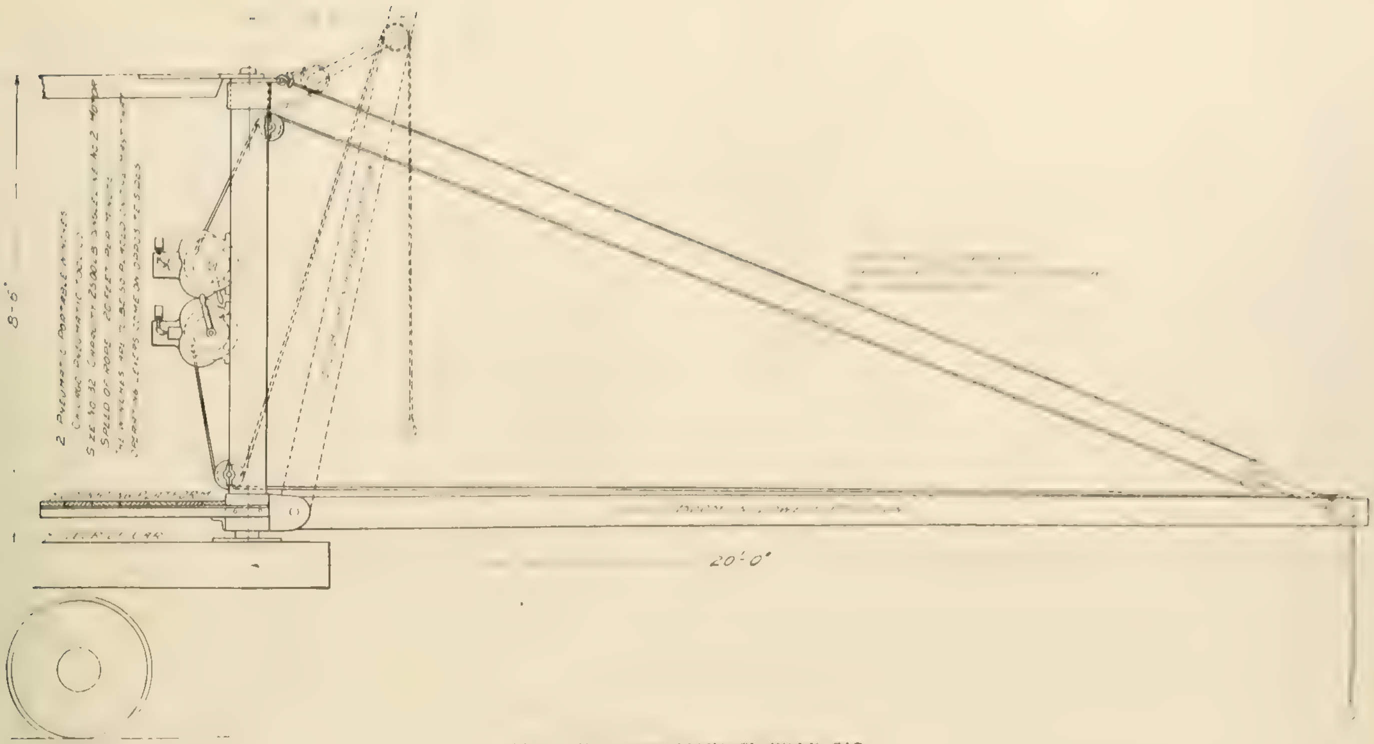
are provided on each side for the track crew; the interior is lighted by eight 16-c. p. lamps, and heated by four Consolidated car heaters suspended from the roof. A slate switch box is mounted on one wall. This contains Noark enclosed fuses for the main power circuit and for the compressor motor, heating and lighting circuits; a double throw main knife switch for connecting the car wiring to either the trolley or the third rail; and a

WORK CAR OF BOSTON ELEVATED RAILWAY.

equipped with the National Electric Co's. automatic air brakes. There are three motor-driven compressors of 4-h. p. each, operating at 550 volts and 1,100 r. p. m. These supply the air for the operation of the brakes and the winches, drills, grinders, etc. The flat car in front carries rails, frogs, bolts, third-rail insulators, spikes, ties and other supplies. It is of the same length as the

main switch for the power circuit. On the outside of the box are the snap switches for the compressor, heating and lighting control. Snow brushes of the company's standard steel spring construction are mounted on the trucks adjacent to the third rail shoes, and the roof is equipped with two trolleys.

Underneath the seats in the car are various wrenches, grippers,



CRANES ON BOSTON ELEVATED WORK CAR.

picks, bolts, washers, ropes, chains, etc. One of the motor-driven compressors is mounted inside the car also. On the walls are a medicine cabinet equipped with emergency bandages, antiseptics and other relief appliances, and racks holding lantern globes, fibre insulating joints used in the signal rail, brushes, hack saws, incandescent lamps, lignum-vitæ blocks, monkey and Stillson wrenches, adzes, axes, a track level and gage, spike pullers and air hose. The derrick is supplied with air through a 1-in. hose which connects it with the reservoirs of the compressor system.

Suspended from the roof are two emery grinders for use on the rails, equipped with flexible shafts which are driven by an air motor on the car; cages of incandescent lamps in banks of 5, cross-cut saws and a "bug" or portable trolley pole for connecting with the trolley underneath the elevated structure. On the floor is a large assortment of spike bars, hand jacks, wrenches, special track bars, tie clamps, spades, brooms, rail drills, boards, etc. Extra fuses are carried on a shelf, and there are boxes of bolts, nuts, washers and other odds and ends, likely to be of use in the work of repair. A sand pail, metal waste can and a Badger chemical fire extinguisher are also supplied to the construction car. Despite the great variety of equipment upon this car is appears roomy and convenient. It was designed and equipped by the Elevated Division, the construction of the car body being effected at the Bartlett St. shops of the company.

INTERIOR BOSTON CONSTRUCTION CAR.

Street Railway and Highway Conflicts.

An interesting paper on street railway and highway conflicts was recently presented by Mr. Bentley W. Warren, of Boston, at the meeting of the Good Roads Association in that city. Mr. Warren's prominent connection with the legal side of street railway work in New England enabled him to speak with authority upon the broad relations existing between the street railways, town authorities, and the commonwealth. He began by pointing out that two parties are always necessary to every quarrel, and that every dispute is due either to the ignorance of one or both parties to it, or else to a wish by one party to take an improper advantage of the other party. Conflicts between street railway companies and public officials must be attributed either to the ignorance of the parties concerned or to the improper intention of the street railway company. Mr. Warren stated that in his experience controversies of this nature have rarely been due to a wish on the part of the street railway company to evade the performance of a lawfully imposed duty, or to take advantage of the official representatives of the public. Of course, exceptional cases occur in which the foregoing does not apply, but even in these exceptional cases the unseemly and often disgraceful features involving disorder, violence, childish waste of money and inevitably great discomfort and inconvenience to the public, for whose safety and convenience both the public officials and the corporations exist, might be absolutely avoided if the public officers who were parties to it were properly informed of the law and its ample provisions for prompt and effectual regulation of any corporation which either wilfully or negligently fails to obey the law.

In general the cause of these conflicts is ignorance of some essential condition, and it is no reflection upon public officials that this ignorance more frequently exists upon their side than upon that of the railway officials. The latter have but one professional interest to study—street railways, and the facts and law pertaining to them; while the public officials, whether they be aldermen, selectmen, superintendents of streets or supervisors of highways, have duties and responsibilities covering a wide range of subjects, requiring technical and legal information of varied character, and upon many subjects, of which the relation of street railways to the highways is only one, and that, too, one not requiring regular, but only occasional, attention. Again, the street railway officials are usually men of long experience in the business, to the mastery of which they have devoted many years, while on the other hand, public officials under our system of government are frequently changed, so that a street railway question may be presented to such an official only once during his term of office, and there is no opportunity for acquisition by him of a fund of knowledge and experience to enable him to pass quickly and intelligently upon the phases of any dispute which may arise.

Mr. Warren stated that he proposed to approach the question rather with a view to determining the reasons for these frequent clashes, which reflect only discredit upon all the parties to them, than to attempt any particular description of the particular controversies for which the public has suffered in the past. He did this with the hope that if a general understanding could be gained of the difficulties under which the street railway business is conducted, and also of the relations which ought to exist between those responsible for its proper conduct and those responsible for the general oversight of the highways, much needless ill-feeling and quarreling might be avoided.

The ignorance referred to is of two sorts. The first is extremely simple, and would in itself relieve the public of much annoyance and discomfort if it were removed. Ordinarily when a controversy arises, it is due to the wish or order of the constituted authorities that a street railway company should do some particular thing with reference to the highway which the company refuses to do. Thereupon the offended officials endeavor to enforce compliance by a physical obstruction of the railway, or an interruption of its operation, sometimes without any reference to lawful authority for so doing, and sometimes by invoking the authority given to such officials by law, but intended to meet an entirely different situation. In all such cases, the chief sufferers are those members of the public dependent upon the operation of the railways for getting to and from their homes. The only question really involved in any such case is the legality of the requirement which the officials are endeavoring to enforce in an irregular and unlawful manner. In no case, probably, is there the least necessity for resort to force or for inconveniencing the public; but in their ignorance of the law governing such situations, these officials, sworn to the faithful performance of their duties, unwittingly and ignorantly expose the public to a real hardship. Under the revised laws as they now exist, both the supreme and superior courts have equity jurisdiction to compel the performance, and to restrain the violation, of all laws which govern street railway companies, and of all orders, rules and regulations made in accordance with the provisions of law. In every controversy, therefore, it is possible for the public official to apply at once to a justice of either of these courts for an order compelling the street railway company to comply with a requirement about which the controversy exists, and that order will be issued by the court in every case in which the requirement is a lawful one, and certainly no one could expect or desire compliance with an unlawful requirement. By pursuing this method pointed out by the statutes themselves, full obedience can be exacted from the most recalcitrant street railway company, and the most obstinate street railway official, of every obligation to which it is subject, and this in a prompt, orderly and complete manner, without hardship or inconvenience to any member of the public desiring to use either the facilities furnished by the street railway, or those existing in the highway itself. Recent examples of the enforcement of this remedy can be found in the decisions of the Supreme Court in Newcomb vs. Norfolk Western St. Ry. Co., 179 Mass. 449, and Gardner vs. Templeton St. Ry. Co., 184 Mass. 294.

Most of these controversies might be avoided if there were a more general knowledge and appreciation of the legal nature of highways and of the relation of street railway companies to them and to the officers having jurisdiction over them, and responsible for their condition.

The ownership of the land embraced within a highway belongs ordinarily, and according to many legal authorities always, even where a deed of the land has been made to a city or town, to the owners of the land abutting upon the highway, the only title to the land in and under the highway possessed by the public being an easement in the nature of a right to use it for highway purposes. The title of this easement is not in the city or town in which the highway may happen to lie, but is in the whole public of the state, which is represented by the legislature. This easement includes not only the right to use the highway for all ordinary methods of travel, represented by foot passengers, equestrians, drivers of carriages and wagons for merchandise, but also covers the use of highways by street railways and by motor carriages, and the right to use the soil under the highway for steam, water, gas and sewer pipes, electric light, power, telephone and telegraph wires, and may include some other uses besides those mentioned. All these uses are sanctioned by the courts upon the theory that they are in aid of the public easement for which the highway was originally taken and laid out, and the owner of the land in which the easement was originally taken is conclusively presumed by the court, in his original damages, to have received full compensation for all the possible uses to which the land may be put consistently with its use as a highway. Railroads operated by steam, because of the great speed at which the cars are operated, and elevated railways, because of the obstruction to light and air occasioned by the elevated structure, have been held not to have been included in the original easement, and, therefore, not to be authorized in the highways except upon the payment of additional damages. The question of the legality of a street railway in a highway was repeatedly passed upon by the Supreme Court during the period that such railways were operated by horse power, the case usually cited being that of Attorney General vs. Metropolitan R. R. Co., 125 Mass, 515.

It was again considered by the court after the introduction of electricity, and the use of the highway for electric cars was upheld by the Supreme Court in Howe vs. West End St. Ry. Co., 167 Mass. 46, decided in 1896, and the use of a private freight railroad operated by horses in a public highway was sustained by the Supreme Court in the case of White vs. Blanchard Brothers, 178 Mass. 363.

Mr. Warren stated that the latest case of which he had knowledge re-viewing and re-affirming all the previous cases is that of Eustis vs. Milton St. Ry. Co., 183 Mass. 586.

In Massachusetts, and probably in all jurisdictions governed by the common law, the control and ownership of the public easement in the highway is vested in the whole public, acting through its

representatives, the legislature. The legislature may exercise its control directly, or may delegate it to subordinate bodies and agents responsible to itself, and it may change these agencies at pleasure. Nothing is clearer in the judicial decisions in Massachusetts than that a city or town has no ownership in the highways within its limits. For convenience, the legislature has in almost all instances delegated the control, both of bridges and highways, to inferior governmental agencies, but this delegation carries with it no title to the property controlled, and no guaranty that the agency will not be changed. For a long period the favorite agencies for laying out highways were county commissioners and boards of aldermen and selectmen, while the almost universal agency for the maintenance and repair of the existing highways were the cities and towns themselves, acting through their appropriate officers; but that the powers which have been given to the cities and towns by the legislature are in no sense a contract and do not become vested rights as against the legislature was distinctly affirmed in Prince vs. Crocker, 166 Mass. 347, p. 359.

In recent years, the creation of the Massachusetts Highway Commission is a striking example of the legislative power to change the control of highways, and this already very important commission, with its jurisdiction and control over the many miles of state highways in Massachusetts, is likely in the not remote future to be the chosen agency representing the legislature in the control and maintenance of all highways not purely of local extent. Again, the Metropolitan Park Commission, with its control of the many miles of parkways built under its direction, is another example of the legislative power in respect to highways. Between these state commissions and the street railway companies, however, conflicts are gratifyingly rare. By reason of their extended jurisdiction and frequent occasion for dealing with the street railways, as well as from their relatively permanent character and infrequent change of membership, together with their right to the advice of the Attorney General on legal questions arising in the performance of their duties, such controversies, or the rare occasions on which they arise, are easily adjusted; or, if a real difference of opinion exists, they are referred to the courts for solution.

The chief trouble exists in those highways in which street railways have been constructed where the control of the highways is vested in cities and towns, or their officers. As was well said by Chief Justice Shaw in the leading case of Commonwealth vs. Temple, 14 Gray, 69, decided in 1859:

"It is very important that the rights and duties of all persons in the community, having any relations with them (street railways) should be distinctly known and understood, in order to accomplish all the benefits and as far as practicable avoid the inconveniences arising from their use. This is important to proprietors and grantees of the franchise, who expend their capital in providing a public accommodation, on the faith of enjoying, with reasonable certainty the compensation in tolls and fares, which the law assures to them; to all mayors, aldermen, selectmen, commissioners or surveyors especially appointed by law for the care and superintendence of streets and highways; to all persons for whose accommodation in the carriage of their persons and property these ways are especially designed; and to all persons having occasion to use the ways through or across which these horse railroad cars may have occasion to pass."

A street railway company derives its right to existence and its right to exercise its franchise from the legislature itself. It has no relation to a city or town through which its railway runs, except such as may have been created by the legislature; and it owes no duty and is under no liability to any city or town except such as has been imposed by the legislature; nor, on the other hand, has a city or town in its municipal capacity any authority over a street railway in any case, nor have its officers any such authority except where the same has been specifically delegated to those officers by the legislature.

The first street railway in Massachusetts was built about 1853, and in the decision already referred to, Commonwealth vs. Temple, it was stated that

"The accommodation of travelers, of all who have occasion to use them, at certain rates of fare, is the leading object and public benefit for which these special modes of using the highway are granted, and not the profit of the proprietors." The latter "is a mere mode of compensating them for their outlay of capital in providing and keeping up this public easement."

This statement of the real object of street railways, as enunciated by Massachusetts' greatest chief justice, has been recognized and adhered to in the commonwealth almost without variation since the earliest street railway charter was granted. Statute after statute has recognized and enforced the two propositions that a street railway company on the one hand should furnish proper accommodation to travelers, and that its profits, on the other hand, should be limited to a mere reasonable compensation for furnishing this accommodation. As a result, these companies have been held very strictly to limiting their rates of fare to such amounts only as would, if the companies had sufficient business, realize a reasonable profit. Whenever the profits have shown a tendency to become excessive or even generous the fares have been either compulsorily reduced by legislative action, or voluntarily reduced by the companies through fear of such action. This legislative policy, while apparently having nothing to do with highway conflicts, is really intimately connected with them. Most of these conflicts arise from efforts to compel a company to perform some work upon the highway. Such work necessarily involves expense. Being deprived of surplus income, and in fact enjoying only at best a very limited income, the street railway company, like every individual similarly situated, is obliged to scrutinize carefully every proposed expense, if it would at the end of the year show any balance of profit. If, as is the case in many other states, its profits were unlimited, or if it were permitted to conceal its profits by the issue of fictitious capitalization—a proceeding absolutely prohibited in Massachusetts—the company could afford to be generous because in receipt of a generous income.

Although it is apparent that the mere right to build and operate the railway in a highway did not in itself create any relation whatever between the corporation and the city or town in which the highway was located, that relation was created, and the interests of the two were speedily brought in conflict by certain legislation imposing certain duties upon such companies with respect to the highways.

There have been for many years two legislative provisions of great importance to the subject in hand, touching the relation of municipalities to highways. While the legislature might have itself assumed both the duty and expense of maintaining highways, it very early saw fit to place both upon municipalities, and enacted the following provisions (Revised Laws, Chap. 51, Secs. 1 and 10):

"Highways, townways, causeways and bridges shall, unless otherwise provided, be kept in repair at the expense of the city or town in which they are situated, so that they may be reasonably safe and convenient for travelers, with their horses, teams and carriages at all seasons," and

"The surveyors and road commissioners shall cause whatever obstructs such ways, or endangers, hinders or incommodes persons traveling thereon to be removed, and shall forthwith cause snow to be removed from such ways or to be so trodden down as to make them reasonably safe and convenient."

When, however, the legislature began granting street railway charters, it otherwise provided, in certain respects, for maintenance of highways. Without such other provision it is clear that the street railway company would have had nothing to do in respect to the highway, and it was because of these other provisions that conflicts speedily and frequently arose. These other provisions varied from time to time, sometimes enlarging and sometimes diminishing the highway obligations of the street railways, but they finally crystallized into two statutes:

Public Statutes, chapter 113, section 32.—"A street railway company shall keep in repair to the satisfaction of the superintendent of streets, street commissioner, road commissioners or surveyors of highways, the paving, upper planking or other surface material of the portions of streets, roads and bridges occupied by its tracks, and if such tracks occupy unpaved streets or roads, shall in addition so keep in repair (18) eighteen inches on each side of the portion occupied by its tracks."

This provision modified the first provision of the general law imposing the duty of highway repair upon cities and towns. The other provision follows:

Public Statutes, chapter 113, section 27.—"The board of aldermen or selectmen may from time to time establish such regulations as to the rate of speed, mode of use of the tracks and removal of snow and ice therefrom within their city or town, as the interest and convenience of the public may require."

This provision again modified the other provision of the general law relative to the removing of obstructions, and particularly snow, from the public ways. The obvious reason for the imposition of the former highway duty upon street railway companies was that they used horses, which, traveling always in a beaten track, would much more seriously injure the surface of the highway than would a greater number of horses scattered over the entire breadth of the highway.

Mr. Warren stated that the only judicial decision he could recall upon the statute of interest in this connection was one that the space occupied by the tracks meant only the space between the two rails of each track, and not the space between the two tracks or outside of either track, and that the requirement was confined to the surface material, and did not involve responsibility for an opening in the street into which a traveler had fallen. Although conflicts were numerous, and, as pointed out in the Report of the Special Street Railway Commission in 1898, frequently presented the absurd and wasteful spectacle, for example, of two bodies of men, one employed by the corporation, and the other by a public official, busily engaged, the one in shoveling snow from the tracks, and the other in shovelling it back onto the tracks, both to the injury of travelers, there were but few judicial decisions under these statutes. In the case of Union Railways vs. Cambridge, 11 Allen 287, the snow question was settled by the decision that the board of aldermen could entirely prohibit the removal of snow and ice from the tracks. Mr. Warren then stated as his opinion that the absence of judicial decisions upon these statutes as a basis was due to the existence of another statute, which enabled a board of aldermen or selectmen to revoke a street railway location and order the tracks out of a street without any appeal to any other board or court. At all events, these statutes imposed upon street railway companies some duty to maintain and repair a part of the surface of the highway in which the track was located; leaving, under the general law, the duty of keeping in repair the balance of the highway, upon the city or town; and also, that the municipal authorities had free control in the matter of removing snow from the tracks, even to the extent of refusing to permit such removal at all, thus suspending the operation of the railway until the snow was removed by natural causes.

Thus the law stood in 1897. At this time the mileage of street railways operated in the state had increased, in the thirty years from 1866 to 1896, from 107 to 1,291; the capital investment from $5,257,740 to $61,117,714, and the gross receipts from $1,707,447 to $14,900,941. The car mileage run had increased from 4,952,248 to 53,613,685. In this year the increase in the number and extent of street railways, and in their importance to the traveling public, which was becoming more and more dependent upon this method of travel, the relations between the municipalities and the street railways became the subject of serious legislative consideration. A special committee of three disinterested and prominent citizens was appointed to consider the whole question and report to the legislature. This committee made a very full investigation of street railway problems, both in this country and Europe, and submitted to the General Court of 1898 a valuable and exhaustive report printed as House Document No. 475. This report took up in detail the relations between municipalities and street railways, and particularly the subject of highway conflicts. A draft bill designed to obviate, as far as possible, occasion for further disputes, accompanied the report. The committee laid down two propositions as of the greatest importance:

a. That a divided control of the highways, and consequently divided responsibility for their condition, was illogical and bad, and that both the control and responsibility should reside in one body; and that body should be the city or town in which the highway existed.

b. That public convenience absolutely required the uninterrupted operation of street railways, and that it was quite as important that a street railway track should be broken out and cleared of snow as it was that a sidewalk should be. With various amendments this bill was enacted as chapter 578 of the acts of the year 1898.

While this statute made many changes in the street railway law, the important ones, as concerns highway conflicts, were, like the recommendations of the committee itself,

1. Undivided control of, and responsibility for, the condition of highways.

2. The imposition of a special graded excise tax, amounting substantially, however, to 2 per cent of the gross earnings of all the street railways in the state.

3. The distribution of this excise tax, and also of the franchise or corporation tax paid by the street railway companies, among the cities and towns within which the street railway tracks were located, in proportion to the miles of track in each city or town.

4. A requirement that all money received by any city or town from this distribution of the street railway tax should be applied to the construction, repair and maintenance of the public ways, and removal of snow therefrom within such cities and towns.

5. An enlargement of the equity jurisdiction of the courts to enforce compliance with the laws. (This was added by the legislature.)

The public generally is ignorant of the present status of the street railway resulting from this legislation of 1898. Not only did the statute provide that street railways shall not be required to keep any portion of the surface material of streets in repair, but it also expressly repealed section 32 of chapter 113 of the Public Statutes, which had previously required such repair work from street railways. The general law was left in effect, that cities and towns should keep the streets in repair.

The bill as recommended by the committee further provided that street railway companies should clear snow from their tracks in such manner as the superintendent of streets, or other official exercising like powers, should approve; but that they should not be required to remove from the streets the snow cleared from their tracks. The provision about removing snow was struck out of the bill in the legislature. The statute, however, further expressly repealed that part of section 27 of chapter 113 of the public statutes which authorizes aldermen and selectmen to make regulations as to removal of snow and ice.

Since the passage of this statute of 1898 the importance of street railways to the traveling public has been immensely increased. The miles of track operated have grown from 1,291 in 1896 to 2,670 in 1903. The capital investment has increased from $61,117,714 to $122,666,365. The gross receipts have increased from $14,900,941 to $25,540,811. The amount paid in taxes in 1896 was $523,546. This amount had grown in 1903 to $1,725,312, or more than three times that paid seven years earlier; while the amount paid in dividends had increased from $1,802,847 to $3,586,248, or not quite twice as much.

Briefly re-stated, the plan of this change in legislation was designed to prevent thereafter the performance of highway work by two different parties, and to place all such work in the control of the municipality whose general duty it had been to do this work. In the other highways, and also in the highways occupied by street railway tracks except for the limited space where the street railway tracks lay, it had, however, always been claimed, and probably with some justice, that the presence of a street railway track in the highway, or at any event, in the wrought portion of the highway, caused a more rapid deterioration and consequently a more frequent need of repair than was true of a highway without such tracks in it. The new legislation recognized this claim, just as the old legislation had recognized it by imposing highway work upon the street railway companies; but instead of continuing the duty of such highway work, it substituted therefor a new excise tax; which, as appears from the report of the commission, was carefully estimated to be at best the money equivalent of the highway work actually performed by the companies prior to this legislation. The legislature even went further, and provided also that the entire corporation tax paid by the companies should be distributed to the cities and towns, and that the receipts from both taxes should be used only for highway purposes and for the removal of snow. The financial result of this legislation to the companies has been that while their gross receipts have increased only about 66 per cent, the amount paid by them in taxes has increased over 200 per cent since the passage of the statute, and they paid in 1903 in taxes, all of which went to the cities and towns in which the railways were operated, half as much as the stockholders received in dividends upon the $68,500,000 of capital stock invested in the business.

That the conflicts still continue is in large measure due to a failure on the part of the representatives of the public to appreciate the changed relations existing between themselves and the companies. The companies, too, are more insistent upon their alleged rights and exemptions in view of the great increase in their taxes. They claim not only that it is unjust and illegal that they should be expected to

both perform the work formerly required and also to pay the tax which the legislature imposed as a substitute for the requirement to do that work; but also that with the low fares in force and the additional accommodations furnished by the companies, it is utterly impossible for them not to insist upon their rights, if they are to avoid in many cases a suspension of dividends, and in some cases even more serious financial trouble.

Some of the conflicts which have arisen since 1898 have been passed upon by the Supreme Court in decisions which should go far to prevent trouble in the future. It has been held that there is no longer any obligation upon a street railway company to maintain any part of the surface material of a highway by virtue of any requirement contained in a grant of location, unless that grant happened to be the first one ever made to the company in the particular city or town. Mr. Warren then stated that these decisions make the law perfectly clear as regards so-called extension locations at any time granted to companies which were in existence before 1898, and said that there could, in his opinion, be little question but that they also decide that any requirement in a location granted to a company organized since 1898, that the company shall maintain any part of the surface material of a street is void. The decisions do, however, leave unsettled the requirement to maintain some part of the surface of a street imposed in an original grant of location, before the 1898 law went into effect.

There has been no final decision as to the liability for the removal of snow under the new statute, but opinion seems to be that the most that a company can be required to do is to clear its tracks of snow, so as to be able to operate its railway, and that it shall so far as practicable level the snow cleared from its tracks over the adjacent portions of the highway. A great deal of misunderstanding exists among some people because of the diversity of practice existing in Boston and its suburbs in which the Boston Elevated operates, and in other places in the state. The fact that in Boston the railway company does keep in repair its portion of the streets, and does itself remove from the streets a large quantity of snow, has often led officials in other cities and towns to demand that the street railway companies shall pursue the same course. A study of the statute shows, however, that this claim is unwarranted. The changes effected by it do not apply to the Boston Elevated or to lines operated by it until the end of the 25-year period named in the Elevated charter as the time during which no new burdens shall be imposed upon it, and it was expressly provided that the change in the law should not apply to that company until the end of the 25 years.

Conflicts still arise, and may continue to arise, as long as new street railways are built, growing out of the questions relative to construction. It is difficult to avoid these as long as the grants of location are drawn with the present indefiniteness and carelessness of requirement which generally characterizes them. It is well to avoid such general phrases as, that this or the other work "shall be done to the satisfaction" of somebody, and, if on the other hand, the persons promoting a street railway enterprise would refuse to accept any grant of location unless its requirements were made thus specific and definite. But even in these instances much trouble would be avoided if the party to the conflict feeling itself aggrieved would apply to the courts for relief.

Every conflict between city and town officials and a street railway company tends to hasten the day when municipal authorities will have no jurisdiction whatever over street railways. With the great growth of this system of travel and the greatly increased public dependence upon it, there has always been a marked tendency to recognize the fact that street railways are no longer local affairs, but that their regular and uninterrupted operation is essential to the public's whole comfort and convenience, and that anything which interrupts this operation, even under the color of a legal right, is a public hardship. If necessary, problems of the foregoing character should be determined by some tribunal so situated that it can take a broad view of the circumstances.

Mr. Warren then discussed the general trend of legislation of late toward placing the State Railroad Commission in an authoritative position in connection with street railway problems of great public importance. Matters of grade crossing, fenders, wheel guards, heating of cars, furnishing additional accommodations for passengers, acquiring real estate for park purposes, leases, consolidations and the use of foreign tracks were all within the control of this board even before the legislation of 1898. Great authority with respect to locations was granted by the legislation of 1898, and recently the board has been granted [illegible] the vestibuling of cars, determining when a street railway may be opened for public use, approval of local speed regulations, locations on private rights of way and the regulation of fares. The accommodation of the traveling public, uninterrupted operation and the greatest public safety have apparently been in the minds of legislators as these changes in control have been made. These railways are of too much importance to the public to permit any crippling of service by reason of local conflicts. If the result of such conflicts is to be an interruption of travel it is safe to predict that the legislature will speedly transfer to some state commission the remaining jurisdiction still retained by local authorities.

Last year the street railway tax in Massachusetts amounted to 3½ per cent of the total amount of money raised by local taxation in the commonwealth. The latter sum was $46,990,749. Legislation is needed by which some part of this tax may be made directly applicable to the maintenance of state highways, which are increasing notably in importance.

Mr. Warren concluded by stating that it is safe to assume that when the public understands, it will approve the scheme of leaving the entire physical control and maintenance of the highways to the public officials, and that when these officials realize that the street railways are paying a million and three-quarters of dollars annually toward this maintenance, they will see that the money is devoted to the purposes for which, under the law, it is paid, and that they will find that ample funds have been provided for any highway expense necessitated by street railways. At any event it is to be hoped that the remedy now afforded by the statutes will put an end to efforts on the part of either the street railways or public officials to decide these questions of taking the law into their own hands, assaulting each other's employees, tearing up rails, or obstructing either the highway or that part of it represented by the regular operation of street cars.

The Geneva Traction Co.

The Geneva Traction Co. has been organized under the laws of the state of Indiana for the purpose of constructing and operating an electric railway from Marion, Ind., to Celina, O., through Montpelier and Geneva, Ind., passing through the heart of the Indiana and Ohio oil belt for the entire distance, 52½ miles. Franchises and right of way have been secured over the entire route, and the engineers are now working out the details of construction and equipment. The road will handle both freight and passenger business, will be equipped with 55-ft. cars, single phase. The power house will contain water tube boilers and direct connected turbine engines. The power house, car barns and machine shops will be in one building, with the machine shop located in the center, so that the engine room crane can be used to handle material to the machine shop from either the power station or the car barn. The building will be of cement block construction with steel truss roof, and will be located at Geneva, Ind. Chestnut poles will be used in the line construction, except in cities where iron poles will be substituted, and 70-lb. standard T-rails will be used in the track construction.

The officers of the company are: President, Senator Silas W. Hale; vice-president, James H. Hardison; secretary, Andrew G. Briggs; treasurer, Charles D. Porter, all of Geneva; chief counsel, Dudley M. Shively, South Bend; general manager, William J. Hester, Geneva; assistant general manager, Hugh H. Hesford, Buchanan, Mich.; civil engineer, Henderson McClellan, South Bend, and electrical engineer, James H. Forbush, Columbus, O. The offices of the company are at Geneva, Ind.

It is reported that the Baltimore & Ohio will make an electric line out of the Cleveland, Wooster & Muskingum Valley road or at least a part of it.

The Western Ohio Railway Co. and the Dayton & Troy Electric Railway Co. have issued a very convenient time card in connection with their limited service between Dayton and Lima. On one side of the card is a map of the lines while on the other is the time card. This fast service, which has recently been established, includes four limited trains daily each way between Dayton and Lima, making the run of 80 miles in 150 minutes, without change of cars. This is considered the fastest trolley service in the world.

Two New Pleasure Resorts.

The International Construction Co., with headquarters at 1101 Herman Building, Milwaukee, Wis., is now constructing a pleasure resort, which will be known as "Wonderland," located at Oakland Ave. and the city limits of Milwaukee, where the company has a tract of 15 acres. This is about 4 miles from the city hall, an 18-minute ride on the electric cars. About one-third of the site is thickly wooded and from this wood a double row of maple trees, planted some 30 years ago, extends down to the river front, making a most beautiful shaded avenue. The cost of this resort will be $140,000 and the attractions will include the scenic railway, which was on the Pike at the St. Louis fair; shoot the chutes; flying swings built by the Amusement Construction Co., such as illustrated in the "Review" for December, page 982; an electric tower; the Old Mill; a Cagney miniature railway; Chilkoot Pass, otherwise known as the bump-the-bumps, which was illustrated in the "Review" for September; a laughing gallery; a fairy theater; mystic maze; flying horses; dancing pavilion; helter skelter and down and out. Several of these attractions, among which are Chilkoot Pass, helter skelter and down and out, are free to patrons, the idea being that when a crowd gets warmed up by indulging in the exercise which these devices promote, it will be in better spirit to patronize the pay shows.

One of the new attractions is the Fairy Theater, and it is a most ingenious one. The stage and all stage settings are constructed on a large scale, tables, chairs and all furniture being five or six times as large as they would be made for ordinary use. The performers in the theater are children. The audience looks into lenses which are placed in a curved partition separating the stage from the auditorium, the effect of which is to reduce the exaggerated stage properties to their normal size and the effect of the children when correspondingly reduced is quite startling.

Music and outdoor vaudeville acts will be special features. Mr. Richard Kann, who is known to our readers as the author of the article on "Some New Ideas in the Pleasure Resort Business" in the September "Review," is president of the International Construction Co., and Mr. Sherburn M. Becker is vice-president.

Mr. Kann is also president of the Park Construction Co., which is erecting a $200,000 "Wonderland" midway between Minneapolis and St. Paul on the route of the electric interurban line now building by the Twin City Rapid Transit Co. between those points. It should be mentioned that this new line will be the third interurban road of the Twin City company connecting the Twin Cities. At Minneapolis "Wonderland" baby incubators and the Santiago Naval Show will be among the attractions.

Additions to Purdue Railroad Museum.

Negotiations have been completed whereby Purdue University is to receive from the New York, New Haven & Hartford R. R., through the courtesy of Mr. Samuel Higgins, general manager, the historic locomotive "Daniel Nason". A few years ago the University interested itself in securing from railways samples of such classes of locomotives as are now being superseded by machines of more modern construction, its purpose being to preserve as museum exhibits types of design which were in danger of becoming extinct. As a result of this plan, a number of valuable relics are already upon its grounds. From the beginning of this movement, an effort has been made to secure a representative of a type which was common throughout New England thirty years ago, namely, an 8-wheeled engine having cylinders inside the frames connecting with the crank axle. This effort has now been crowned with success. The "Daniel Nason" is said to have been built in 1858. It was exhibited in Chicago in 1893 and has since been held as a relic at Roxbury, Mass. The engine weighs about 25 tons, is complete with its tender, and will be shipped to the University at Lafayette, Ind., upon its own wheels.

The University is also to become the custodian, on behalf of the same railway, for a stage-coach passenger car which is said to have been placed in service in 1835. It consists of the body of a stage-coach suspended over a simple railway truck by means of thorough braces. It will seat inside and on its top about twenty persons.

Correspondence.

Editor "Review": In connection with the proposed combination of the Massachusetts Institute of Technology with Harvard University, the following authoritative statement of foreign opinion (translated from the Zeitschrift des Vereines deutscher Ingenieure of Sept. 24, 1904,) is of interest:

"At a meeting of the Union of German Engineers, held at Munich September 12th, with the participation of thirty eminent representatives of technological schools and universities, as well as of other schools and of industries, the following resolutions were adopted:

"1. It is not advisable, so far as can be foreseen, to attempt to meet the need of new technological schools by the addition of technological faculties to universities, but rather by the establishment of independent institutions; for the technological schools would be hindered in their independent development by attaching them to universities. This separation should not, however, impede the welcome development of intellectual good-will between the two institutions. The attachment to universities would also in no way involve economies of consequence.

"2. The Union of German Engineers stands now, as before, by its expression of 1886, as follows: We declare that the German engineers have the same needs and will be subjected to the same judgment as to their general culture as the representatives of other professions based on higher scientific education.

"In this view we rejoice as the conviction more and more gains ground that a considerably greater significance is to be attributed than before to mathematical and natural science as a means of culture. Knowledge of these branches is becoming more and more an indespensable constituent of general education. The predominantly linguistic education now received by the majority of our gymnasium graduates does not satisfy the demands which must be made on the leading classes of our people, in particular, in respect to the increasing significance of economic questions."

Tech Graduate.

New York Transportation Co.

In connection with the election of Mr. Richard W. Meade as president of the New York Transportation Co., it should be of interest to our readers to know what field this company covers.

The business of the New York Transportation Co. is primarily that of renting, storing and repairing electric vehicles of all kinds, of which it owns between five and six hundred. Its main station is at 49th St. and Eighth Ave., and it has additional stations at 66th St. and Third Ave, 64 Vesey St., New York City, and 19 Downing St., Newport, R. I., containing in all a floor space in New York City of 201,600 square feet, and in Newport 20,000 square feet. It is the largest concern of its kind in existence and has been the principal pioneer in the development of electric automobile livery service.

The Transportation company also controls the Fifth Avenue Coach Co., which possesses franchises of considerable value on Fifth Ave. and other important streets of New York, and the Park Carriage Co., which has an exclusive franchise for operating vehicles in the parks and parkways of the Borough of Manhattan. In other words, it controls all the fixed route transportation facilities in the Borough of Manhattan other than those of the railroads.

Important Contracts in San Francisco.

The Crocker-Wheeler Co., through its Pacific Coast managers, the Abner Doble Co. of San Francisco, has secured a contract from the California Gas & Electric Corporation for three 4000-kw., 25-cycle, three-phase, 13,200-volt revolving field alternators, to be driven by 6000-h. p. gas engines built by the Snow Engine Co. These generators are the largest in capacity in the world driven by gas engines, and will furnish power for operating all the street railways in San Francisco and vicinity. The installation of these three engine-driven generating units in San Francisco will mark an important step for the transmission company, as they will operate in parallel with the water power plants of the company and thus serve as an important reserve plant for the entire system. One of the units will be used exclusively for handling the peak load on the railway lines.

The Electric Tramways of Amsterdam, Holland.

BY E. G[illegible]

In the city of Amsterdam is an interesting tramway which was built by the Allgemeine Elektricitaets Gesellschaft and the Siemens & Halske Co. These tramways cover about 30 miles of route and are

VIEW OF TRAMWAY LINE IN AMSTERDAM.

partly single and partly double track. The cars were built by Raab, of Prague, which concern also supplied the trucks, which have given entire satisfaction. All the cars are single deck and trailers are extensively used. The motor cars are equipped with motors made by the Union Electric Co., of Berlin. The Siemens pattern of bow trolley is used exclusively.

The track is laid with grooved rails and has no ballast, but is merely supported on a bed of sand. No concrete or grouting is used for the reason that the soil is so yielding that a bed of concrete would be liable to break owing to the elasticity of the soil underneath. It has been found with this construction that the cars run very smoothly even at high speed.

The new power station which furnishes current for lighting as well as for tramways presents some unusual features. The building is of brick and ample space has been left for additional machinery as may be necessary. There are 10 high tension feeders leading from the station to the transforming sub-stations which number about 50. At these sub-stations the current is reduced to 220 volts before being delivered to the consumers.

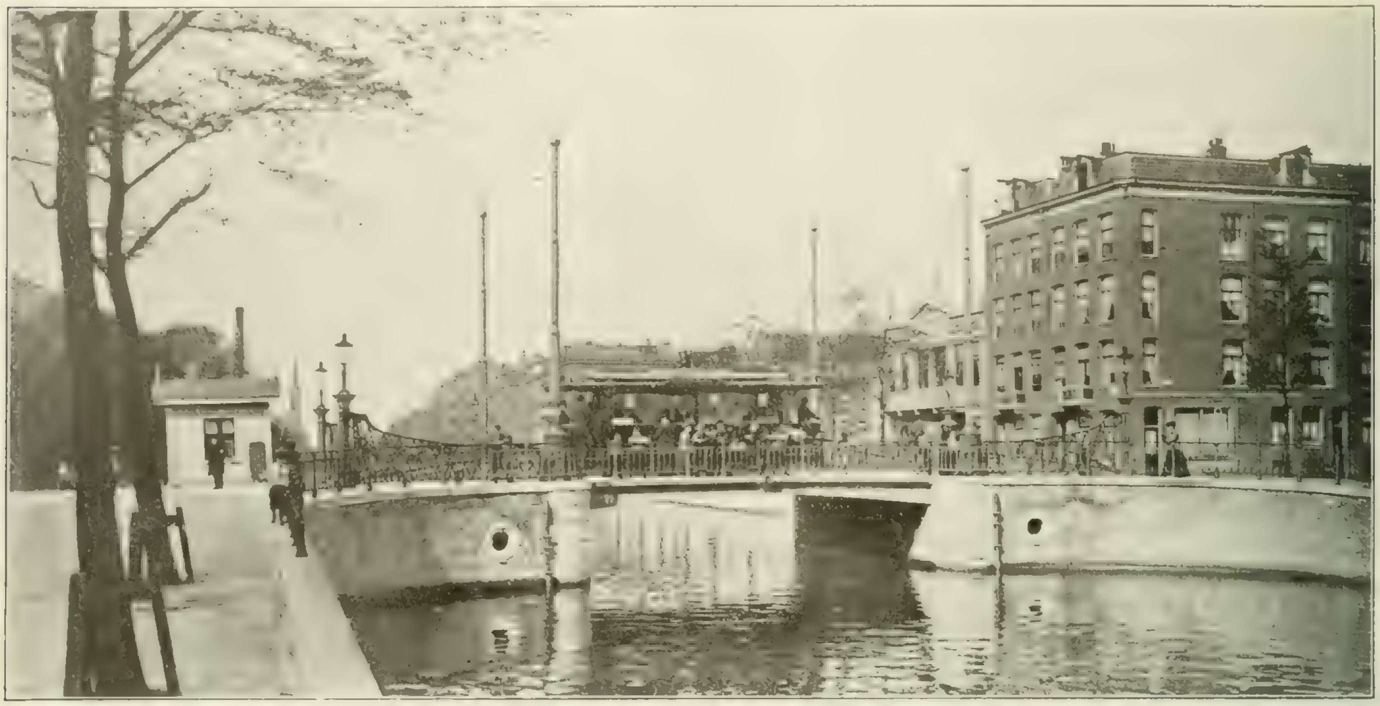
The boiler house contains 12 boilers, each of which is double, one being placed above the other. The lower boiler is of the cylindrical type and the upper one is of the water-tube pattern. Superheaters are fitted behind these boilers. The flames and gases from the furnace after passing the cylindrical boiler pass up to the water-tube boiler above and finally pass to the superheater before being led to the chimney. The steam produced in both sections of the boiler is led to a drum to which the steam pipe connects. Hand firing is employed in this station.

The engine room contains five cross compound horizontal engines of 1,000 h. p. each, directly [illegible] engines drive continuous current generators for the tramways. Two are coupled to three-phase high tension alternators for lighting and the other engine to both a continuous current and an alternating current generator, either of which or both may be used at once as a

[illegible]

[illegible] the continuous current machines were built by Stork & Co., and those for the alternators were made by the Netherlands Co. and are of the Sulzer design. All the engines run at 105 r. p. m. with steam [illegible] superheat. The engines are pro-voltage necessary for electric lighting is well secured. All the generators are of the Allgemeine Elektricitaets Gesellschaft type. The continuous current machines generate at 600 volts pressure and this is fed direct to the trolley wires.

A storage battery is connected in parallel with the railway dyna-



[illegible] AMSTERDAM.

vided with stuffing boxes loose enough in the cylinder covers to allow a certain amount of play and the air pumps for the condensers are operated by a connection from the tail-rod of one of the pistons. The engines which drive the alternators have a small motor connected to the governor and the motor can be actuated from the switchboard so as to help the governor in maintaining a uniform speed whether the load is light or heavy. In this way the steady

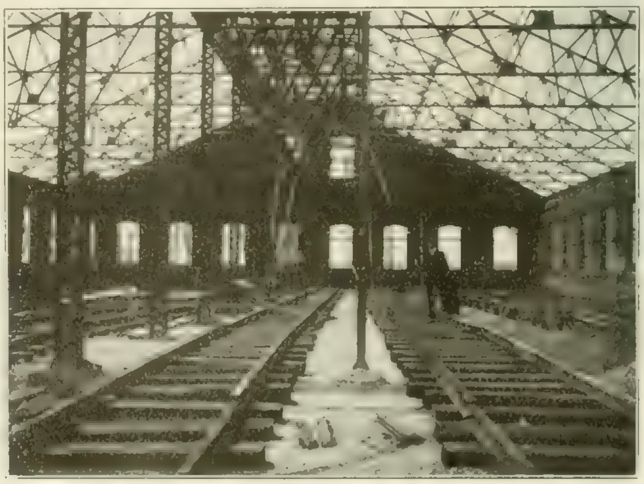
mos and this battery carries all the load after one o'clock in the morning when the only current required is for lighting the station and driving the tools in the repair shops. The three-phase alternators generate current at 3,000 volts and 50 periods per second.

It should also be noticed here that the new electric railway which runs from Amsterdam to Haarlem runs over a part of the tramway lines in both Amsterdam and Haarlem.

The Amsterdam-Haarlem Tramways System.

About five years ago there was constructed in the city of Haarlem, by a local Dutch company, an electric tramway system, the first in Holland. This system included a belt line about the city, with two suburban branches, one running north to Bloemendal and another west about 5 miles to Zandvoort. Haarlem itself is a city of 65,000 inhabitants and the distance between the city limits of Haarlem and Amsterdam is 10 miles. Several years ago a concession was granted for an interurban line, but the route was rather roundabout, and finally the Holland Steam Railway Co. secured control of the enterprise and prevented the construction of the line. In 1901, however, Messrs. Anderhagen & Neumeyer, of Amsterdam, took the prelim-

[illegible] HOUSE, HAARLEM.



INTERIOR CAR SHED, HAARLEM.

inary steps towards securing a new concession over the direct government high road connecting the two cities and running parallel with the steam railroad. In addition to this concession for the use of the government high road, the company secured private right of way for two miles from the government road to the city limits of Amster-

the through [illegible] expense of the concessionaires, who also agreed to pay 40 per cent of the fares which the town would have charged within the city limits, on the basis of its own rates, also to repay the actual cost, plus 10 per [illegible]

GOVERNMENT ROAD FROM HALFWEG TO HAARLEM.

dam, which included a strip of land for the whole distance wide enough to permit of a row of building lots on each side of the road. On this section the tramway is built in the center of the road, with a paved driveway on each side, and outside of this driveway the usual footpaths and building lots are arranged. Running powers were then secured over the tramways of Amsterdam, then in process of conversion for electric operation, for a distance of about one mile from the city limits to the center of the office and retail business

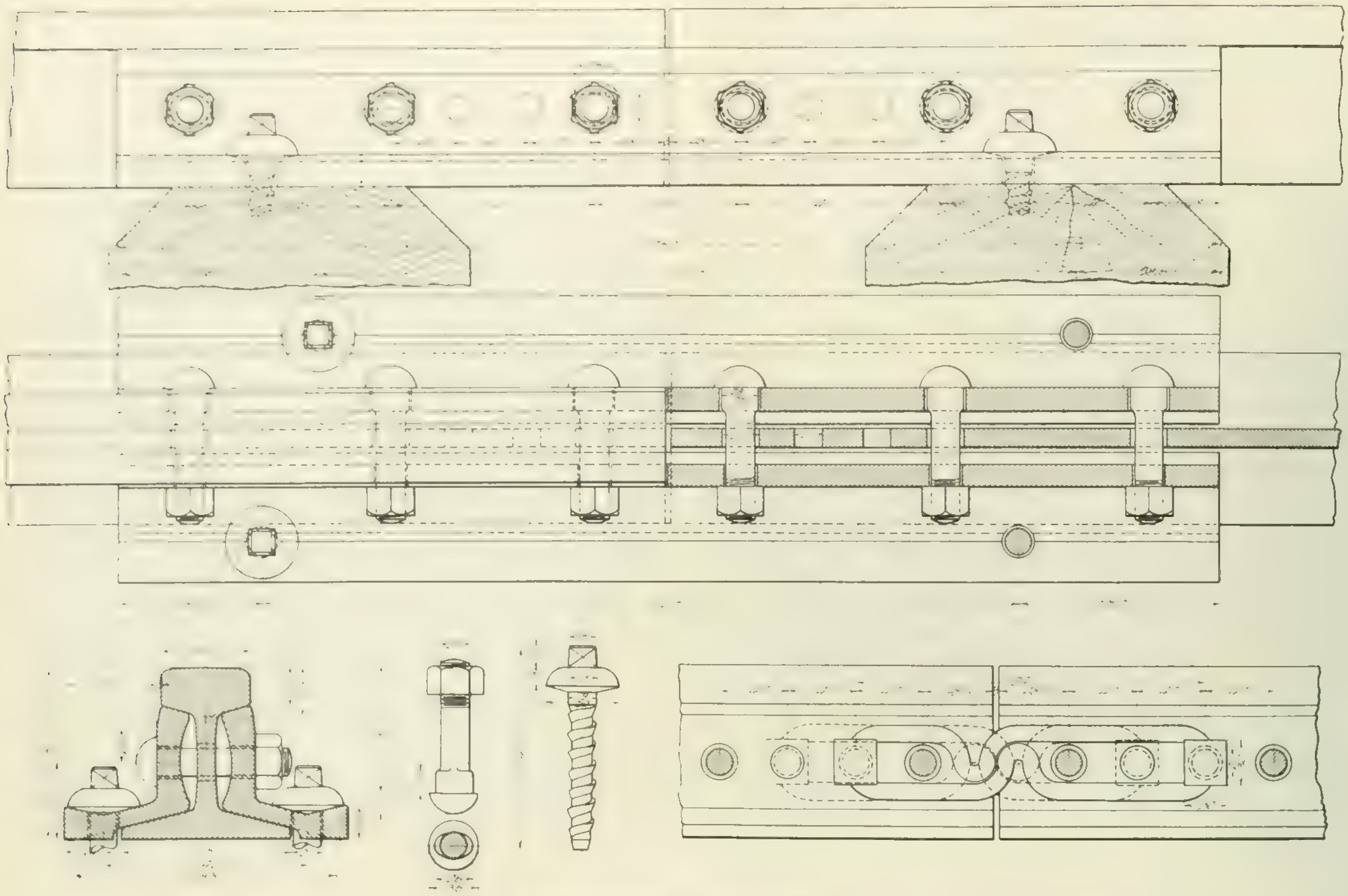
track, and further to pay for the power within the city. An agreement was then secured with the corporation of Haarlem permitting the construction of about 1½ miles of lines within the city to give the company a satisfactory terminus at its eastern end; this concession is also for a period of 50 years.

When all these concession arrangements were completed, the matter was presented to an American syndicate, headed by Mr. H. J. Pierce, of Buffalo, who organized the Netherlands Tramway Co.,

OLD GATE, HAARLEM, AND SPECIAL RAILWAY [illegible]

districts of Amsterdam. The gage of the Amsterdam city lines being standard and that of the new concession being one meter, it was necessary to lay a third rail for the greater part of the distance, where the routes are common. This was made more expensive by the fact that a large swing bridge had to be constructed to permit

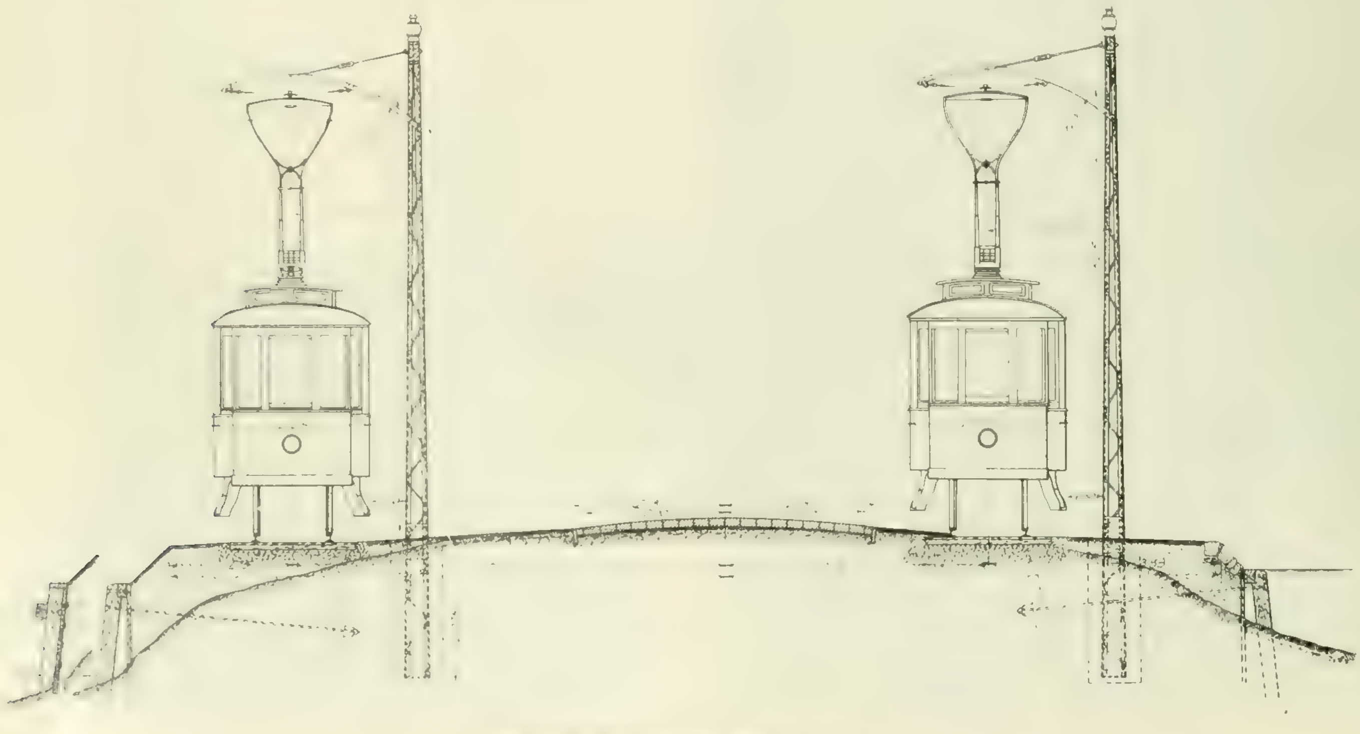
of New Jersey. The Electric Railway Co. of Amsterdam, a Dutch corporation, was also organized to take over the concessions and build the line, all the shares of this company being subscribed and fully paid for in cash by the American syndicate. In order to secure satisfactory terminal facilities in Haarlem and



DETAILS OF TRACK CONSTRUCTION

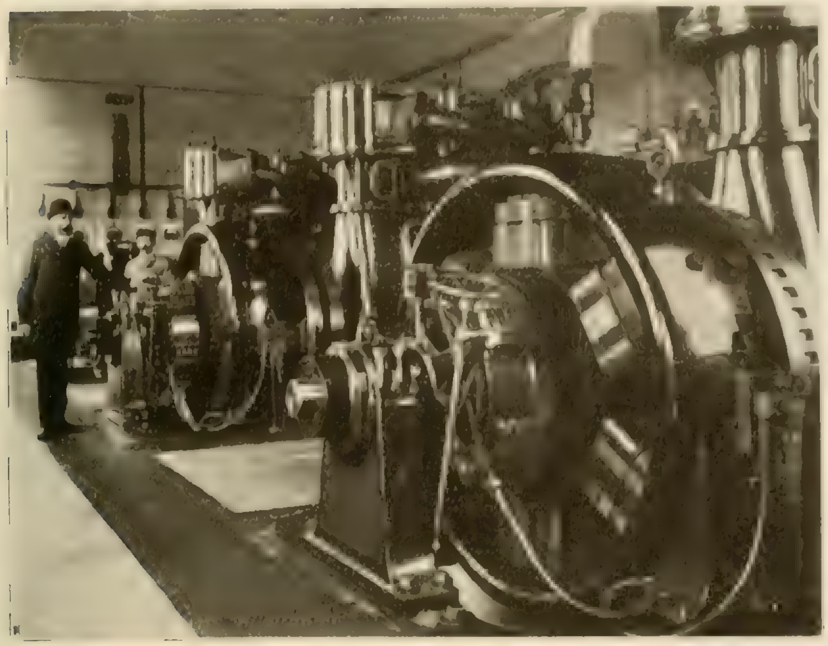
through running arrangements between Amsterdam and Zandvoort, the local Haarlem company, which is known as the First Netherlands Electric Tramways [abbreviated F. N. E. T.], was purchased outright. Contracts were then entered into on Jan. 1, 1903, with J. G. White & Co., Ltd., of London, for the complete design and construction of the road, and operation of the completed system was commenced in October, 1904.

Over the greater portion of the route in Amsterdam the line followed the existing tram line of the municipality and on such portions the third rail was laid. The bridge which is located at the city limits of Amsterdam is what is generally known as the bascule type of swing bridge designed and built by the Haarlem Machine Co. The general details of this bridge are as follows: 12 meters span, 12 meters wide, 876 piles to the foundations, 176 cubic meters of other timber, 1,250 cubic meters of brickwork, 100 cubic meters of granite and 220 tons of steel. From the bridge the line runs over its private right of way the length of which is 2,444 meters. The cross section of this part of the route is 22 meters from building line to build-



SECTION OF ROADBED ON EMBANKMENT

ing line, with a center strip 8 meters wide for the track and center pole construction. At the village of Sloterdyke the line joins the government high road, on the north side of which road runs a canal, except through Halfweg, and on the south side is a ditch. The land is of a boggy, peaty nature, and is used wholly for grazing purposes.



INTERIOR OF POWER HOUSE.

The paving of the high road was practically relaid the entire length, to the stipulated datum level of Amsterdam. In this work there were used 43,500 piles, 4,600 cubic meters of timber, creosoted and uncreosoted; 160 tons of iron for tie rods, 5,000 tons of basalt for slopes, 75,200 cubic meters sand filling, 31,600 square meters brick paving, 9,600 cubic meters dredging, 1,700 meters of fencing and 74 gateways and approaches to farms and houses.

The permanent way along the government high road and along the private right of way is standard railway construction, 70-lb. T-rails of A. S. C. E. section, being used. The rails rest on ties which are spaced 76 cm. center to center, except at the joints, where they are at 50 cm. The joints are staggered. The ties are creosoted Norway pine, 23 x 11.5 cm., the upper edges being beveled. The rails are fastened to the ties by screw bolts and doubled concealed bonds are placed at each joint. The length of route along the canal is 13,417 meters. At the village of Halfweg the line crosses two canals, over which bridges were built, one of four spans of 15 meters each, and the other of two spans of the same length. Through the village of Halfweg there are two sections of single line, which are controlled by an automatic electric signaling device of the Siemens-Schuckert Co. The terminus of the line in Haarlem coincides with the terminus of the Zandvoort line. The construction in Haarlem is all grooved girder rail of 84-lb. section, resting on ties spaced 74 cm. center to center, except at the joints, where they are 56 cm. In Haarlem it was necessary to reconstruct a swing bridge and to entirely rebuild three other bridges, as well as to construct a new bridge for the entrance into the city.

Power.

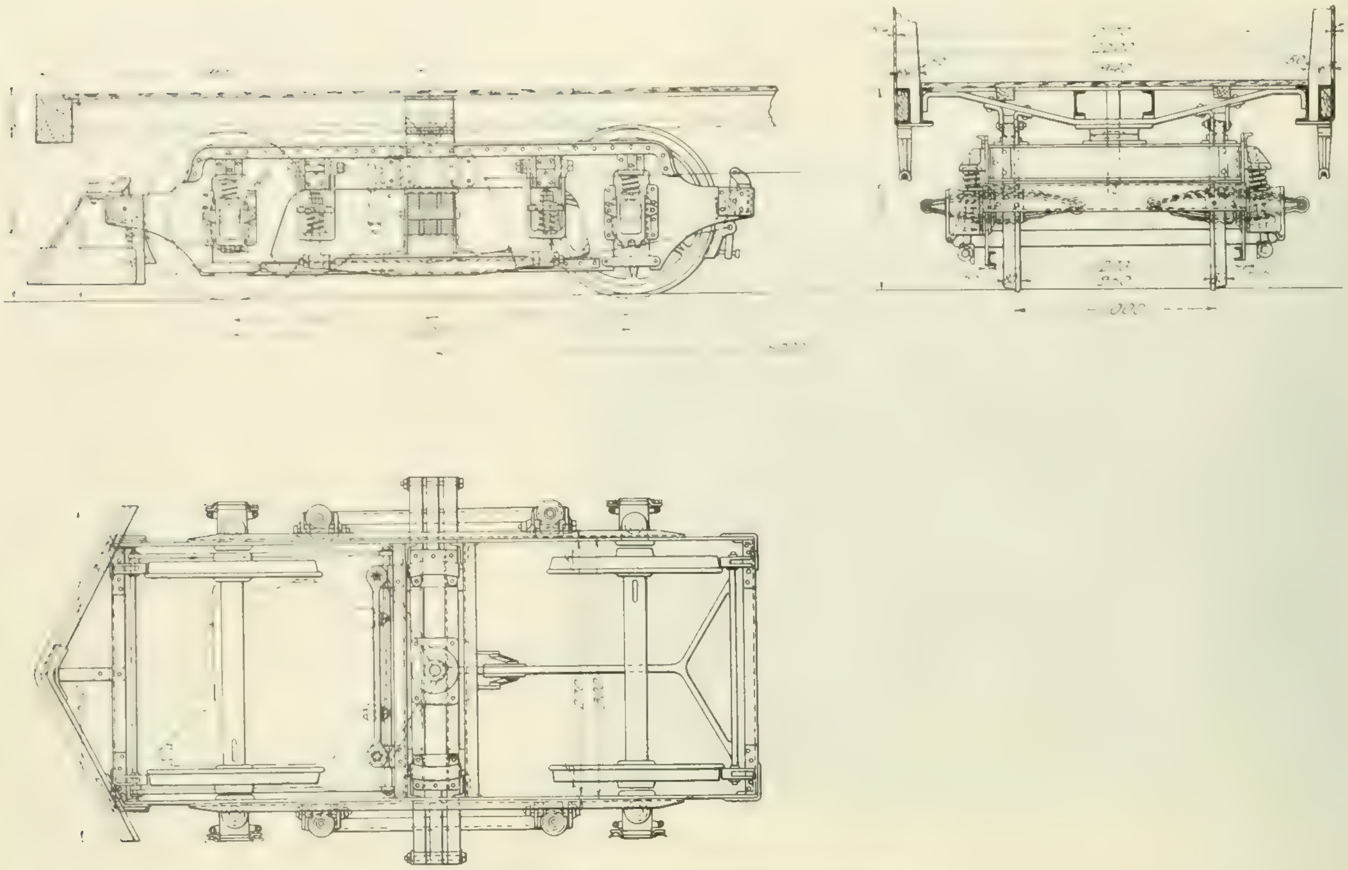
The power house is situated in a central position at Halfweg, being located on the banks of the Ringvaart Canal, which affords cheap facilities for transportation of supplies, and also an abundance of water for feed to boilers and jet condensation. Owing to the nature of the country and the poor condition of ground at the site of the power station, an elaborate arrangement of piling was necessary, the entire site being covered with piles 46 ft. long by 9¾ in. diameter, placed 4 ft. 1 in. apart, each pile being estimated to carry 4 tons. The buildings are of brick, substantially built and neatly finished with stone trimmings. The ground area occupied by the power station site is about 9,150 sq. ft. with sufficient ground for future extensions. A wharf 26 ft. 3 in. wide was erected, immediately adjoining which is the boiler house, 88 ft. 7 in. by 52 ft. 6 in. in size. A [illegible] ity for 400 tons. Good light is obtained throughout the entire build- [illegible] is provided for bringing machinery into the building

[illegible] ent self-lubricating, three-crank, triple-expansion en- [illegible] heated and 17 lb. with saturated steam, with 26 in. vacuum. The speed is 375 r. p. m. The cylinders are 12, 17 and 26 x 13-in. stroke, steam inlet 4½ in. and the exhaust 11 in. in diameter. The foundations are built of concrete, engine centers being 14 ft. 9 in. apart, and the flooring consists of tiles bedded in concrete and supported on two layers of brick. The boiler house contains six Lancashire steel boilers, manufactured by Stork of Hengelo, Holland, encased in heavy brickwork walls with foundations of brick work. The heating surface of each boiler is 926 sq. ft., the grate area 35 sq. ft. and the steam pressure 160 lb. per sq. in. Directly behind the boilers are the superheaters, of which there are six, manufactured by Stork, of Hengelo, which are arranged to work at a temperature of 500° F. By means of flue doors, the superheaters can be cut out and engines worked by saturated steam. The heating surface of each superheater is 330 sq. ft.; each superheater consists of 10 rows of coils, the ends of which terminate in two cast steel headers, the coils being bound by steel straps bolted together. The steam enters the one header, passes through the tubes and discharges at the other. Fixed to the discharge steel header are a safety valve, a blow-off cock, and two small holes for testing purposes.

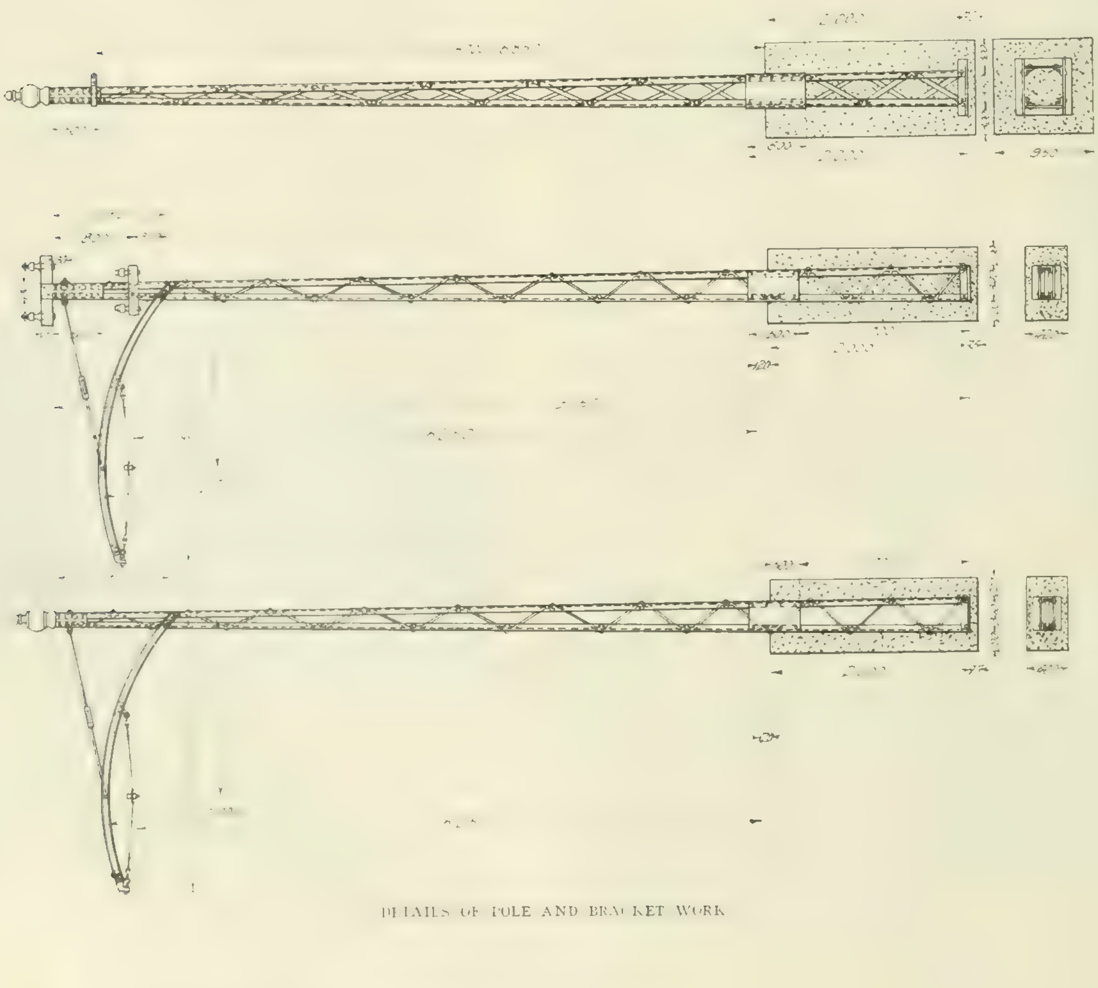
The generators, made by the Societe Anonyme Westinghouse, Le Havre, are three in number, coupled to the engine shafts. The output of each compound 6-pole machine is 300 kw. at 525 to 575 volts when running at a speed of 375 r. p. m. The generator is supported on a cast iron frame, which also supports the outward bearing, the whole being secured by four foundation bolts. The switchboard consists of five panels, three generating and two feeder panels, and is situated on the floor at the end of the engine room.

The panels are of marble fitted to a steel frame and have the usual standard forms of instruments, switches, etc. The cables from each of the generators are led into a trench, which runs along the ends of the generators and terminates behind the switchboard.

A 10-ton traveling crane spans the engine room at a height of 15 ft. The hoisting and traveling, both longitudinally and trans-



PLAN AND ELEVATIONS OF STANDARD TRUCK.



DETAILS OF POLE AND BRACKET WORK.

[illegible] are worked by means of hand chains from the engine room floor. A round brick chimney is situated [illegible] from the building at one end of the boiler house and is 131 ft. high [illegible] diameter.

The condensing plant for the main engine was manufactured by the Nederlandsche Fabrick, Amsterdam, and consists of three jet condensers, pumps of vertical type and cylinders supported on a cast iron frame. The feed water to the boilers is taken from the canal and filtered, the filtering medium consisting of sand and clinkers. A vertical exhaust feed water tube heater made by the Wheeler Condenser & Engineering Co. is placed directly behind the feed pumps, of which there are two sets, each capable of delivering 2,400 gallons per hour against 300 lb. per sq. in.

All steam piping was made by Seiffert & Co., of Berlin, and is extra heavy throughout and arranged by closing valves in the main header, to permit the operation of this plant as three independent units. The diameter of the main header, which is made of cast steel, is 8 in., while the diameter of the pipe from the main header to the engine is 4½ in. The feed water piping to the boilers is arranged in duplicate, the diameter of the suction pipe being 3 in., the discharge from pumps 2 in., mains 3 in. and branches to check valves 2¼ in. From each of the three engines an exhaust pipe is carried across the engine room into the boiler room, where the three pipes connect leading to the atmosphere; a branch pipe is then taken from the engine into an independent jet condenser. The diameter of the exhaust pipe from the engine to condensers is 11 in. and to atmosphere 16 in. The auxiliary steam piping is worked with saturated steam taken from the branches off the main steam pipe and is designed on the loop system, while in the auxiliary exhaust piping the exhaust from each of the three condensers joins into a main pipe and runs to a point where it meets a main exhaust pipe from the three feed pumps to the heater. Valves are placed in the piping so that any unit can be isolated when required.

Cars.

The 34 cars were made by La Mettalurgique at Nivelles, Belgium. They are divided into two compartments, the larger for seating 22 passengers, and the other 12. The smaller compartment is for smoking. The cars are vestibuled. Besides the hand brakes, the cars are equipped with Christensen air brakes supplied by R. W. Blackwell & Co., Ltd., London. Air pumps are worked by an electric motor automatically regulated. The trucks were also furnished by La Metallurgique. The special feature of these trucks is that the swing hangers are pivoted on the outside of the truck frame. This permits a maximum distance between the supports of the spring plank and a maximum distance center to center of the swinghangers. The result of this construction has been most satisfactory. The trucks are very easy riding, even at the higher speeds of 35 to 40 miles per hour.

The motors are 50 h. p. furnished by the Union Elektricitats Gesellschaft, now incorporated with the Allgemeine Elektricitats Gesellschaft.

A new car-shed was constructed in Haarlem. The pit construction in the car-shed tracks was made with cast-iron columns, which carry the rail directly. These columns at the other end have flanged bases, resting on the pile foundations.

Overhead Work.

The overhead equipment is on the bow system, with a pressure of 500 to 575 volts. The poles are of the lattice girder type, of three different weights, 250 kg., 317 kg. and 590 kg. The first two are constructed of two channel sections bolted together and the last with angles. The poles are provided with heel plates and set two meters in concrete. Bracket arms consist of two channel sections, bolted together. Bracket arm construction is used throughout, except in Haarlem, and the poles carry both the feeder cables and telephone wires. Feeder cables consist of two bare copper conductors, each 194 sq. mm. section. The trolley wire is 68 sq. mm. in section. On that part of the route from Haarlem to Zandvoort, bow contact is made with two wires simultaneously. The trolley wire is zig-zagged, in order to equalize the wear on the bow. The height of the wire from the ground varies in Amsterdam, on the government road, and on the E. N. E. T. section; this variation in height caused at first considerable trouble with the bows, but at present the bow base is so arranged as to keep an equal tension on the bow at the respective heights. The wire is screwed and held up by mechanical clips, [illegible] strength.

Theodore P. Bailey.

[illegible] and general manager of the L. E. Meyers Co., Chicago, the company has secured one of the most [illegible] railway and lighting business. To [illegible] ey resigned the position of assistant manager of the western office [illegible] years. Mr. Bailey began his business career in 1882 as an employe of the Van Depoele Electric Light Co. Shortly after entering the services of this company he was elected secretary of it, which position he held until 1884. He then left this company to become selling agent for the arc lighting apparatus of the Thomson-Houston Co., and in 1887 was made manager of its railway department in the west, which territory covered the entire United States west of Chicago. At the time of the consolidation of this company and the organization of the General Electric Co., in 1892, Mr. Bailey continued in charge of the railway department of the company, later assuming the additional duties as assistant manager of the western office.

T. P. BAILEY.

The Chicago Consolidation.

The latest development in Chicago Union Traction matters is the reported consolidation of the Chicago City Railway Co. and the Chicago Union Traction Co., which has been brought to a successful conclusion in New York City by a syndicate headed by J. P. Morgan & Co., and composed chiefly of J. P. Morgan, H. B. Hollins & Co., Marshall Field, John J. Mitchell, the Armour interests, and John A. Spoor. On January 11th, the following advertisement appeared in the Chicago newspapers, which tends to confirm the report:

"To All Stockholders of the Chicago City Railway Co.:

"In behalf of Messrs. J. P. Morgan & Co., as syndicate managers, the undersigned hereby offer to purchase any and all shares of stock of the Chicago City Railway Co., at the price of $200 per share, provided that not less than 90,001 shares, constituting a majority of the total outstanding capital stock, shall have been delivered under this offer.

"All stockholders desiring to accept this offer will deliver certificates for their stock, duly endorsed in blank for transfer, to the Illinois Trust and Savings Bank, in the City of Chicago, Ill., on or before the 15th day of February, 1905, and in exchange therefor will receive a certificate entitling the depositor on or before the 31st day of March, 1905, to receive payment at the rate of $200 per share for the stock therein specified, if by that date the majority of such stock shall have been so delivered or accepted, and otherwise to receive a stock certificate for the same number of shares represented by such certificate."

The above was signed by Marshall Field, John J. Mitchell and P. A. Valentine. The only exception to the purchase of all the stock is that these three gentlemen have agreed to retain their holdings and become the active Chicago element in the merger. As soon as the syndicate is assured of the control of the Chicago City Railway Co., negotiations with the city will be opened and for this purpose it is possible that a protective committee of Chicago City, Union Traction, and underlying interests will be formed to deal with the council committee on local transportation relative to franchise matters. Buying of City Railway stock and West Chicago Street R. R. consolidated bonds absorbed the larger part of the interest in the local stock market during the last few days, City Railway advancing [illegible]

CHICAGO THE LONDON

STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE

KENFIELD PUBLISHING CO.,

45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address "Winfield" Long Distance Telephone, Harrison 754.

BRANCH OFFICES:

New York 39 Cortlandt Street. Cleveland 302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Please make all remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV JANUARY 15, 1905 No. 1

CONTENTS OF THIS NUMBER.

ANNUAL INDEX.

The annual index for the "Review" for 1904, is included in the January, 1905, number and should not be overlooked in preparing the files for binding.

ANOTHER NEW ASSOCIATION.

Last month we had the pleasure of recording the organization of the Indiana Electric Railway Association, and this month there is yet another in the field. The Canadian Street Railway Association was organized at Montreal, Dec. 20, 1904. One point on which the new association is deserving of especial commendation is that it has provided itself with an ample taxing power, so that it will not be prevented from carrying out its work by lack of funds. Not only are the dues comparatively high, but there is granted to the executive committee the power to levy assessments on members, prorated according to gross receipts.

THE EAST BOSTON TUNNEL.

The tunnel connecting Boston with East Boston, which was begun by the Boston Transit Commission in May, 1900, was opened to traffic by the Boston Elevated Ry. Dec. 30, 1904. The cost of this work was about $3,300,000. As an indication of what may be expected in the way of traffic it is interesting to note that nearly 13,000,000 passengers traveled between Boston and East Boston by the ferries in 1903. Upwards of half an hour is required in the journey from Maverick Sq. to Court St. by ferry and surface cars The tunnel time is six minutes, a toll of one cent being collected by the Elevated road for the city of Boston in addition to the regular 5-cent fare. As the ferries also charge a one-cent toll, this immense reduction in time is secured without additional expense to the passenger. The added efficiency which the East Boston tunnel confers upon the elevated system as a whole is bound to be considerable, and it is safe to say that the citizens of Boston will probably never have cause to regret the carrying out of this notable and permanent triumph of transportation engineering.

HOW FIGURES ARE MADE TO TALK.

At the December meeting of the Western Railway Club, Mr Slason Thompson presented a paper on "American and British Reports of Railway Accidents," which is a most interesting discussion of the way in which facts are distorted and used to inflame public opinion against railroad corporations. Mr. Thompson's paper is open to one adverse criticism which it is feared will detract to some extent from the value it should have. This objection is the use of somewhat intemperate language in characterizing the motives attributed to the Interstate Commerce Commission in publishing garbled or incomplete extracts of official documents and drawing conclusions unjustified by the premises. While the Interstate Commerce Commission apparently deserves all the bad things said about its action and motives, we believe that Mr. Thompson's argument would have been stronger if he contented himself with stating the facts.

It is said that the statistics of railroad accidents "are given out by the Interstate Commerce Commission no less than seven times a year, with what Grover Cleveland would call 'ghoulish glee, to fill the public mind with horror over the harrowing totals of every description of frightful or trivial railway accident." The fact that in England in 1901 for the first time on record not a single passenger was killed in a train accident "has been rolled as a sweet morsel through the disingenuous reports of the Interstate Commerce Commission" and served to divert attention from the totals for the Board of Trade Report, which should be compared with corresponding statistics for America.

The Board of Trade report for 1901, the year in which no passenger was killed in a train accident, states that the number of personal accidents reported to the Board of Trade by the several railway companies of Great Britain during the 12 months amounted to 1,277 persons killed and 18,735 injured. If these figures are multiplied by 10, which represents the difference in risk by reason of the greater mileage, tonnage and number of employes in America, the result of 12,770 killed and 187,350 injured; this is the gross total to be compared with American figures. The American figures for the year ended June 30, 1903, were 9,480 killed and 76,553 injured.

Mr. Thompson points out that in Great Britain statictics of rail-

way accidents are collected to locate the cause and responsibility and where possible to prescribe and enforce the remedy, while in America these statistics are collected, tabulated and published to establish a preconceived theory and shift the responsibility to the absence of some safety device and convict American railway managers of a greed which shows shocking disregard of human life.

TICKET CONTRACT.

At its last meeting the Ohio Interurban Railway Association agreed upon a form of interline coupon ticket which is recommended to members of the association. The description of the ticket and the form of contract are given on another page. The avowed object of printing and selling such tickets is to benefit the passenger by enabling him to buy one ticket that will carry him through to his destination, instead of having to buy three or four, or half a dozen separate tickets, one for each road; and also to benefit the companies by getting the passenger to decide to make the whole of his journey over electric lines, collecting the money for the whole trip, and conserving the patron for friends instead of possible rivals. It is therefore proper to examine the contract with a view to judging how well the ticket will accomplish its objects; in doing this it is quite as important to consider how the companies act, as well as how the passengers may, from the text of the ticket contract, properly infer they are going to act. And divergences between acts and words justify some adverse criticisms.

The one-way coupon ticket is intended to be on its face limited, while the rate charged for it is (according to the present general practice) the sum of the local rates on the various roads over which the ticket reads. The law is well settled that a railroad ticket sold at full rates is good until it is used, and there is no reason to suppose that this principle would be overthrown were a case against an electric line to be carried up to the court of last resort. Moreover, it is the present practice of nearly all, if not all, the electric lines selling these tickets not only to redeem one-way tickets if presented after the time limit has expired, but they instruct their conductors to accept the tickets when presented on the cars, even if the limit has expired. What could be more absurd than to issue written instructions (the ticket itself) for conductors to do certain things and then issue oral instructions to violate the written ones? What course is better calculated to invite trouble in event the conductor is either stupid or ill-tempered? A dead-letter law is always bad because it engenders contempt of other laws. Passengers will not be long in learning that the limited ticket rule is a bluff, and naturally have the right to presume that other rules of the company are intended for bluffs also. The same is true of employes.

The only argument we have heard in favor of limited tickets is that it brings them into the auditor's office sooner and facilitates accounting. This does not seem to be a sufficient reason, because the outstanding ticket liability always exists, and whether it be a trifle larger can make little difference, especially as the company has the money received for the ticket; and even more especially as the company is in fact willing to redeem the ticket whenever presented.

The requirement in the limit clause that if limited the ticket must be "used to destination before midnight of the date indicated," is an unusual one and we believe that it is invalid; because a passenger in planning his journey has a right to rely upon the railway running cars on the scheduled time which it does not always do, and it is unreasonable to make the passenger suffer loss from delays which are the fault or misfortune of the company and easily may cause him to exceed the time limit. As the ticket is subject to the stop-over regulations of the roads over which it reads, and these will naturally vary the "used to destination" limit will offer opportunity for much confusion.

The limitation of baggage liability to $50 for a whole ticket and $25 for a half-ticket is also of doubtful value, as the company can not hope to evade paying for all the baggage which, in view of the circumstances and of his condition in life, the passenger has reasonable need to take with him, provided it be lost through negligence of the company's servants.

These criticisms apply in a lesser degree to the contract on the round trip tickets (which is practically identical as to the conditions) because round trip tickets are usually sold at a reduced rate, and there consequently is some consideration for the restrictions imposed upon the passenger. Yet even in the case of round trip tickets it is the general practice to redeem them regardless of the time limit, and the dead-letter law argument is equally valid.

[illegible] we believe they will benefit both railways and passengers.

Patrons will appreciate the convenience of interline tickets just as they do the interchangeable coupon books of the O. I. R. A. form. But the appreciation will be in spite of and not because of the restrictions, and it seems to us that the companies concerned [illegible] liberal ideas, which we know their managers have, and which their practice demonstrates.

PARK RECEIPTS.

A great many street railways have embarked, directly or indirectly, in the amusement business, believing that the pleasure resorts would be a source of profit in themselves or that regardless of the direct return, the street railway traffic would be so increased that the general result would be profitable. The testimony of those street railway men who have had experience with pleasure resorts is almost unanimous to the effect that the parks have been good investments. Varying conditions have caused different companies to equip their resorts in correspondingly different ways, and quite a few unsuccessful experiments have been tried; these failures, however, are as a rule attributed to faulty applications of the park idea, rather than to the idea itself.

Those who have parks, and especially those who are expecting to operate parks for the first time this season, will be interested in some of the deductions of Mr. Richard Kann, from his experience in the amusement business. As illustrating the tendency of the inexperienced man to over-estimate the possible receipts he states that at the White City, New Haven, Conn., a number of street railway men who were inspecting the resort ventured to guess at the gross receipts from 21,000 people, when the admission fee was 10 cents and there were 10 amusement devices charging 10 cents each, and placed the total at $13,000 per day or 65 cents per capita. This guess was nearly 300 per cent too high.

The amount spent at Coney Island, New York, is given as 24 cents per capita; for other resorts the average expenditure is stated to be 18 cents per capita. The endeavor of the amusement manager is to increase this average expenditure, and a multitude of plans have been tried.

Band music was one of the first means used to put the crowd in a lively humor, and one resort has spent over $40,000 for music in a single season. The gate receipts were increased but the patronage of the amusement devices fell off, because the band concert held the crowd. Vaudeville had the same effect.

Sensational vaudeville "acts," such as high diving, tight rope, and other short but thrilling performances, were found to have the desired effect. Such acts in full view of the entire crowd, at intervals of half an hour, each one requiring only a few minutes, keep the crowd moving about the grounds, hold it till late in the afternoon or evening, but do not keep it so occupied that there is neither time nor inclination to visit the pay shows in the intervals between the sensational free performances. To promote good nature on the part of patrons and get them into the proper frame of mind to spend their dimes such free amusements as the Spiral Slide, the Helter Skelter, the Bumps, etc., are found to be very efficacious.

It is Mr. Kann's idea that in 1905 most of the large resorts will have a carefully selected band (not a band that will keep a crowd enthralled for forty minutes at a time, but one that will play popular music and make the crowd hum), a series of vaudeville acts so sensational that they will easily advertise (and very short in their performance) given at intervals of thirty minutes, properly bulletined, so that the crowd may know when to expect them, and a number of free attractions designed to make people laugh.

Also that there will be a reduction in the price of the big attractions within the grounds, because it has been found that 25-cent attractions must be produced on a tremendous scale to be profitable, inasmuch as the 25-cent performance, no matter what it may be, must not be over 25 minutes in length. If longer time is required it will interfere with the earning capacity of the other devices in the park. Last season many of the 25-cent attractions in the large resorts were reduced to 10 and 15 cents and made shorter for that reason. The theory is that as the average person will spend from 18 to 24 cents, the correct policy is to get this 18 or 24 cents as soon as possible. A Scenic Railway will earn it in four minutes and twenty seconds, an Old Mill in six minutes, a Shoot the Chutes in

one minute, while the Johnstown Flood, the Galveston Flood, the Fall of Pompeii, or a vaudeville performance, requires thirty minutes.

THE RAILWAY MOTOR OF 1905.

The custom of taking account of stock [illegible] year is one which is worth while in matters of engineering no less than in personal affairs, and as the transportation world swings into line for another twelve months of progress, it is fitting to glance for a moment at both the present status and future prospects of the railway motor.

The civilized world has realized its dependence upon the railway motor more in the year which has just closed than ever before. It is a fortunate thing that this appreciation has come about through the extension of rapid transit facilities and possibilities, rather than through costly interruption of service. Telephone experts, electric lighting engineers and other specialists have always enjoyed the opportunity of picturing the inconvenience and discomfort which the cutting off of their circuits would cause the communities served by them; but it is safe to say that few persons realize the paralysis and stagnation of business which would ensue if the electric railways of any great American city should stop operation. The year 1904 takes its place among its predecessors as one more period in which the railway motor successfully performed its huge daily task of carrying countless thousands of passengers quickly, comfortably and cheaply between their homes and their places of business in the great ebb and flow of urban life. Many of these passengers had no alternative transportation facilities, and many others deserted the old steam routes for the less expensive, cleaner and more convenient trolley lines.

Two events of great significance mark the departed year as an epoch of unusual progress. These are the commercial development of the series alternating current motor, and successful completion of the largest and most powerful direct current locomotive ever built. That the future has great things in store for each, no one can gainsay, but it is also true that much confusion of mind exists as to the prospective development of these two radically different types of motor. The general characteristics of both these alternating current and direct current engineering triumphs are familiar, but the relative disadvantages of each have thus far been less widely appreciated.

It is always the case that when any new type of equipment is placed upon the market, plenty of enthusiasts will be found predicting the passing into oblivion of every preceding type of apparatus. Seldom are such predictions completely fulfilled. The telephone was going to relegate the telegraph to the junk pile; the bicycle was going to put the trolley car out of business, and last but not least, the wireless telegraph is going to depreciate ocean cable securities! Prophets have not been wanting to declare that the commercial design of the alternating current series motor has given the coup-de-grace to every direct current motor underneath a car, and that the completion of the first electric locomotive for the New York Central suburban service is the advance signal for the end of the steam locomotive.

Too much enthusiasm in this direction is as bad as too little. What is needed in every case is a broad-minded analysis of the situation which considers impartially both the advantages and disadvantages of every available motive power on the market. From the standpoint of the electric railway expert there is perhaps too much conservatism in steam railroad circles in the matter of adopting electricity for suburban service, but with the New York Central and Pennsylvania terminal work as the entering wedges, the local passenger business need not be despaired of. The next five or ten years will doubtless witness tremendous electrical development in the handling of heavy suburban traffic in and near our larger cities. Chicago and Boston are bound to follow close upon New York's experience, with their enormous suburban business.

Turning to the two latest types of railway motors as exemplified in the alternating current and direct current development of 1904, it seems probable that the tried and trusted direct current series motor of city service need not fear the advance of its later brethren for some time to come. The perfection to which the direct current machine has been brought after years of hard earned experience under adverse conditions of load, track, voltage, weather, slush, mud, water and handling makes it difficult to point out wherein any improvement in design can be effected, in connection with the latest types of direct current series railway motors now on the market. Weight has been cut down in terms of output; efficiency has been increased; heating and ventilation have received the attention born of past failures, and sparking at the commutator has been pretty well eliminated. It is certainly no small advantage that the alternating current motor has proved to operate with direct current as well as any direct current machine that the manufacturers have produced, but this fact is not sufficient to cancel direct current motor contracts for urban equipment. A car fitted with both alternating current and direct current control is naturally more expensive to build and maintain than one in which almost the last available square inch is not occupied by equipment, although this is perhaps a minor consideration. For combined alternating current and direct current running, however, the series alternating current motor is well adapted to meet the conditions of a mixed city and suburban service, and it is here that the new machine is most likely to score, rather than in purely urban operation.

For suburban or even interurban service demanding not too great powers in the motor rating, the great economy in the first cost of the overhead system and notable saving in the cost of rotary converter transformations and attendance hold a bright future before the alternating current motor. The increased weight of the alternating current equipment as compared with the direct current cannot be urged as a vital objection, since this increased efficiency of the system due to the elimination of the rotary converter is about offset by the addition in weight. Particularly is the alternating current motor adaptable to cross country lines through sparsely settled territory, as it is in these long stretches that the full force of copper economy and the absence of substation attendance charges is most directly brought home.

Thus far, it has been difficult to design alternating current series motors much above 75 or 100 h. p. in capacity. The 4 ft. 8½ in. gage is a special bar to progress in this direction, and it has not been possible as yet to design gearless alternating current motors with the armatures mounted directly upon the axles. It has recently been pointed out that if it were possible to construct gearless alternating current motors of the same general arrangement as those upon the New York Central No. 6000 type of direct current locomotive, it would be found that the maximum coefficient of traction available would work out not far from 15 per cent of the weight upon the drivers, as compared with 25 to 30 per cent with direct current motors. This is due to the pulsating torque of the single phase motor, which if transmitted directly to the drivers is only half the maximum. With a geared alternating current motor the situation can be improved to the extent of utilizing about 80 per cent of the torque of the direct current motor for the same weight upon the driving wheels. This is a serious matter in general railroad service, where both the wheel base and weight upon drivers are limited. Although a multiple unit system of alternating current control is feasible, the cost of two alternating current units of the same capacity as a direct current locomotive is at present prohibitive. Higher voltages than 600 to 700 are not advisable upon the third rail and the difficulties of trolley insulation and taking off large currents with trolley wheels mount up as voltages and powers increase.

Apparently the direct current locomotive has the best of the situation at present, for heavy suburban train service. It is therefore reasonable to expect that for some time to come the alternating current motor will find it difficult to compete with this formidable rival in the electrical equipment of steam roads. We are at an interesting stage in the development of rapid transit systems. Three points have become well established, viz:

That the direct current series motor holds the urban field; that the alternating current series motor will prove extremely useful in the suburban and interurban sphere; and lastly, that the direct current locomotive at present is the better in the suburban train service of steam railroads.

Finally, the foreging comments are printed with no intention to disparage the brilliant development carried out by both alternating current and direct current designers within the past two or three years. Rather is it intended to point out some of the limitations which must be considered in making a wise choice of rapid transit equipment and to add a word of caution against accepting the idea that any single type of equipment is the key to every problem of railway motive power. The grand prize of the locomotive designer will be won when the heavy long distance freight and passenger traffic of the steam railways is captured by electrical methods.

Ft. Wayne, Van Wert & Lima Traction Co.

The recently completed electric railway between Lima and Van Wert, Ohio, is interesting as an example of good construction work rapidly executed, and also as an indication of the continued vitality of the interurban electric railway in the central west where it has been most extensively developed. This line closely parallels the Pennsylvania railroad throughout its entire length and was built to give the towns along its route the better local passenger service which is much needed. When completed to Ft. Wayne it will make

OVERHEAD CROSSING OF FT. WAYNE, VAN WERT & LIMA WITH PENNSYLVANIA, [illegible]

possible a through service to Logansport, more than half-way across the state.

The Ft. Wayne, Van Wert & Lima Traction Co. was organized Aug. 4, 1902, to build an electric railway from Ft. Wayne, Ind., to Lima, Ohio, a distance of 63.2 miles. In both Ft. Wayne and Lima entrance is over the tracks of the local street railways; at Ft. Wayne the urban section is 2.2 miles; at Lima, 1.8 miles. This leaves for the interurban line proper 59.2 miles, of which the section between Van Wert and Lima, 26.5 miles, is now open for traffic. The section from Van Wert to Ft. Wayne will be completed in 1905.

At Ft. Wayne the interurban company pays 2½ cents per passenger for use of the city tracks, while at Lima it pays 22½ cents per car-mile to the Lima Electric Railway & Light Co., this being estimated, from experience on the Western Ohio Ry., as the equivalent of 2½ cents per passenger. For the towns of New Haven, Monroeville, Van Wert and Delphos the interurban company secured 35-year franchises on very favorable terms. Through the villages of Besancon, Zulu, Tillman, Dixon, Convoy, Middlepoint and Elida it purchased a private right of way. Outside of towns and villages the company has its own right of way with a minimum width of 40 ft., the location being chosen with a view to high speed operation.

The country traversed is level except that short section between Ft. Wayne and New Haven which is slightly rolling. This favorable topography has enabled the grades between Lima and New Haven to be kept under 1 per cent without excessive construction cost, and the right of way was so chosen as to give [illegible] Haven and Ft. Wayne will have a grade of about 2½ per cent but for a short distance only. From Lima to Monroeville the route is close beside the Pittsburg, Ft. Wayne & Chicago R. R. right of way.

The territory served comprises sections of Allen County, Indiana, and Van Wert and Allen Counties, Ohio, districts already well settled, and which are being further rapidly developed. The Ohio counties include rich oil fields which not only insure prosperity for rural land owners, but provide both passenger and freight business for the railway. Over one hundred manufacturing concerns, many of them large ones, have their headquarters in the terminal cities and the towns on the route; aside from these the oil wells, stone quarries and grain elevators in the territory are numerous.

At Lima the road interchanges business with the Western Ohio Ry., and when completed to Ft. Wayne will have similar arrangements with the Ft. Wayne & Wabash Valley Traction Co.

ELIDA WAITING ROOM AND SUB-STATION.

The population tributary to the line is as follows:

Allen County, Indiana:	
Ft. Wayne	57,000
New Haven	1,200
Monroeville	1,000
Rural population along line	8,000
Total	67,200
Van Wert County, Ohio:	
Convoy	1,100
Van Wert	9,000
Middlepoint	1,500
Delphos	2,300
Rural population along line	8,200
Total	22,100
Allen County, Ohio:	
Delphos	2,800
Elida	550
Lima	33,000
Rural population along line	5,000
Total	41,350
Grand Total	130,650
Average, including terminal cities	2,067
Average, excluding terminal cities	677

THE HOGUE FORCES AT WORK.

An estimate of the gross earnings based upon results on other Ohio and Indiana interurban lines, and taking into consideration the relative populations available, shows an income of $4,500 per mile may be expected.

The work of construction of the section east of Van Wert has been carried out very rapidly. The directors on June 20, 1904, voted to build from Lima to Delphos, and work was commenced July 20th. The contract for grading, track laying and all overhead work was let to G. A. Hogue, of Indianapolis, and he completed the 15 miles within 60 days. Cars have been in regular operation since October 1st on this section.

The construction of the section between Delphos and Van Wert was authorized Sept. 28, 1904, and the work began October 15th, the contractor being Mr. Hogue. This section of 13¼ miles was completed late in December and the first car was operated between Lima and Van Wert on December 31st, the opening of the line being appropriately celebrated by the citizens of Van Wert and Lima who now have available a satisfactory local transportation service—something not heretofore enjoyed.

Roadbed Construction.

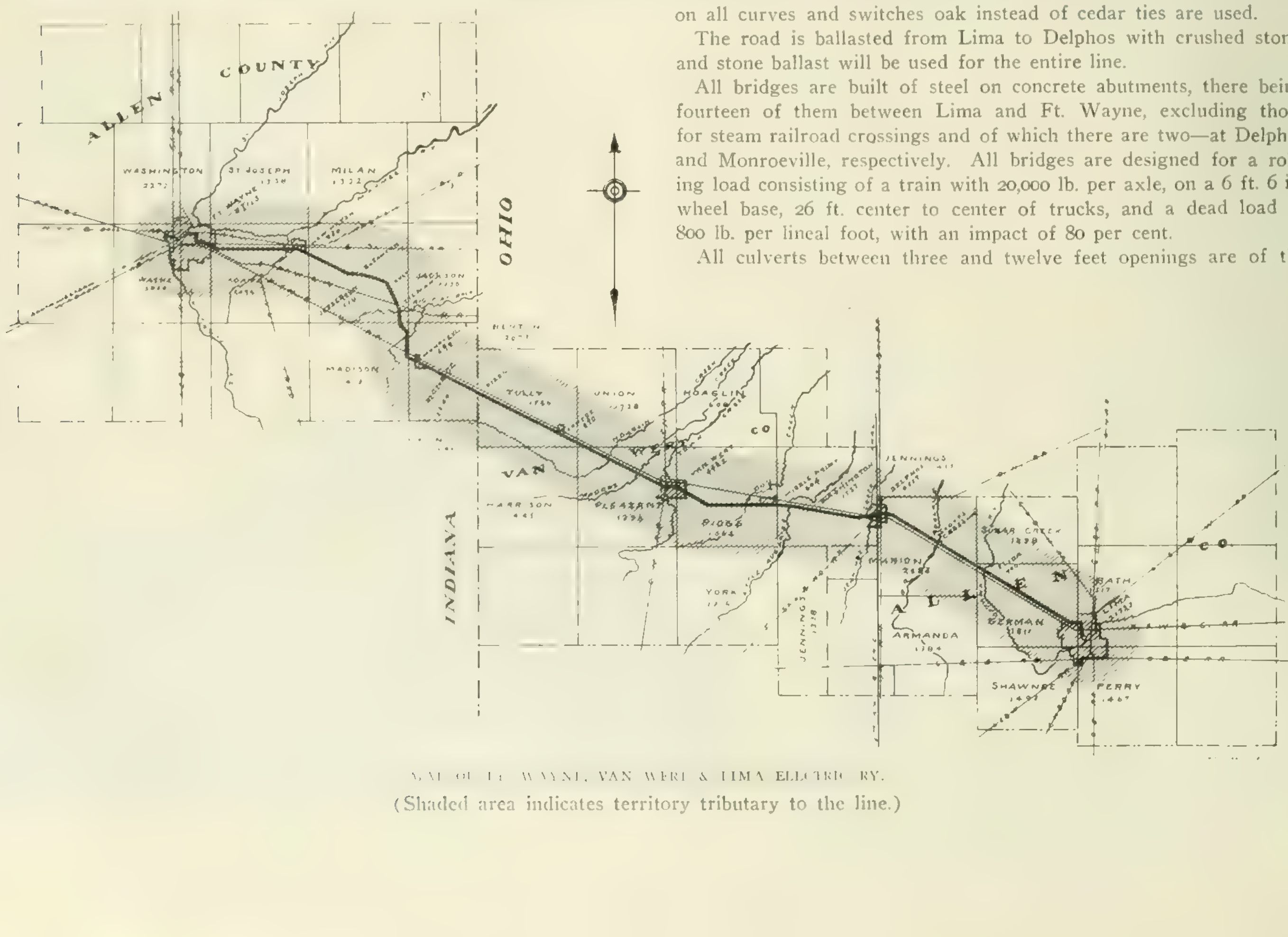
The road, as stated, is built for the most part on a private right-of-way, not less than 40 ft. wide, which has been purchased outright at a cost of $75,000.

The track is of 70-lb. A. S. C. E. section steel T-rail, with six hole splice bars at joints. Cedar ties 8 ft. long are laid 2 ft. between centers. At each rail joint on tangents are two white oak ties, and on all curves and switches oak instead of cedar ties are used.

The road is ballasted from Lima to Delphos with crushed stone, and stone ballast will be used for the entire line.

All bridges are built of steel on concrete abutments, there being fourteen of them between Lima and Ft. Wayne, excluding those for steam railroad crossings and of which there are two—at Delphos and Monroeville, respectively. All bridges are designed for a rolling load consisting of a train with 20,000 lb. per axle, on a 6 ft. 6 in. wheel base, 26 ft. center to center of trucks, and a dead load of 800 lb. per lineal foot, with an impact of 80 per cent.

All culverts between three and twelve feet openings are of the



MAP OF FT. WAYNE, VAN WERT & LIMA ELECTRIC RY.

(Shaded area indicates territory tributary to the line.)

CONSTRUCTION THROUGH TOWNS.

concrete arch type, and those of less than three feet are of extra heavy vitrified clay sewer pipe, reinforced by a concrete jacket.

The bridge proper at the overhead crossing with the Pennsylvania tracks is a steel truss through bridge of 125-ft. span, crossing the 66-ft. right of way of the railroad at an angle of 41 degrees. The bridge rests on concrete abutments high enough to give 22½ ft. clearance measured above the rails of the Pennsylvania tracks.

REAR OF ELIDA SUB-STATION.

The approaches are trestles, the bents of which are 16 ft. center to center. On each side of the bridge the inclined section of the approach is straight with a uniform grade of 3½ per cent to points within 175 and 225 ft., respectively, of the bridge; between the inclined sections and the bridge are curves, the 175-ft. curve on the north side being 18 deg. and the 225-ft. curve on the south side 20 deg.

This structure was built by the LaFayette Engineering Co.

Between Van Wert and Ft. Wayne the grade is ready for track laying, all bridges and culverts are in place and the right of way is fenced on both sides.

Overhead Equipment.

The poles are of cedar 7 in. at the top, and from 45 to 50 ft. high. Extra heavy yellow pine cross arms and galvanized braces are used. Provision has been made for two three-phase high tension transmission lines with all necessary feeders and telephone lines, as shown in the line drawing.

The tra[illegible] line of No. 2 [illegible] celain insulators supported on steel pins, while the feeder line is of No. [illegible] extends the entire length of the line.

The trolley wire is No. 000 round hard drawn copper and is carried on [illegible] and clamps. The trolley is tapped to the feeder every 1,000 ft. A

TYPICAL SECTION OF LINE IN COUNTRY.

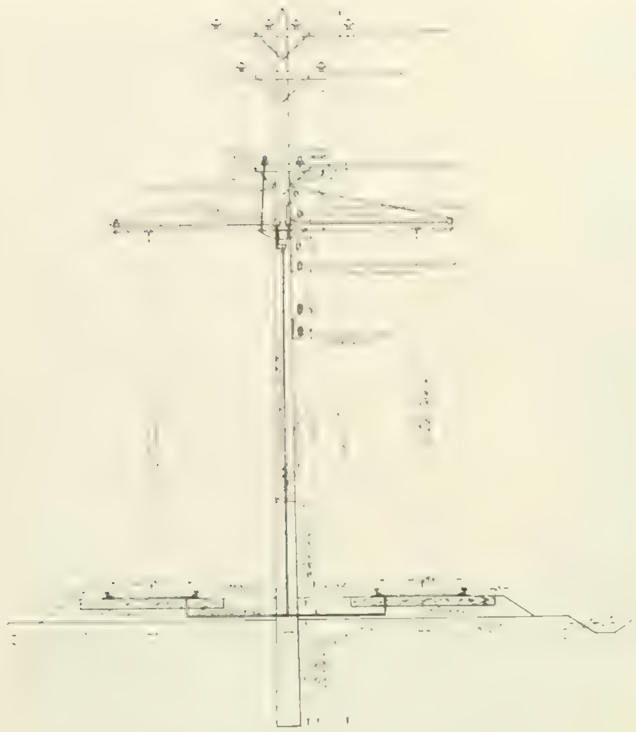
telephone circuit of No. 12 copper is carried on one of the cross arms on glass insulators.

Span wire construction is used in villages where necessary, and in these instances 5-16 in. double galvanized standard span wire was used.

Sub-Stations.

There are two sub-stations on the Lima-Van Wert section, one at Elida and the other at Middlepoint. The Elida sub-station is completed. It is equipped with one G. E. 6-pole 300-kw. rotary converter, which was put into service about December 10th. The Middlepoint sub-station will be completed this month. Pending the

INTERIOR OF ELIDA SUB-STATION.

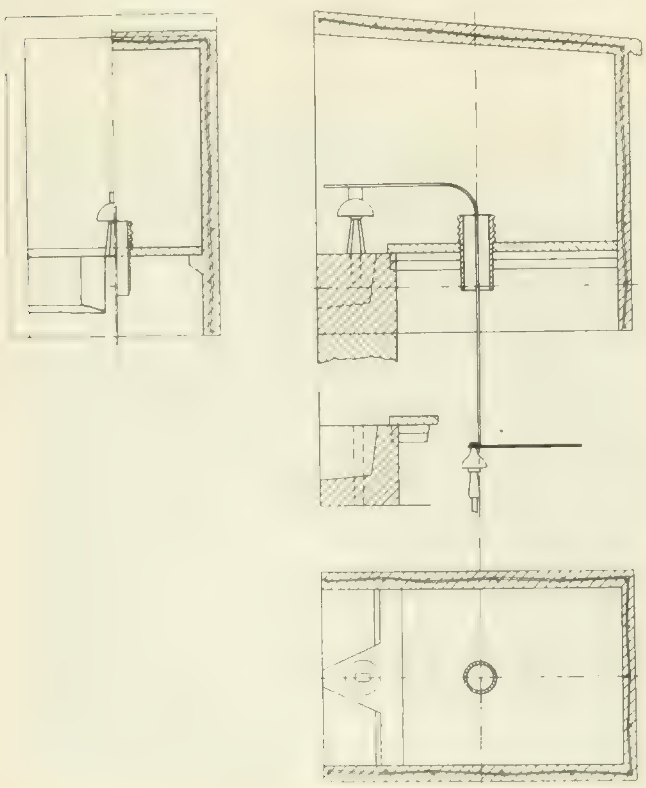


OVERHEAD CONSTRUCTION AT SWITCHES.

completion of the station, however, current for the operation of cars into Van Wert is furnished from the Elida sub-station, the feeders provided having ample capacity for this service.

The first equipment in the Middlepoint sub-station will be a Westinghouse 300-kw. rotary.

As the sub-stations are both located in villages, they have been designed for passenger and freight stations as well as electrical distribution stations. These stations are built with concrete foundations for both building and machinery, and the walls are of brick with natural cement mortar. The roofs are of tile, manufactured by the National Roofing Tile Co. Space has been provided in each for an additional 300-kw. rotary, also arrangements have been made for the operation of a portable sub-station car in conjunction with either of the stations.



WEATHER TRAP FOR HIGH TENSION WIRES.

A very interesting feature of the sub-station buildings is the construction of the weather traps through which the high tension wires enter the building. There is a separate hood for each wire, consisting of side and front walls, a sloping roof, and a support for the insulator which support connects the side walls at the rear; all of this is of reinforced concrete molded in one piece. The hood is 24 in. wide, 34 in. deep and 36½ in. high at the rear and 21 in. high at the front. Steel rods bent to a U-shape for the side walls and roof and for the front and side walls, and steel rods bent to an L-shape for the front wall and roof provide a reinforcement in both directions of each side of the hood. These rods are ¼ in. in diameter and are spaced about 6 in. apart.

Inside are molded corbels to support the slate slab forming the bottom of the hood. Through this slab extends a porcelain sleeve through which the wire enters. The insulator in the station side of the hood is supported on an iron pin.

The steel-concrete hood weighs from 800 to 1,000 lb. and is built into the wall of the building as any other special shape would be, and further supported by pilasters or columns. At Elida columns are used and at Middlepoint, pilasters.

The details of this hood were perfected by Mr. W. H. Roney, and he has applied for a patent on the design.

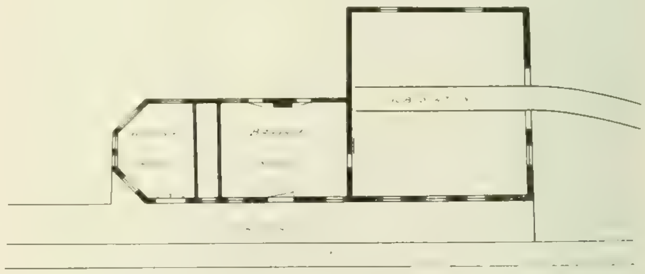
In both sub-stations columns for supporting floor beams, where the loading requires intermediate supports, have been made of drain tile of 14-in. outside diameter filled with concrete.

Power.

Current is to be secured from the Western Ohio Railway Co. from the power house at St. Mary's, O.; the contract with the Western Ohio is for the term of five-years.

Rolling Stock.

The cars which are being operated over the road at present are the property of the Lima Electric Railway & Light Co. and the Western Ohio Railway Co. An order has been placed for three interurban combination passenger and baggage cars with the Cincinnati Car Co. which will be delivered soon. These cars are to be of the most modern type. They are double-vestibuled and finished



PLAN OF ELIDA STATION.

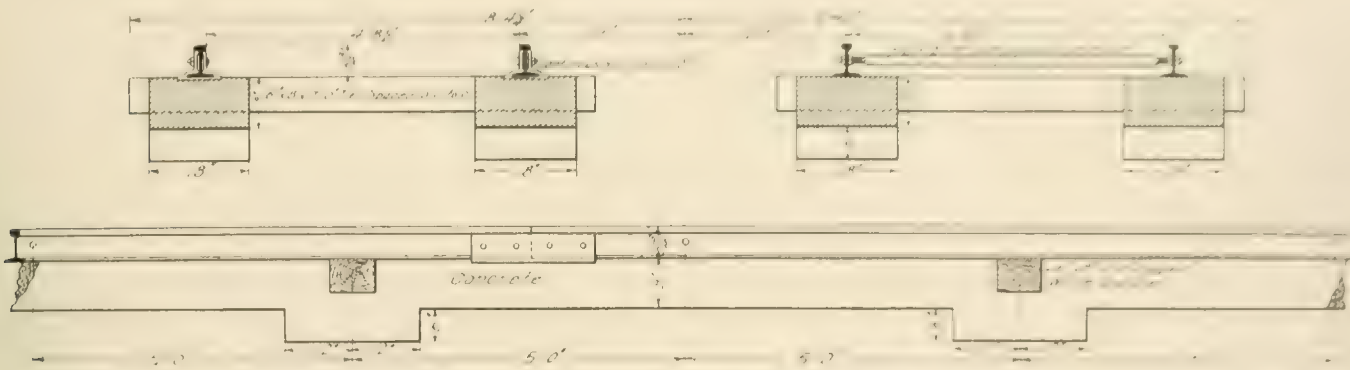
in mahogany, with smoking compartment and toilet rooms, water coolers and Peter Smith hot water heaters. Each coach is to be equipped with a telephone set. They are built after designs especially adapted for high speed interurban service. The length of the car over corner posts is to be 44 ft. 4 in., while the extreme length over buffers is 55 ft. The extreme width of the car is 8 ft. 6½ in. and the height from under the sill to the top of the roof is 9 ft. The interior finishings will be attractive and comfortable throughout. The appointments of the regular passenger and smoking compartments, of course, differ somewhat; in the former the seats are to be of the Hale & Kilburn walk-over type, upholstered in green plush, with high backs and head rolls.

The trucks are of the Taylor extra heavy, M. C. B., swing bolster type, with triple elliptic springs. The axles are 5½ in. with steel-tired wheels. Westinghouse straight-air brakes are provided with a motor driven compressor for each equipment. Each car has four Westinghouse No. 56 motors.

The officers of the Ft. Wayne, Van Wert & Lima Traction Co. are: President, James Murdock, president Merchants National Bank, LaFayette, Ind.; vice-president, D. J. Cable, Lima, O.; secretary and treasurer, J. D. S. Neely, Lima.

The line between Van Wert and Lima has been built by the

Ohio & Indiana Construction Co., of which H. C. Paul is president, L. G. Neely, secretary and general manager, and C. D. Emmons, superintendent of construction. Mr. Emmons is manager of the Ft. Wayne & Wabash Valley Traction Co. The general contractor for the track and overhead lines was G. A. Hogue, of Indianapolis and the contractor for the sub-stations W. H. Roney, of Chicago.



SECTION OF TRACK CONSTRUCTION IN CITY STREETS.

The half-tone engravings used herewith are from photographs by J. B. Hoff, of Delphos, O.

Relieving Congested Traffic at Rush Hours.*

BY D. M'DONALD, MANAGER MONTREAL STREET RY.

All that has been said or written in regard to other difficult problems of a like nature such as congestion of traffic in London, the difficulties of getting quickly through the center of Paris on a gala day, the irritating slowness of a horse car or cable ride through Broadway, up to recent date, the tedious features of all the best plans or remedies that have been already tried to prevent overcrowding in all public places or vehicles: all this verbal and written information would be a fitting preamble to convey to the ordinary reader a faint idea of the difficulty of the problem that we are endeavoring to solve.

We are requested to deal with a question that is difficult of solution and to enter immediately into the practical discussion of this question we must cite certain figures concerning the growth of street railway business that tend to show how quickly the existing rush hour conditions have been thrust upon us and the practical catering that street railway companies all over this continent have furnished in the last ten years, to meet the requirements of traffic.

Statistics prove that from 1892 to 1903 the mileage of street railways on this continent has increased from about 8,000 to 25,000 miles, which means, practically, on account of transforming electric, that since 1890, which was about the birth year of electric traction on a large scale, 25,000 miles of track were laid at a cost of $2,150,000,000 and that these street railway companies are now carrying an average of 5,000,000,000 passengers per annum. Why should it not be overcrowded?

These ten cipher figures to which the world has been unaccustomed in the way of increased traffic lead us to believe that street railway companies have not spared their efforts to cater to public comfort, especially when we stop to consider that this phenomenal work has been done by 850 companies, and that perhaps less than 100 companies of this number have to deal with the overcrowding problem which we are now discussing.

If we take the existing conditions in towns of three or four hundred thousand inhabitants we find that the working population may be one-half that number and again that a quarter of the number (100,000 people) usually work in the business or downtown section of the city, which section is generally limited to a square of about one mile in length and a quarter or a third of a mile in width. Seventy-five thousand persons of this 100,000 would like to get home quickly and all want to board cars in ten or fifteen minutes at six o'clock. The question naturally arises how many cars with a capacity of fifty or [illegible] passengers [illegible] required to carry this rush conveniently?

Seventy-five thousand divided by fifty equals thirteen hundred cars.

The answer [illegible] day of cheap fares and transfers) to furnish that number of cars, to be used for fifteen or twenty minutes per day this remedy would seem excellent.

It must not be forgotten that these thirteen hundred cars are only the rolling stock necessary to provide the desired accommodation for down town passengers and that at the same hour the rest of the system must be provided for, which might possibly mean one hundred or two hundred cars more, to provide the same roomy service. But, as already stated, the settling of the question would be easy, though impracticable financially for the company, if we did not have to contend with a still greater difficulty, which is "Time."

This "Time" difficulty comes from the natural desire of everybody to rush home at the same hour, which is easier to imagine than to cure. Hence the 1,300 cars referred to must be rushed through the business center of the city in ten or fifteen minutes, and this is where the plan becomes impossible.

The business center of the city is generally provided with two streets at most where this traffic must be taken on; that is to say, two lines going east and two lines going west or north or south, as the case may be.

The closest headway that may be run by cars, at 5 or 6 miles an hour speed, is about 20 seconds; hence we must find a means of running 1,300 cars over four tracks in 15 minutes, or 900 seconds; that is to say, we must run 325 cars over each track in 900 seconds, which means that the interval between cars must be less than three seconds. This is a material impossibility and if each car must have a headway of 20 seconds we arrive at a total time space of (325 x 20 equals 6,500 seconds equals 108 minutes) or 1 hour and 40 minutes to let the procession go by.

It is evident from these figures that the possibility of relieving congestion with an unlimited number of cars, even if it were approved as a commercial venture, cannot be done without sacrificing time and speed, which would probably aggregate a larger general loss than that above mentioned and also give rise to greater recrimination that the disagreeable, quicker ride that passengers must endure under present conditions.

There is a maximum in all measurements and the limit of cars that a city street may accommodate is pretty nearly covered by the service that most companies are at present giving in the heart of busy cities.

The European plan of numbering and limiting passengers, which by the way is generally disregarded in most European countries in Sunday and holiday rushes (for they do business calmly and amuse themselves rapidly) the European plan would not suit our speedier temperament.

It would not avail us much to get a roomy seat in a blockade, and most of our countrymen would prefer to get there standing.

The "no seat, no fare," plan would certainly cause an irresistible desire with most people to prefer standing room.

The limiting of the number of passengers would be a good move in favor of the companies, as it would reduce the actual loss caused by missing fares, but it yet remains to be seen what public favor

*Read before the Canadian Street Railway Association, Montreal, Dec. 20, 1904.

such a limitation would meet with in this busy country. The first passenger to be refused admittance in such a case takes it very bitterly and if he happens to be accompanied and there is only room for one he is forced to give way to another passenger who should have waited. Again, if a car is filled at this corner a would-be passenger must wait, whilst another patron a block further on, who arrived later, on account of somebody getting off, will be served first. All these little intricacies which appear trivial when not in force, are exceedingly aggravating in practice and to Canadians or Americans, who are constitutionally in a hurry, become intolerable. Consequently we are forced to the following conclusions:

1. That congestion at rush hours cannot be avoided.

2. That it may be possible to relieve the crush by the addition of a reasonable number of cars to a limit where speed must not be sacrificed.

3. That with a view to further increasing the maximum number of cars that may be run without loss of time, most cities should consider the advisability of increasing the speed and giving clearer right of way to allow space for more cars and thereby afford greater and better accommodation to the public.

4. We are inclined to think that when the London business man, whether riding in a hansom or seated on the wet or dry top of an omnibus will be able to ride directly to his office in the business center, without having to worry about the blockade that he is treated to daily; when the Parisian count or citizen may be able to drive from the Opera to the Louvre on a busy afternoon, a distance of a quarter of a mile, without going ten blocks out of his way; when the devout church goer or the impassioned theater patron can attend service or play without having to share in the final disagreeable crush which is an integral part of all such meetings; when the camel will go easily through the eye of the needle without ruffling its silken sides; when a large city and a maddening throng will cease to be synonymous, then may it be that the "No seat, no fare missionary," the "Car passenger rights association crusaders" and a small percentage of street car patrons who live eternally in the winter of discontent, may realize their very improbable dreams and then we may all rejoice that the rush hour crush and congestion will have totally disappeared.

Allis-Chalmers Appointments.

Mr. A. O. Stranahan has been appointed manager of the power department of the Allis-Chalmers Co., Milwaukee, and will have charge of the sales of reciprocating engines, gas engines, and steam turbines. Mr. Stranahan has been, for the past three or four years, in charge of the engine business of the British Westinghouse Electric and Manufacturing Co., and in that work has met with marked success. He has given much attention to gas engine developments, particularly with regard to producer and blast furnace gas developments which are very much farther advanced in Europe than in the United States.

Mr. H. Schifflin has recently been made assistant manager of the mining and crushing machinery department of the company, with headquarters in the New York Life Building, Chicago. Mr. Schifflin has been in the employ of the Allis-Chalmers Co. or some of its constituent companies continuously during the last 18 years.

Mr. W. L. Loveland, the newly appointed head of the Mining and Crushing Machinery Department of the Allis-Chalmers Company, is widely known among mining men, and few men have the good fortune to be so well liked. He has at command all the benefits which come from both a technical and practical training, and his acquaintance extends from city men to those who operate plants in the wilds of the mining countries.

Mr. J. U. Jones of Dallas, Texas, one of the best known salesmen in the southwest, has joined the staff of the Allis-Chalmers Co. of Milwaukee, and will hereafter represent the company and its widely varied products in Texas and its tributary territory.

Opening of East Boston Tunnel.

The submarine tunnel connecting Boston and East Boston, which was begun in May, 1900, has been completed and on Dec. 30, 1903, was opened to the public and dedicated to its use without formality. At the date of the annual report of the Boston Transit Commission for the year ended June 30, 1903, it had been, with the exception of a slight gap at Atlantic Ave., substantially completed from the terminus in East Boston to Washington St. in Boston proper, and on July 16th of that year the Governor of Massachusetts accompanied by members of the Commission and others walked through the tunnel from Maverick square to the Old State House. Since that time the completion of section B, section C, section E (the Old State House section), and section F (Court St.), has been effected. The tunnel, which is double-tracked, is 1.4 miles in length, of which 2,700 ft. is under the harbor waters. The tunnel was built by the city of Boston, which has leased it for 25 years, dating from 1897, to the Boston Elevated Railway Co. Mr. H. A. Carson was chief engineer, and the members of the Boston Transit Commission are: George G. Crocker, Charles H. Dalton, Thomas J. Gargan, George F. Swain and Horace G. Allen.

Chimney vs. Mechanical Draft.

A chimney with natural draft will have a draft dependent upon its height, the power of which will not vary, except upon the rise or fall of the internal temperature. It has, therefore, no sucking power; in fact, the term suction in this connection is a falacy. The chimney acts because the external air is heavier than the internal, and thus presses into the chimney by the only available opening, viz., that at the bottom, the furnace front. The pressure or intensity of the draft fixes the amount of fuel it is possible to burn on a given area of grate. It therefore becomes necessary, when it is desired to increase the steaming capacity of a boiler by increasing its coal consumption, to increase the intensity of the draft, and the only way in chimney draft is to increase the temperature of the gases passing up it, or increase the height of the chimney. The first method, of course, means a large amount of waste, and is a very uneconomical arrangement; the second is expensive and unusual. A chimney stack 150 ft. high will burn from 15 lb. to 20 lb. of coal per sq. ft. of grate area per hour under normal conditions, but in wet or foggy weather it will be very much less than this, as the wet air is lighter than the dry, and thus produces less pressure at the furnace (the weight of water vapour is about half that of air). A fair average of temperature in the furnace is 2,400° F., and that of the escaping gases at the chimney, without economizers, 600° F. This means that one-quarter of the total heat generated is sent up the chimney to waste. Thus, on a 2,000 h. p. plant, almost 500 h. p. is going up the chimney per hour, and the coal bill necessary to sustain this will come to a big figure in the year.

It is not the author's contention, but it has become a well ascertained fact, that it is cheaper and better in every way to provide the necessary supply of air for burning fuel in steam boilers by mechanical means, and to take as much heat out of the hot gases after they have ceased to be in contact with the boiler itself before they are turned out into the atmosphere, than to do it in the older way by utilizing a portion of the heat generated to create the necessary supply of air. This is the primary reason for using a mechanical means of moving the air. The heat previously necessary to create the draft by means of a chimney may now be employed usefully in other directions.—The Engineering Review (London).

Nahant & Lynn Street Railway Co.

The selectmen of the town of Nahant, Mass., have granted a franchise for the location of a street railway connecting Lynn and Nahant. This line will be about four miles long. The bulk of the travel will be in the summer months, Nahant being a summer resort. It is expected that by means of transfer system with the Boston & Northern for which amicable arrangements are thought will be made, that the trade will be largely increased by travel from Swampscott, Saugus, Peabody, Salem, Wakefield, Revere and Boston. It is estimated that ¾ of a million passengers will be carried the first year, entirely superseding all other modes of transportation. The accommodation in the past has been by the old fashioned barge lines.

The organization of the new company, which is called the Nahant & Lynn Street Railway Co., has been brought about by Walter H. Southwick, 38 Exchange St., Lynn, Mass., who is now working on the details of cost of construction and equipment.

The franchise has not as yet been accepted, but it is thought likely that it will be, and that efforts will be made to have the cars in operation by June 1, 1905.

The New Terminal Station of the Indianapolis Traction & Terminal Co.

It is not realized by the public in general, nor perhaps even by those most interested in electric railways, that the scene of most active development in this field has in the recent past been moving westward and is now in Indiana. Indianapolis, the capital of that state, is now one of the great interurban electric railway centers, and the roads now operated by the seven companies having that city for a terminus aggregate 515.8 miles. Connecting with two of these seven roads are the lines of five other interurban companies, with an aggregate of 173.3 miles of track in operation, bringing the total of electric railway systems over which through cars might be run to Indianapolis up to 669.1 miles. Large as these figures now appear, they will soon be increased by the completion of the Indianapolis & Cincinnati Traction Co.'s line from Rushville to Cincinnati and the building between Plainfield and Brazil of a line which will complete an electric railway between Indianapolis and Terre Haute.

A statement in detail of the lines in operation is as follows:

Company.	Miles.
1. Indiana Traction Co.	206.0
Connecting with—	
Fort Wayne & Wabash Valley Traction Co.	78.2
Indiana Northern Traction Co.	20.0
Kokomo, Marion & Western Traction Co.	9.5
Muncie, Hartford & Ft. Wayne Railway Co.	41.8
2. Indianapolis & Eastern Railway Co.	63.0
Connecting with—	
Richmond Street & Interurban Ry. Co.	19.3
Dayton & Western Traction Co. (in Indiana)	4.5
3. Indianapolis & Cincinnati Traction Co.:	
Shelbyville Division	29.0
Rushville Division (to be opened January)	
4. Indianapolis, Columbus & Southern Traction Co.	41.5
5. Indianapolis & Martinsville Rapid Transit Co.	30.0
6. Indianapolis Coal Traction Co. (Plainfield Line)	14.0
7. Indianapolis & Northwestern Traction Co.	92.3
Total	689.1

Of which Indianapolis is the terminal of 515.8 miles.

One of the great points of advantage which electric interurban roads have had in competing with the older steam lines for local passenger traffic has been the fact that in the cities the electric railways traverse the principal business streets, making it possible for patrons to board the cars at the points most convenient for them. The multiplication of interurban lines entering the principal interurban centers made it desirable to facilitate interchange of traffic between the different companies by having a common meeting place for cars at some central point near which could be located a waiting station for passengers. Naturally this resulted in providing a loop in the down-town district for the use of all electric lines entering the city, a plan more convenient than for each company to have its own terminal, but one which was susceptible of great improvement. The next step was to provide a station into which cars could be run so that passengers taking them could be protected in inclement weather.

The erection of a terminal station for the electric railways entering Indianapolis was the idea of Mr. Hugh J. McGowan, then president of the Indianapolis Street Railway Co. and now of its lessee, the Indianapolis Traction & Terminal Co., and he was not content until the plan had been brought to successful completion in a most admirably designed union station—the first to furnish adequate facilities for interurban passengers and the only building of its kind that can be compared in size, in architectural appearance, or in completeness of appointment, with the terminal buildings provided by the steam railroads of the country. This building, erected at a cost of nearly a million dollars, is a monument not only to the business sagacity of Mr. McG[illegible] concentration of electric railway interests which this building makes possible and desirable is already seen to have had its effect in promoting their further rapid development, with consequent increased prosperity for the city and state.

The railway terminal was only one feature of Mr. McGowan's plan. With the station proper was to be a modern office structure to be designed with the avowed purpose of making the building the business center of the electrical industry in the central west.

Similarly the terminal station is only one, though the latest to be consummated, of the many plans proposed by Mr. McGowan for the betterment of the electric railway service in Indianapolis, and successfully carried out by him since he became the head of the city system in 1899. In this work Mr. McGowan has been extremely fortunate in having associated with him the most influential electric railway financiers and experienced managers in the country, including Messrs. Randal Morgan and Thomas Dolan, of Philadelphia, and W. Kesley Shoepf, of Cincinnati, as well as the leading business men of Indianapolis and Indiana.

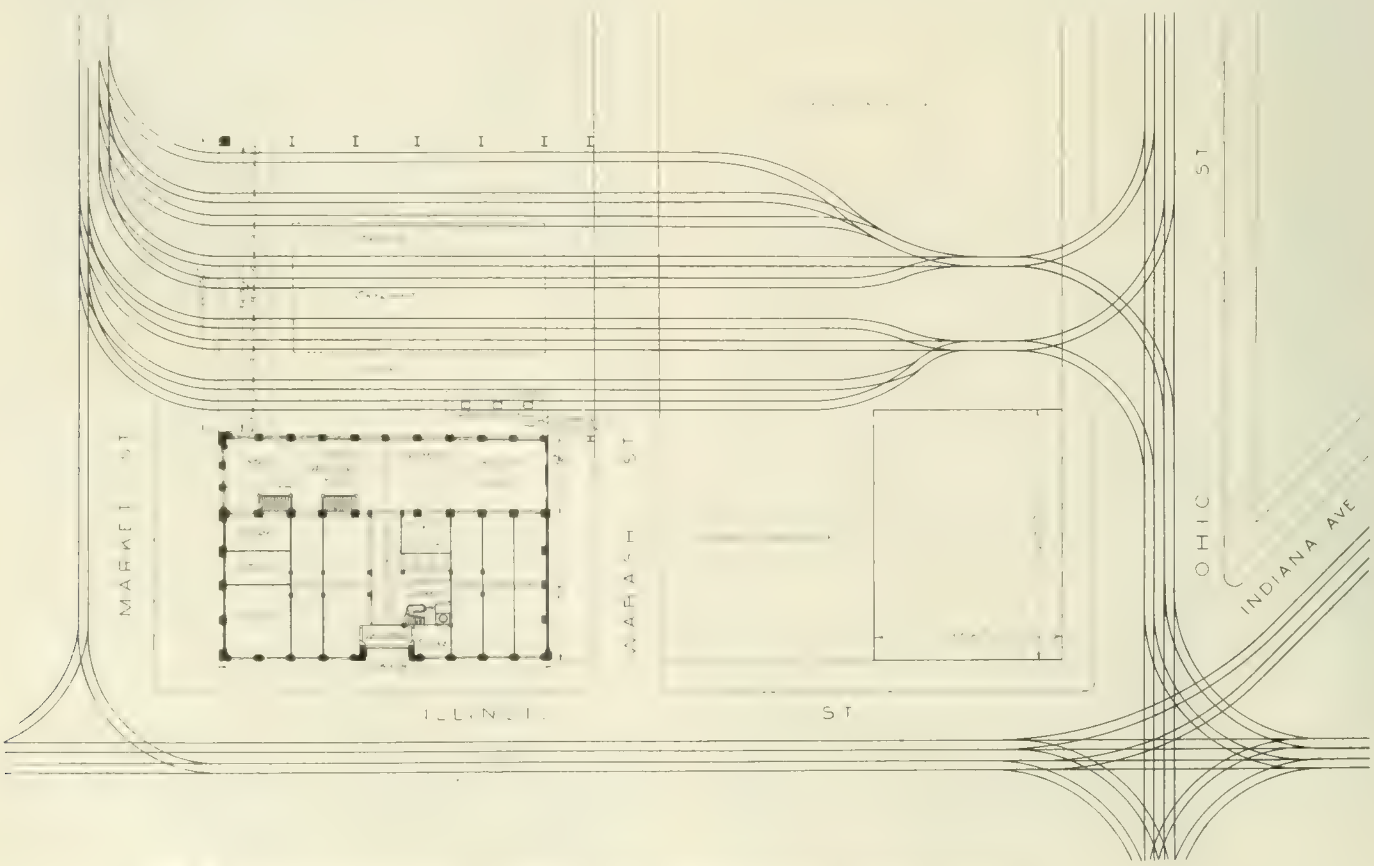
GENERAL VIEW OF BUILDING

Mr. Morgan is probably the most prominent traction man in the country, being identified with many undertakings of great magnitude in this field besides the United Gas & Improvement Co., of which he is president. Mr. Dolan, Mr. Schoepf, president and general manager of the Cincinnati Traction Co.; Mr. A. W. Brady, president of the Indiana Union Traction Co., and Mr. James Murdock, president of the Merchants National Bank, La Fayette; are others of commanding position who are members of the directory of the Traction & Terminal Company. Mr. Morgan, Mr. Dolan, Mr. McGowan and Mr. Schoepf are closely identified with the Indiana Union Traction Co. and with the Ft. Wayne & Wabash Valley Traction Co.

ELEVATION MARKET ST. END OF TRAIN SHED AND WAITING ROOM.

It will be remembered that it was in 1899 that the present management assumed control of the Indianapolis Street Railway property. At that time there was a very bitter fight between the old Citizens Street Ry. and the city regarding the renewal of the franchise, the right of the company to charge 5-cent fares, and the transfer privileges that should be extended. The hostile public sentiment which had been engendered by this controversy resulted in the passage by the legislature of a 3-cent fare law, a law authorizing a competing company, and also a law requiring the old company to sell its property at the expiration of its franchise. When the new management took charge, the first thing necessary to insure the financial stability of the property was to secure the repeal of the acts imposing a 3-cent fare and authorizing local competition and also to get a law giving the company permission to contract with the city for a new franchise. All this was carried through successfully and enabled the company to undertake the needed improvements with prospect of financial success. There were at that time a number of interurban lines entering the city, and others proposed, and the question of how these lines should bring their cars into the business district of the city was seen to be one that would require careful consideration in order to provide for the needs of the future. This matter was taken up and Aug. 4, 1902, the Indianapolis Traction & Terminal Co. was chartered. Contracts had been made the preceding year between the Board of Public Works and three of the interurban lines entering the city, by which the latter were given the right to operate over the lines of the Indianapolis Street Railway Co., subject, of course, to a satisfactory agreement with that company being made. Contracts were made between the city company and the interurbans and having in view the erection of a union station, provision for this was made.

The principal features of this contract are permission to use the city tracks necessary to reach the down town district, and to use sections of dead track for unloading express and freight; the local company to furnish power for the interurban cars and keep the track and overhead lines in repair; the number of interurban cars to be brought into the city to be fixed by the local company and not to be



PLAN OF INDIANAPOLIS TRACTION & TERMINAL CO'S NEW STATION AND ADJACENT TRACKS.

greater than one every 30 minutes ordinarily, and on special occasions a car every 15 minutes, with permission to run out going trips at intervals of 10 minutes, if necessary to return passengers brought into the city; the number of round trips of exclusively freight and express cars is limited to five per day.

Each interurban company may bring into the city under its contract only cars operated by it and its successors. Transfers are not permitted between the interurban and the local cars. Statements of moneys due under the contract are made weekly and the account settled monthly. The account of passenger fares is kept upon registers in the interurban cars, the expense of installing the registers being equally divided between the two companies. An interesting provision of the interurban contract is that in event of the limits of the city being extended to take in a part of the tracks built by the interurban company, the latter agrees to sell to the Traction & Terminal company the tracks included within the corporate limits, exclusive of any franchise valuation, at a price to be agreed upon, or failing that to be determined by action in the Marion Circuit Court.

Plans for the interurban terminal station were first considered by the Indianapolis Street Railway Co. in the spring of 1902. Ground was broken in 1903, and, while the office building was completed in August last, the station was first opened for traffic on Monday, Sept. 12, 1904, the beginning of State Fair week.

The site chosen is an admirable one, being one block west of the "Circle," which is the geographical center of the city, and one block east of the State Capitol; it is one block north of Washington St., the main business street.

The company secured the entire southeast quarter and the entire northwest quarter of the block bounded by Ohio St., Market St., Illinois St., and Capitol Ave., also the entire northeast quarter of this block, excepting a lot [illegible] ft. on Illinois St., and [illegible] southwest quarter. [illegible] street known as Wabash St. [illegible] alley. The company [illegible] so that it has in effect a rectangle 420x425 ft., with the exception of lots at diagonally opposite corners; one of these, as mentioned, is 120x97 ft. and the other [illegible] 195 ft.

The office building occupies the southeastern corner of the terminal property and is 163 ft. 8 in. long by 68 ft. wide and nine stories in height. The framework is of steel, with tile fireproofing wall and floor foundations.

TRAIN SHED AND OFFICE BUILDING—INDIANAPOLIS TRACTION & TERMINAL CO.

The building is designed in the Byzantine style of architecture and is very pleasing in appearance. The two lower stories are done in Bedford stone, with an imposing main entrance handsomely carved. Above the second story the exterior walls are of buff speckled brick with molded brick jambs, terra cotta window sills and at the top is a well designed cornice done in terra cotta.

The ground floor is finished in marble, and above this the hallways are wainscoted with marble and the floors laid with marble tiling. The elevator enclosure is an ornamental design executed in iron with Bower-Barff finish to correspond with the balustrades, hardware and electric light fixtures. Floors in the offices are of hardwood and the other woodwork is solid San Domingo mahogany. Fireproof vaults are placed in each suite of offices; also wash basins and mahogany coat closets. On the ground floor the hallway, with entrance to the three elevators which serve the building, is in the center. North of

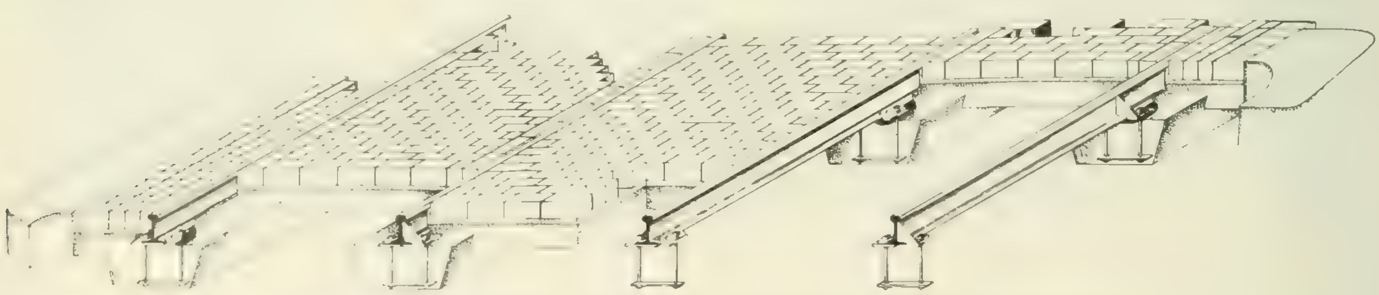
WAITING PLATFORM—EXITS TO TRAIN SHED AT LEFT—EXIT TO OFFICE BUILDING AT RIGHT

the elevator lobby are three storerooms fronting on Illinois St. and abutting on the station platform, in the south end of the building are two storerooms extending from Illinois St. to the station platform and three short rooms fronting on Market St. One of these is at the corner and also fronts on Illinois St.

The office for the sale of interurban car tickets is just in the rear of the elevators, and on the right hand as one passes to the waiting room from the Illinois St. side of the building. A basement extends under the entire building; the greater portion of this is in one room, and admirably suited for a cafe, for which purpose it will probably be used. With the object of providing a suitable entrance for a cafe in this location, the south building line was moved back 10 ft., leaving ample room for an entrance to the basement from the sidewalk. At the north end of the basement is placed the power plant for the building. Three elevators will be operated, and the design provides for the installation here of a lighting plant and a water purifying and refrigerating system.

Fronting as it does on three streets and overlooking the one-story waiting room, the building is well lighted from all four sides and contains no dark rooms. It is the intention to make this building as attractive as possible to tenants, and electric light as well as heat and janitor service is furnished. Iced water is provided in all the corridors. Elevators are operated both day and night, something that is unusual even in the best appointed modern office buildings in the largest cities. The 24-hour elevator service, it is expected, will be found of great advantage to men traveling out of Indianapolis or having branch offices in near-by territory to which they must make frequent trips. The idea is that persons visiting Indianapolis can avail themselves of the interurban lines and save a great deal of time by making appointments in the evening and can attend to business without having to climb stairs in an office building. The tenants are for the most part life insurance companies, railway passenger and freight agents, engineering firms, bridge companies, dealers in railway supplies and the several electric railway companies having offices in the city. The companies using the station for terminal purposes have already been specified. Those now having offices in the building are the Indianapolis Traction & Terminal Co., which together with the Indiana Co. occupies the entire top floor; the Coal Traction Co. (operating the Indianapolis & Plainfield Electric R. R.), and the Indianapolis & Cincinnati Traction Co.

Just west of the office building is a waiting station. This is a platform at the sidewalk level and is 37½ ft. wide and 164 ft. long. It is covered by a roof with skylight, and in the basement below are the waiting rooms. The main waiting room is reached by two stairways from the platform above and is provided with settees. At one end is a room for women, and adjoining this a toilet room and lavatory. At the opposite end is a smoking room and lavatory and toilet room for men.



TRACK CONSTRUCTION FOR OHIO ST. AND CAPITOL AVE., INDIANAPOLIS TRACTION & TERMINAL CO.

Coal is conveniently unloaded into the basement through the hatchways indicated on the ground plan. Ashes are removed by means of an elevator of the usual sidewalk design, which will lift the ashes so that they can be dumped into cars run onto the first track.

The train shed extends from the waiting platform to the west property line of the company and is 133 ft. 9 in. wide inside. It is somewhat longer than the office building. The plan view shows this arrangement of the nine tracks, which have been provided in the train shed and also the leads to the Ohio, Market and Illinois St. tracks, which together with those in Capitol Ave. constitute the approaches to the station. The train shed is lighted at night by 15 arc lamps.

The track work on the terminal loop and in the train shed is all new, and for this there has been used a 7-in. T-rail with base [illegible] in. wide and web 9/16 in. thick. These rails are in 60 and [illegible] length. The rail, with a web [illegible] in. thicker than is found in the usual section, was adopted to avoid failure of the rail by bending of the web, a condition that has been met with in some of the 9 in. girder rail used by the company.

Within the limits of the station building and ground the tracks are laid on 6 in. x 8 in. x 7-ft. ties, spaced 24 in. between centers with gravel ballast extending [illegible] in. below the ties. In the train shed a cement concrete flooring is used. In the street the rails are supported on concrete beams, as shown in the perspective view of the track section. The concrete beams are 18 in. deep and 22 in. wide, the concrete coming up about 2½ in. above the base of the rail. Wooden ties are spaced at intervals of 12 feet. It has been found that with the heavy cars it is quite as important to hold the rail down as to hold it up, and to prevent lifting two anchors are placed on the rail between adjacent ties. In the illustrations these anchors are shown, consisting of brace tie plates from which is hung a plate by two bolts. In the greater part of the new work the anchor consists, instead of solid plates, of 3-in. cast washers suspended by ¾-in. bolts 10 in. long, two bolts at each brace tie plate. In this track the rails are connected by continuous rail joints and bonded with two No. 0000 "Protected" bonds.

HUGH J. M'GOWAN.

The architects for the building were D. H. Burnham & Co., of Chicago, and the construction was carried on by the Indiana Co., of New Jersey, which is the construction company organized to carry out the work of the Indianapolis Traction & Terminal Co. Mr. E. B. Peck is vice-president and active head of the Indiana Co.

At each end of the train shed some form of mechanically operated gates will be installed; these as well as the switches will be controlled from a tower. There are now in place a pair of pneumatically operated gates made by the Buda Foundry & Manufacturing Co., a type that will probably be adopted.

There is published regularly a 12-page folder containing the official time tables of the interurban electric lines diverging from Indianapolis, which folder shows a total of 294 regular cars per day entering or leaving the station.

Indiana Union Traction Co.—	Out.	In
Muncie Division	18	18
Logansport and Peru Division	18	18
Indianapolis, Columbus & Southern	18	18
Indianapolis-Plainfield	17	17
Indianapolis-Shelbyville	19	19
Indianapolis & Northwestern	23	21
Indianapolis & Martinsville	17	17
Indianapolis & Eastern	18	18
	148	140

The revenue of the Traction & Terminal company from the station proper consists of one cent for each incoming or outgoing passenger on the interurban lines.

In 1903 the number of passengers carried over the tracks of the Indianapolis Street Railway Co. in interurban cars was 2,347,936. The total number that will be carried in 1904 is estimated at 3,500,000. This estimate is based on the traffic for 1903, taking into account the natural increase that is to be expected and the fact that a number of lines now entering the city were only in operation for a few months of 1903. As the cost of the land and the building for this station was between $900,000 and $1,000,000, it is evident that within a very short time the revenue from interurban passengers will be sufficient to pay all of the fixed charges, leaving the excess of rent over the operating charges of the office building as profit on the investment.

[illegible] John Appel, second vice president; W. Kesley Schoepf and Arthur W. Brady. William F. Milholland is secretary and treasurer. The [illegible] J. McGowan and John Appel. The finance committee comprises [illegible]

LIBERTY BELL AT TRACTION AND TERMINAL STATION, NOV. 17, 1904.

apolis Street Railway Co. are Admiral George Brown, president; Dr. Henry Jameson, vice-president; James Murdock, Harry S. New, Marshall Morgan, J. A. Lemcke and H. B. Hibben.

Canadian Street Railway Association.

The first meeting of the Canadian Street Railway Association was held at the Windsor Hotel, Montreal, December 20th. Mr. W. G. Ross was chosen temporary chairman, and the meeting proceeded to the consideration of constitution and by-laws for the association. After thorough discussion this subject was postponed until the following day for final revision and approval.

The fees from Dec. 20th, 1904, to June 1st, 1905, were fixed at $50 per member. At the afternoon session Mr. E. A. Evans, Manager of the Quebec Railway Light & Power Co., presented a paper on "Handling of Express by Electric Suburban Railways." After discussion of this subject there was a general discussion on "Transportation of Mail and Letter-Carriers," and on the "Use and Abuse of Passes." In the evening delegates attended a dinner, at the St. James Club, given by the Montreal Street Railway Co.

On the second day the constitution and by-laws were adopted, in the form printed herewith.

The chairman next introduced Mr. W. B. Brockway, acting secretary of the Street Railway Accountants' Association, and Mr. Elmer M. White, who since that meeting has been chosen secretary of the Accountants' Association, both of whom addressed the meeting.

Mr. D. McDonald, manager of the Montreal Street Railway Co., then read a paper on "Relieving Congested Traffic at Rush Hours."

The association then proceeded to the election of officers, which resulted as follows:

President, W. G. Ross, managing director Montreal Street Railway Co., Montreal.

Vice-President, W. H. Moore, assistant to the president Toronto Railway Co.

Secretary-Treasurer, A. Royce, vice-president of the Toronto Suburban Railway Co.

Executive Committee, The President and Vice-President, and C. E. A. Carr, general manager London Street Railway; E. A. Evans, manager Quebec Railway, Light & Power Co.; D. McDonald, manager Montreal Street Railway Co.

Attorney, Col. H. H. McLean, St. John Ry.

Those participating in the first meeting of the Canadian Street

Railway Association were: W. G. Ross, D. McDonald, R. M. Hannaford, Nelson Graburn, D. E. Blair, P. Dubee, H. E. Smith, Montreal; H. H. McLean, M. Neilson, W. Z. Earle, St. John; E. A. Evans, Quebec; A. Royce, W. H. Moore, R. J. Fleming, Toronto; C. E. A. Carr, London; Dr. S. Ritter Ickes, Brantford.

CONSTITUTION.

I. NAME—The name of the association shall be the Canadian Street Railway Association and its office shall be at the place where the secretary-treasurer resides.

II. OBJECT—The object of this association shall be the acquisition of experimental, statistical, and scientific knowledge, relating to the construction, equipment and operation of street railways, and the diffusion of this knowledge among the members of this association, with the view of increasing the accommodation of passengers, improving the service and reducing its cost; and the encouragment of cordial and friendly relations between the roads and the public.

III. MEMBERS—The members of the association shall consist of street railway companies in the Dominion of Canada, and each member shall be entitled to one vote by a delegation presenting proper credentials.

IV. AMENDMENT—This constitution may be amended by a two-thirds vote of all the active members of the association, present or represented by proxy, at any regular meeting or properly called special meeting, after the proposed amendment shall have been submitted in writing to each active member of the association thirty days prior to the date of the meeting when the proposed amendment is to be acted upon.

BY LAWS.

I. APPLICANTS—Every applicant for membership shall signify the same in writing to the secretary-treasurer, and if elected, shall pay the requisite fee and assessment.

II. OFFICERS—The officers shall consist of a president, a vice-president and a secretary-treasurer. There shall also be an executive committee, composed of the president, vice-president and three members, three of whom shall constitute a quorum. The officers and members of the executive committee shall be elected by ballot, at each annual general meeting of the association, and shall hold office until their successors shall be elected. They shall have the entire charge and management of the affairs of the association.

III. DUTIES OF OFFICERS—The officers of the association shall assume their duties immediately after the close of the meeting at which they are elected.

IV. PRESIDENT—The president, if present, or in his absence, the vice-president, or in the absence of both, a member of the executive committee, shall preside at all meetings of the association.

V. SECRETARY-TREASURER—The duties of the secretary-treasurer shall be to take minutes of all proceedings of the association and of the executive committee, and enter them in proper books for the purpose. He shall conduct the correspondence of the association, read the minutes and notices of all the meetings and also papers and communications, if the authors wish it. He shall receive and safely keep all moneys of the association, keep correct account of the same, and pay all bills approved by the executive committee; and make an annual report to be submitted to the association, and if required, shall give a bond to the president in such sum and with such sureties as shall be approved by the executive committee, and perform whatever duties may be required in the constitution and by-laws appertaining to his department. He shall be paid a salary to be fixed by the executive committee. Each member of the association shall furnish annually to the secretary a list of its officers and directors, and such other information as may be desired from time to time by the executive committee and the secretary shall keep a record of the same.

VI. MEETINGS—The annual general meeting of the association shall be held in the first week in June, and quarterly meetings shall be held in the first week in the months of September, December and March in each year, and at such hour and place as shall be designated by the executive committee. Notice of every meeting shall be given by the secretary-treasurer to each member. Five members shall constitute a quorum of any meeting. Every company which is a member of this association shall be entitled to be represented at all meetings of the association by the officers and directors of this company, all of whom shall be eligible to be elected officers of this association, provided, however, that on all votes each company shall only be entitled to one vote.

VII. ORDER OF BUSINESS—At the annual general meeting of the association, the order of business shall be:

1. The reading of the minutes of the last meeting.
2. The address of the president.
3. The report of the executive committee on the management of the association.
4. The report of the secretary-treasurer.
5. Reports of special committees.
6. The reading and discussion of papers, of which notice has been given to the secretary-treasurer at least twenty days prior to the meeting.
7. General business.
8. The election of officers.

VIII. ORDER OF BUSINESS—At the quarterly meeting of the association, the order of business shall be the same, except as to 2nd, 4th and 8th clauses.

IX. NOTICES—The secretary-treasurer shall send notices to all members of the association at least ten days before each regular meeting, mentioning the papers to be read, and any special business to be brought before the meeting.

X. MEETINGS OF EXECUTIVE COMMITTEE—The executive committee shall meet at least one hour before each meeting of the association; and, on other occasions, when the president shall deem it necessary, upon reasonable notice.

XI. VOTING—All votes, except as herein otherwise provided, shall be viva voce; and in case of a tie, the presiding officer may vote.

XII. READING OF PAPERS—All papers, except reports of committees, must be approved by the executive committee before being read to the association.

XIII. PAPERS, DRAWINGS AND MODELS—All papers, drawings and models, submitted to the meetings of the association shall remain the property of the owners; subject, however, to be retained by the executive committee for examination and use, but at the owner's risk.

XIV. FEES—In consideration of the benefits and mutual protection which the association gives to each corporation in membership, each corporation binds itself and agrees to pay into the treasury of the association an annual fee of one hundred dollars, and such special assessment or assessments as the executive committee, upon approval of the association, may, from time to time determine.

Assessments in addition to the annual assessment may be levied, from time to time, as the necessity may arise, upon recommendation of the executive committee and the approval of the association, and shall be levied pro rata upon the corporations forming the association in such proportion as the gross earnings arising from the operation of its street and electric railway systems reported in preceding fiscal year's annual report of each corporation bear to the whole amount. Appeals may be made to the executive committee on account of special considerations, such committee to have full power.

The annual fee is payable on the first day of July in each year, and all special assessments are due and payable within thirty days after they are levied.

XV. ARREARS—No member whose annual dues or assessments shall be in arrears shall be entitled to vote.

XVI. ELECTION—All applications for membership shall first be submitted to the executive committee and if approved by a unanimous vote, shall be ballotted for at the next quarterly meeting, and shall upon a majority vote be elected to membership.

XVII. WITHDRAWAL—Any member may retire from membership by giving a written notice to that effect to the secretary-treasurer, and the payment of all annual dues and assessments to that date; but shall remain a member, and liable to the payment of such annual dues and assessments, till such payments are made, except as hereinafter provided.

XVIII. EXPULSION—A member may be expelled from the association by ballot of three-fourths of the members voting, at any regular meeting of the association, upon the recommendation of the executive committee.

XIX. AMENDMENTS—Amendments to the by-laws shall be laid before the executive committee, who shall bring them before the next meeting of the association.

XX. Each member of the association shall be furnished by the secretary-treasurer with a copy of the constitution and by-laws of the association and also a list of the names and addresses of the members.

Interchange of Freight Between Steam and Electric Roads.

Decision of the New York Supreme Court Further Affirming the Right of an Electric Railway to Interchange Freight.

At the time of its organization in 1901, the Hudson Valley Railway Co., of Glens Falls, N. Y., was engaged in litigation to secure physical connection with steam railroads and recognition of its right to interchange freight with them, proceedings having been instituted by the Stillwater & Mechanicville Street Railway Co. (one of its constituent companies) to obtain an order permitting it to unite and connect the tracks of its railroad with those of the Boston & Maine Railroad Co. The decision in this matter by the Supreme Court was in favor of the electric road, but this was reversed by the appellate division of the Supreme Court; the case was carried to the Court of Appeals, however, which rendered its decision June 27, 1902, reversing the appellate division and affirming the original decision. The opinion of the Court of Appeals was published in full in the "Review" for July, 1902, at page 419.

Following this litigation the physical connection contended for was effected and the company for two years enjoyed the benefits following such union of the two systems, which rendered it practicable and convenient to exchange freight. After that time, however, the Delaware & Hudson Co. reached the conclusion that the decision of the Court of Appeals merely entitled the electric line to physical connection of its tracks without the right to interchange cars and refused to deliver to the electric road cars from other railroads consigned via the Hudson Valley Railway. The Boston & Maine was induced to take the same position and annulled the agreement that had been made between it and the Hudson Valley Railway Co. and refused to operate under contracts then in force. The Hudson Valley company immediately began action against the Delaware & Hudson Co. and the Boston & Maine R. R., and secured injunctions; the motion to continue the temporary injunction was argued in November last at a special term of the Supreme Court. Justice John M. Kellogg has just made his ruling on the motion, which is against the steam railroads. Below are given extracts from the opinion covering the principal features of the case:

"The defendant plants itself upon the ground that its cars are its property and it has the right to control them in its own way, and that it cannot be compelled to carry the cars of other companies upon its lines except by contract. It overlooks the broad proposition that a railroad is of a semi-public nature and assumes somewhat the form of a public utility; that while the stockholder views it as operated for his benefit, the public views it as being maintained also for the convenience of the people, the transaction of the people's business and means of commerce. It is a common carrier of freight and property, a highway, as it were, for the transaction of the business

of the public according to such reasonable rules and regulations as the company may establish and which are not against public policy. The owner, by putting his private property into the track and the cars upon it, has lost some of the absolute and independent control which he had over his property by dedicating it to this public use, and his profit and interest, and the demands of public commerce and public business, are the rules which must govern the use and operation of the property. The defendant contends that it has not refused to receive or deliver freight, but that it only refused to receive or deliver the vehicle in which freight is contained. But whether the refusal of the vehicle is a refusal of the freight depends to a great extent upon the nature of the freight, the packages in which it is contained and the manner in which that class of freight is usually transported. A carrier cannot require a shipper to deliver freight in just the form which the carrier though caprice may require, but must receive the freight in the way and manner in which it is usually shipped and generally forwarded. We can see that the refusal to receive or deliver an oil tank car containing oil is practically a refusal of the oil. The same is true of coal and grain and other merchandise which may be shipped in bulk in a freight car and containing in no separate package, the car being, as it were, the package in which the coal or grain is shipped. And if this bulk is broken, and it is required to be taken in boxes or bins, the expense of removal to another car and the delay of the reshipment would be so great that it would practically destroy the right to ship. If carloads of freight are usually shipped to their destination without breaking bulk, competition in all lines of business is so keen that the shipper who must submit to the delay and expense of the transfer from car to car at every railroad connection cannot compete with his competitor who has to suffer no such expense or delay, and in substance transportation of his freight is denied to him. When, therefore, a company refuses to receive freight in a car, which is usually shipped by the carload, and the expense or delay in the handling of the freight from one car to another might be such as practically to destroy the profit in shipping, it in effect and substance refuses the freight.

"A railroad company, under subdivision seven of section four of the railroad law, has power to take and convey persons and property on its railroad and receive compensation therefor. Under this section it does all its business and gets all its earnings. The railroad law, when it speaks of a railroad carrying property, uses the word 'property' in its broadest sense, and seems to embrace everything which a railroad may carry except persons. Under this word 'property' it transfers for hire or otherwise the cars of other railroads, either with or without freight, and may take a new and empty car from the factory to its road and deliver it to the road for which it is intended, and its right to receive pay arises from the fact that it is carrying property within the meaning of this statute. Section twelve of the railroad law requires that railroads which are intersected by another railroad shall receive from each other and forward to their destination goods, merchandise and other property intended for points on their respective roads, with the same dispatch as, and at a rate of freight not exceeding the local tariff rate charged for similar goods, merchandise and other property, received at or forwarded from the same point for individuals and other corporations.

"It will be noted that this section does not use the word 'cars' but requires the forwarding of all merchandise and 'other property.' 'Other property' properly means any property which from its nature and the condition in which it is, is reasonably capable of being transported over the road.. In my judgment a carload of merchandise comes within the provisions of this section, either as merchandise, the car being treated as the package or holder of the merchandise, and if it is such a package or holder as is usual in the transportation and carriage of such merchandise, it seems unreasonable and improper for the company to refuse to accept it; or the car, if we separate it from the merchandise, well comes within the term 'other property' mentioned in the statute, because it is such property as is usually transported on a railroad. And if there were doubt about this position it is somewhat cleared by section 35 of the railroad law, which requires a railroad whose road at or near the same place connects with or is intersected by two or more roads competing for its business, to fairly and impartially afford to each of such connecting or intersecting roads equal terms of accommodation, privileges and facilities in the transportation of cars, passengers, baggage and freight over and upon its road, etc. This section leaves out the words 'other property' and in place of them uses the words 'cars, baggage and freight.' By [illegible] fairly be inferred that the legislature intended by the general railroad law that railroads should interchange cars loaded with freight and that the intersection provided for by section 12 of that law was intended for that purpose. And this fact is emphasized by subdivision 5 of section 4 of the same act, which empowers the roads to intersect and to build and maintain switches and other conveniences in furtherance of the objects of its connections. The object of its connections is to transfer cars from one road to the other. There can be no other good reason for a connection, and the railroads having the power to make the connection, and if necessary to condemn private property for that purpose, it becomes the duty of each to exercise the power granted it and use the connection for the purpose for which it was created. It is apparent, if one railroad is compelled to transfer freight from one car to another, and perhaps furnish new receptacles in which to place the freight when it is in the car in bulk, that it is not being transported with equal facility or on equal terms with another railroad which transports its freight in the car in which it was originally placed. This connection at Stillwater, it is urged by the plaintiff, fairly comes within section 35 above referred to. And while it is true, as stated by the defendant, that the moving papers do not show that the Delaware & Hudson and the plaintiff are competing for the business of this defendant or near that place, the facts are fairly well supplied by the answering affidavits which show that the connection of the Delaware & Hudson company covers nearly all the territory and points reached by plaintiffs. It thus appears that the Delaware & Hudson and the plaintiff are competing for the business of the defendant at or near Stillwater and that therefore section 35 requires an interchange of cars with substantially the same facility and on equal terms as granted the Delaware & Hudson at or near that point.

"The defendant's contention that if it has violated section 35 of the railroad law, the plaintiff's only remedy is an application to the railroad commissioners for redress is not well taken. That section authorizes the railroad commissioners to prescribe such rules as will secure equal enjoyment of equal accommodation and facilities at such intersections and the terms and conditions upon which interchange of traffic shall be afforded each road. That section enables any dispute as to the terms and conditions upon which the interchange can be made to be settled by the railroad commission. It does not furnish the only remedy where an interchange is absolutely refused without regard to terms and conditions and where one of the roads claims that the statute does not require such interchange. This court may construe the statute and determine the right of an interchange. If the parties cannot agree upon the terms and conditions of the interchange after the right is established by the court, the railroad commission is competent to fix the terms and conditions.

"The defendant produces affidavits which it contends show that the plaintiff's road is not in fit condition for freight traffic. This is probably something of an afterthought, as a refusal to deliver cars was not put upon that ground, and it does not appear that from the interchange of cars which previously existed between the plaintiff and defendant that it was discovered that the cars were injured upon the plaintiff's road in any manner, and it would seem from the fact that there had been such interchange for some time and to a considerable extent and that no bad results followed, that that fact speaks louder than the opinion of experts criticising the physical condition of the road. We can well understand that the road is not adapted to freight business or the running of freight trains at the usual speed and manner, and can well understand that the running of freight cars through the villages would not be allowed with the same speed or manner in which it is done on steam railroads. But there is nothing in the case to show that the cars have been or will be seriously injured if properly handled upon the plaintiff's roads and there is no proof in the case showing that the plaintiff is irresponsible or not able to pay for any damage which may arise from its carelessness or the improper construction of its way.

"This is a motion to continue the injunction which was granted during the pendency of the motion, until the determination of the action. The question as to whether the defendant must load its cars with freight to be carried over the plaintff's road can better be determined upon the trial of the action, and in the discretion of the court it is deemed best not to cover now that situation by an injunc-

[illegible]
the defendant should not receive from the plaintiff for carriage, freight and freight in cars, or freight trains, where said cars are standard cars and properly equipped, tendered to it at the connections referred to, upon its being paid its proper charges in relation thereto. Neither is there any reason why the defendant should not be required to deliver to the plaintiff at the several connections such carload lots of freight, with the car or such cars as it may receive from other roads consigned to parties upon the plaintiff's road, where the cars are consigned and billed by way of the plaintiff's road, and deliver such carload lots of freight, in car, and freight cars, as may be consigned to parties upon the plaintiff's road at points of destination not reached by the defendant's company or by any other connecting railroad.

"Either party may apply to the court to fix the terms and conditions upon which the interchange of cars and freight shall be made in case a dispute arises in any case in which the railroad commission is not competent to direct. If the order is not agreed upon, it will be settled upon ten days' notice."

The court reviewed the action brought by Stillwater & Mechanicville Street Railway Co. to secure a physical connection, which decision gives to a street railroad company the same right of connection as a steam railroad company, and said the court has not the right to force a physical connection that does not carry with it the right to interchange cars. Assuming if an interchange of cars is impracticable, or not to be had, that a physical connection cannot be required.

The following memorandum was filed by the court with reference to the Delaware & Hudson Co.:

"The questions in this case, so far as they relate to receiving from or delivery to plaintiff's road of cars or freight, are disposed of by the decision in Hudson Valley Railway Co. vs. The Boston & Maine Railroad Co., at this term of court, and the injunction will cover the same points and also prevent a removal of the connection now existing at Lake George and Glens Falls. The connections formerly existing at South Glens Falls and Saratoga were put in under special contract for the sole purpose of aiding the plaintiff in getting rails and material to be used in the construction of its road and after such material was moved were to be removed whenever the plaintiff required. This court cannot prevent the removal or require the restoration of those connections in violation of the terms of the contract between the parties. This is not a proceeding to establish a physical connection. It may be that the temporary physical connection as established is at a place or is different in construction than the parties would require or desire for permanent use. If the order is not agreed upon it will be settled on ten days' notice."

Electric Tramway for West Fife.

FROM U. S. CONSUL McCUNN, DUNFERMLINE, SCOTLAND

A company has been formed here by local parties to build an electric railway through the west of Fifeshire. The promoters have given notice to the Fife County council, the corporations of Dunfermline, Inverkeithing, Cowdenbeath, and Lochgelly of their intention to apply to Parliament in November for provisional orders to carry out the scheme. The stock will then be floated, and it is expected the company will begin the construction of the road in the spring of 1905. The road will be 16 miles in length, and besides connecting the towns mentioned will ultimately touch the new naval base, on the Firth of Forth, referred to in my previous annual report. The estimated initial cost is £130,000 ($632,645). The Fife Electric Power Co., which is now building a power plant here, will supply the power required for all purposes in the operation of the tramway system when completed.

At the next meeting of the Connecticut legislature franchises will be presented for electric railways paralleling the New York, New Haven & Hartford Railroad Co's. line between New Haven and Putnam, Conn., via Middletown and Willimantic, and between Bradford and East Lyne. The former line will be extended to Boston and the latter to Providence, R. I. The legislature will also be asked to grant a charter for an electric line between Broad Brook and Buckland, via Wapping, to connect with the Hartford, Manchester & Rockville Tramway Co's. system at Buckland.

Ohio Interurban Railway Association.

The regular December meeting of the Ohio Interurban Railway Association was held at the Hotel McKinley, Canton, Ohio, Thursday, December 29th. The meeting was called to order at 10.30 a. m. by President Clegg, who introduced Mr. F. J. J. Sloat, chairman of the Committee on Interline Tickets.

Mr. Sloat stated that he had found wide differences of opinion among the interurban railway men of the state as to what should be included in a ticket intended for their use. He had therefore secured sample forms for a ten-coupon ticket which embodied about all the features that could be included in such a form, and presented the sample for discussion, the idea being that after discussion the undesirable features could be eliminated.

The form submitted is what is known as the "skeleton ticket," and is one not favored by railroads because of the opportunity it offers for manipulation in the hands of scalpers. It was the idea that after a few weeks' experience had shown the tickets for which there was a demand, these would be printed, and the need for using the skeleton avoided.

The ticket form secured by Mr. Sloat was presented to the association and discussed in detail; the various points decided upon were:

1. There should be an agent's stub, showing the Form No., Starting Point and Destination, Route and Amount Collected. The Route is a necessary addition, because some companies can offer more than one route to a given point. The agent's stub will be at the bottom of the ticket, so that if a skeleton form having more coupons than are needed is used, the unused coupons at the bottom may be detached in one piece, together with the agent's stub. As in some instances agents will make a daily settlement and report at longer intervals, it was made optional as to whether a duplicate stub be provided on the ticket; with two stubs one would be forwarded to the auditor with daily collections, and the other retained by the agent until his report was completed and then turned in; if a second stub is not needed for reporting it could with advantage be used for advising the general passenger agent as to sales.

2. The contract section of the ticket should be provided with a calendar, in which day, month and year can be punched to show limit.

3. The passenger should not be required to sign the contract.

4. There should be a stipulation as to the selling company acting only as agent for other roads over which ticket reads.

5. There should be only one class indicated on the ticket form. It had been suggested that the regular form might be used for special or excursion rates, by punching the ticket second class, but to this it was objected that a great many mistakes on the part of agents and conductors would be eliminated by having a different form for excursion tickets.

6. That the contract should contain a clause making the ticket void in case of alteration, or the cancellation of more than one date.

7. That the ticket should be on its face limited as to time, 30 days from date being the limit on regular tickets.

8. That the contract should stipulate that the ticket is subject to the stop-over regulations of the roads over which it reads and is subject to exchange for train checks in accordance with such regulations.

9. That no proof of identity of passenger using the ticket be required.

10. That the coupons be void if detached.

11. That the baggage liability be limited to $50 for a full ticket and $25 for a half-ticket.

12. That the contract stipulate that no agent or employe has power to modify the contract in any particular.

13. That the coupons be plainly marked with the name of the road issuing the ticket.

On the subject of colors there was a wide variety of opinion expressed. While it was admitted that various colors might be used to advantage with the purpose of making it easier for ticket agents to distinguish tickets in the case, or for conductors, or for the auditor's clerks, it was considered that it was not wise to adopt a plan that would encourage employes to rely on the color rather than the reading matter. Also it was evident were each company to follow its own color scheme, the extensive use of interline tickets would

result in the overlapping of different systems of color and the de-struction of the value of such schemes for distinguishing tickets. Accordingly it was voted to print one way interline tickets on green safety paper, and round trip interline tickets on gray safety paper, half-fare tickets being distinguished from whole tickets by printing on the form the words "half-fare."

The contract decided upon is as follows:

Issued By
THE LAKE SHORE ELECTRIC RY.
Good For
One First Class Passage
To

....

When stamped by Company's agent and presented with coupons attached in accordance with the following conditions:

1st. That in selling this ticket for passage over other lines and checking baggage on it,

The Lake Shore Electric Railway

acts only as agent and is not responsible beyond its own line.

2nd. This ticket is void for passage if any alterations or erasures are made hereon, or if more than one date is canceled.

3rd. If limited as to time, it must be used to destination before midnight of the date indicated by punch marks.

4th. Baggage liability is limited to wearing apparel not to exceed fifty (50) dollars in value for a whole ticket, and twenty-five (25) dollars for a half ticket.

5th. It is subject to the stop-over regulations of the lines over which it reads, and may be exchanged by conductors at any point for tickets or checks conforming to such regulations.

No agent or employe has power to modify this contract in any particular.

(Cancellation Calendar for 7 years given on right hand side of this column.)

Form of Coupon:

Issued By
THE LAKE SHORE ELECTRIC RY.
Acc't of..R. R.
....
To
....
On conditions named in contract.
Via..
One Passage.
Form — Not Good If Detached.

(Destination shown in column on right hand side.)

(Number of ticket shown in left hand column.)

(Agent's Stub, showing form number, number of ticket, rate, route, original point and destination, next attached.)

For special rate tickets the committee was instructed to draft a special contract and report at the next meeting.

Accounting.

As to the basis of settling with foreign roads it was voted that:

1. Settlements be made upon the basis of sales by the issuing road and not upon the collections made by the carrying road. By this means, if a conductor fails to lift the coupon, the road will not lose the fare. Where [illegible] made for [illegible] will be charged against the other road and the amount paid on account of the original sale, collected back.

2. Settlements be made monthly, the creditor road drawing on the debtor road for the balance due.

3. The form of report on coupon tickets recommended for use by the members of the association be that adopted by the Lake Shore Electric Railway Co. The heading of this form is shown herewith:

Through Baggage.

The subject of "Uniform Checking of Baggage" was not discussed at this meeting. Mr. E. C. Spring, chairman of the committee having this in charge, being unable to attend the Canton meeting.

It was stated that the Dayton & Troy Company checked baggage over three roads, using its own checks. In Dayton the express service maintained enabled the company to take baggage from residences, something that but few companies were now able to do.

On the Dayton & Troy, 50 to 60 pieces of baggage per day had been handled at 25 cents each; this Mr. Clegg believed was a source of income worthy of consideration.

Railway Guides.

Representatives of the Central States Guide addressed the meeting and quoted prices as follows for monthly guides: 100 to 300 at $1.20 each per year; 300 to 500 at $1.10 each per year; 500 and more at $1.00 each per year.

It was voted that those wishing to take advantage of this offer communicate with the secretary of the association, so that he could arrange to get the best discount available.

Annual Meeting.

The president announced that the next meeting would be at Dayton, Ohio, Jan. 26, 1905, this being the annual meeting. A nominating committee, consisting of F. J. J. Sloat, F. W. Coen, Valentine Winters, F. D. Carpenter and J. L. Bushnell was appointed.

Institute Annual Dinner.

The annual dinner of the American Institute of Electrical Engineers will be given in the ballroom of the Waldorf Astoria, New York City, on February 8th, and promises to be a most interesting occasion. A number of pioneers and leaders will be present, an original menu has been designed, and some novel features will be introduced; while the list of speakers includes men of national and international reputation. The dinner will be served for $5 per cover without wine or cigars, and as is usual on these occasions, ladies will be present. The participation of the ladies was a feature that elicited Mr. Carnegie's enthusiastic commendation at the famous Institute Library dinner, which he made forever memorable by his million-dollar gift for the United Engineering Building. Notices will be sent to the members forthwith, and it is requested that an early response be made, in order that proper care can be taken of all applications. Over 400 had to be seated at the Edison dinner last year, and the attendance in February promises to be equally large.

REPORT OF COUPON TICKETS

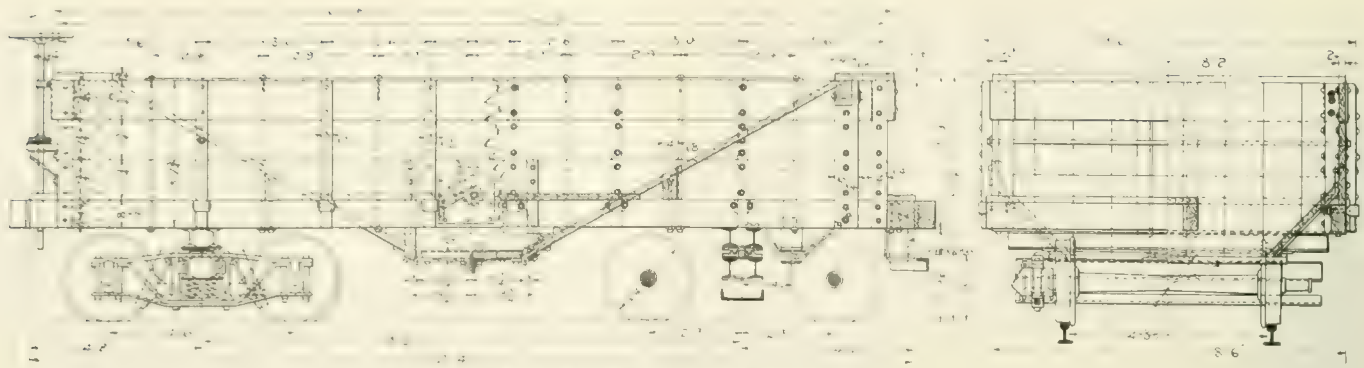
Sold over the *R. R.*

during the month of *, 190*

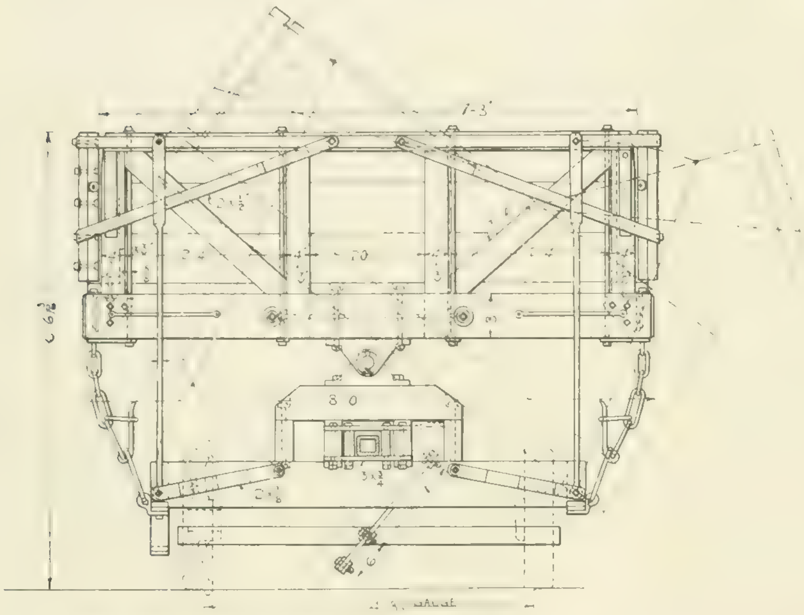
N. B. If any discrepancies are found in this report, please make no alterations but advise by letter and corrections will be made in subsequent statement.

	FROM	TO	FORMS	Consecutive Nos.		No. Sold		Through Rate	Prop'n	AMOUNT
				Com. No.	Clos. No.	R. T.	S. T.			
1										
2										

LAKE SHORE ELECTRIC RY. FORM OF REPORT



TWELVE-YARD MIDDLETOWN DUMP CAR.



END ELEVATION, SIX-YARD MIDDLETOWN DUMP CAR.

Middletown Cars for York, Pa.

The accompanying illustrations show the general views and details of a six-yard dump car and a twelve-yard hopper car, both of which were built by the Middletown Car Works, of Middletown, Pa., for the York Street Railway Co. The six-yard dump car is in service hauling limestone and distributing the same on the pikes over which the railway company has its right of way. This dump car is used for delivering crushed stone in small amounts from place to place for the purpose of repairing the road, and in order to control the distribution of this stone the Middletown Car Works devised a special controlling mechanism which permits the body of the car to be tipped to a certain angle and then righted again, so that any give quantity of material may be deposited at any one or more places. The half-tone illustration shows this car tipped to a certain extent, and the end elevation shows the details of the tipping mechanism. An ordinary type of dump car would discharge the whole load at one stop instead of being able to distribute it from point to point.

The twelve-yard hopper car is used as a ballast car to distribute broken stone along the line of the York Street Railway Co. to such places as it may be required for ballasting. It will be seen from the end and side elevations of this car that the hopper is arranged to discharge between the rails, and, as the slope is 30°, the stone is promptly discharged with a minimum of labor. This car is equipped with steel body and truck bolsters and has proved highly satisfactory in the line of work for which it was designed.

TWELVE-YARD HOPPER CAR, MIDDLETOWN CAR WORKS.

Tramways at Smyrna.

Mr. Rufus W. Lane, U. S. Consul at Smyrna, Turkey, sends the Department of Commerce and Labor the following data:

The first line of tramway in Smyrna was inaugurated in 1879 with about 3 miles of track. It is known as the Tramways des Quais, and is operated by a French company, of which the president, secretary, and general manager is Aimé Tissot. Twenty-five horse cars are in use on this line, which has recently been extended 5 miles. The only other line operating in Smyrna is the Société des Tramways, Smyrne-Guez-Tépé. This line began to run horse cars in 1886, with 2 miles of track; subsequent extensions have given them nearly 5 miles. and they require about twenty cars to accommodate their traffic. This is an Ottoman company, the president being N. Harentz, of Constantinople; treasurer and secretary, Bedros Boloubeyan; general manager, A. Harentz.

SIX-YARD DUMP CAR, MIDDLETOWN CAR WORKS.

The annual ball of the Cleveland Consolidated Street Railway Employes' Beneficial Association was given at the Armory, Cleveland, O., December 2nd.

Cost of Electric Railway Power Production and Transmission in the State of Indiana.*

[illegible]

The word "Electric" in the name of our organization suggests the one characteristic upon which hinge all of the differences distinguishing our business from that of the older railways of the country. In the years of the development of the steam railways, their managers and engineers have determined the possibilities of steam motive power as regards the economical weight of train and length of run, and have evolved by experience the schedules and classes of service which they are now giving our different communities. It is on account of the limitations of the steam locomotive that the older railways have not given the service and obtained the business which is ours today. It is wholly due to the development of the electric motor and electric power transmission that our interurban railways are enabled to run their trains in units of one, two or three cars each, at intervals of ten minutes or two hours as required, and make stops as frequently as desired, and do it efficiently and economically. This is the fundamental reason for whatever success the interurban railways have achieved.

As the method of conveying the energy from our coal pile to our car axles is the one thing which makes possible our business, and especially as the cost of this energy is one-fifth to one-quarter of our entire operating expense, it should be interesting to consider briefly the division of this cost into its components, together with a statement of the average costs per unit of the power used on the Indiana interurban roads.

A very comprehensive listing of the principal physical features of our electric railways was given in a paper entitled "Interurban Electric Railways of Indiana," presented by Mr. Robert P. Woods at a meeting of the Indiana Engineering Society just a year ago. The statistics as given in that paper stand practically correct today, when we add the 20 miles of the Indiana Northern Traction Co. now operating between Marion and Wabash.

Supplementing Mr. Woods' paper as a source of information from which to draw the conclusions presented in this paper, we have written to officials of the various electric railways of the state, requesting car mileage and cost of power statistics. Nearly all of the roads have very kindly taken the pains to reply to our inquiries in a very satisfactory manner, and it is due to their kindness in this regard that we are enabled to furnish some average figures on power costs.

We now have about 800 miles of interurban electric railways in the state, operating 100 cars regularly. These cars vary in size from the ordinary street car to the 60-ft. 35-ton car in use on the Indianapolis & Northwestern. The average weight of the 100 cars in regular daily operation is 25.61 tons and their average scheduled speed is 20 miles per hour.

Twenty-four power stations furnish current to these cars, the combined station capacity (exclusive of the Indianapolis Traction & Terminal Co's. station) being slightly over 20,000 kw., or an installed capacity in generators of about 200 kw. for each interurban car operated and 25 kw. for each track mile operated. One half of the 24 power stations generate and deliver to the cars direct current, while the other 12 generate alternating current, distributing to the cars as direct current through 34 sub-stations. The individual power station capacities vary from 200 to 6,000 kw. and comprise units of nearly every standard rating from 65 kw. to 1,500 kw.

Assuming a power consumption of 100 watt-hours per ton-mile, we have an average total at our 100 interurban cars of about 5,000 kw., using the average figures as given above of 25.61 tons as the weight of car and 20 miles per hour as the schedule speed.

The average load factor of the power stations appears to be about 40 per cent of the installed capacity. Therefore, the average output at power station bus-bars is over 8,000 kw., which appears to indicate that the aggregate losses in overhead lines, rail return, sub-station apparatus, step-up transformers, etc., amounts to more than 3,000 kilowatts average, or an average efficiency from power station bus-bars to car motors of say 60 per cent. As the assumption of 100 watt-hours per ton-mile is probably high, this average efficiency of distribution, if in error, is to be considered higher rather than lower than the actual.

This loss of 40 per cent of the total power generated must be divided between the stations generating direct current and those generating and transmitting alternating current and converting to direct current through rotary converters at sub-stations. But 20 per cent of the railway power generated in the state outside of Indianapolis is the output of direct current generators. Allowing 20 per cent for the transmission losses from the direct current stations leaves us an efficiency of about 55 per cent for the remaining 75 per cent of the generated power which is the product of alternating current stations. This efficiency is probably made up about as follows:

Efficiency of step-up transformers	94 per cent
Efficiency of transmission lines	97 per cent
Efficiency of step-down transformers	93 per cent
Efficiency of rotary converters	80 per cent
Efficiency of direct current distribution	80 per cent
Combined efficiency	54 per cent

The figures given as the efficiencies of transformers and rotary converters will, of course, not compare with the efficiencies guaranteed by manufacturers, as the guaranteed efficiencies are based on full load or nearly full load conditions, while the average load on rotary converter sub-stations in the service which is most general on our roads is hardly greater than 25 per cent of their rated capacities. This difference in distribution efficiency as between 80 per cent for the average direct current station and 55 per cent for the average alternating current station, is at first glance a surprising one and helps many a company to spend a large proportion of the dollars saved by an economical power station. Without doubt, there is more than one railway in the state, now operating an alternating current generating plant with transmission lines and sub-stations, that could have invested the same money in direct current stations and trolley feeder and be operating today with a less charge to cost of power per car mile. On the other hand, there are several alternating current generating stations in the state which are delivering power to the car axles, after paying the price for the losses, at a cost much less than that at which they could accomplish the same result from direct current stations. The question of which system should be installed in a given case is one that should be carefully considered before a decision is made, as too often in the past few years has the alternating current generating plant with rotary converter sub-stations been installed seemingly because such an outfit was in style, when the much more simple system of direct current stations with plenty of trolley feed wire would have been much more economical.

For instance, let us briefly consider a given case as follows: Two cities of about 25,000 population each, situated 20 miles apart, each with a street railway system of say 10 city cars. These two systems are owned by a company which is to construct an interurban road connecting the two, the plans contemplating new power equipment. The schedule will call for two regularly operated interurban cars and 20 city cars, and an installation of say 1,000 kw. capacity in power generating machinery. The location of an alternating current power station midway between the two towns with a sub-station at each end and rotaries in the power station will mean average transmission and conversion losses of about 45 per cent of the total power generated.

The location of a combination alternating and direct current plant at one end with sub-stations at the other end and midway will

*Read before the Indiana Electric Railway Association, Indianapolis, Jan. 12, 1905.

mean average transmission and conversion losses of about 35 per cent. With two direct current stations, one at each end, and direct current feeder of double the cross section on the interurban line, the same results will be attained with power losses of but 20 per cent; the first cost of the installation will be no greater and the cost of generating the power would be but very little, if any, greater, provided, of course, that the facilities for obtaining coal and water are the same in the two towns. Assuming a generating cost of 10 per cent more in the two small stations than in the one larger one (which is high), we have the cost of power at the car from the direct current stations averaging about 25 per cent lower than from the alternating current station at the middle location and over 10 per cent lower than from a combined alternating and direct current station at one end of the line, without considering the additional labor at sub-stations which would be required with either of the alternating current stations.

If the given conditions be varied by the elimination of the city cars at one end of the line, leaving a load to be considered consisting of an interurban line of 20 miles in length, operating two regular cars on an hourly schedule, with a city system of 10 small cars centering at one end of the interurban line, then one direct current power station at or near the city car load probably will prove to be the most economical. In this case, of course, the trolley feeder must be increased greatly, and possibly a booster set will be required, but this additional investment will not reach the cost of transmission lines, sub-stations and sub-station apparatus plus the capitalized cost of sub-station operation and losses.

However, when the proposed line is much to exceed 20 miles in length, especially if future extensions are very likely, and no great number of city cars are to be operated, economy begins to favor the alternating current station with high tension transmission and sub-stations, and as the length of line increases, and with it the number of cars to be operated and the total load on the station, it finally reaches a point where there is no question as between the one alternating current station and a number of small direct current plants. When the construction of a power plant of several thousand kilowatts capacity is under consideration, a location may be selected where a supply of good water is assured, where coal may be easily handled, and the many refinements conducive to economical operation may be introduced which are not possible or practicable in smaller stations. These points, together with the low cost per kilowatt hour for labor which is possible with a large station, combine to reduce the initial cost of power to such a low figure that the seemingly low average efficiency of transmission and conversion, together with the costs of sub-station operation, may be met, and power still be delivered to cars many miles distant at a cost which will compare very favorably with direct current distribution within much smaller possible areas.

In this discussion, no mention has been made of the purely alternating current system, in which the car motors are designed for the use of alternating current, and for which the following claims are made: Reduction in first cost, by the elimination of the rotary converter and saving in trolley feeder; reduction in operating expenses by doing away with constant sub-station attendance; and increase in efficiency by the reduction of trolley and feeder losses, reduction or elimination of rheostatic car starting losses, and the complete elimination of rotary converter losses. As soon as the new alternating current motor can demonstrate these points and prove to us that it is as well adapted to our purposes, as efficient, as reliable, and as easy of maintenance as the direct current series motor, we must seriously consider it in our future plans.

The operation of cars by this system has just been started on the Rushville division of the Indianapolis & Cincinnati Traction Co., and the operation of this line will be very closely watched by street railway engineers and managers, until the success of the system has been fully demonstrated.

The replies which have been received to letters of inquiry represent 85 per cent of the total installed generating capacity of the railway power stations of the state. These power stations generate an average of 5,845,450 kilowatt hours per month at an average total cost of $44,156.38, or .755 cent per kilowatt hour.

This average cost per kilowatt hour is divided as follows: Fuel, 0.526 cent; labor, 0.158 cent; lubricants, waste and miscellaneous supplies, 0.032 cent; repairs, 0.039 cent.

The lowest total cost per kilowatt hour reported is 0.505 cent, while the highest is 2.024 cents. The lowest cost of fuel is 0.368 cent; the highest, 1.405 cent. The lowest cost of labor is 0.100 cent; the highest, 0.331 cent. The lowest cost of lubricants, waste and miscellaneous supplies is 0.015 cent; the highest, 0.086. The lowest cost of repairs is 0.010 cent; the highest, 0.218 cent.

Deducting the output of the two most economical stations, representing two-thirds of the total output reported, the average cost of the rest of the energy generated in the state is 1.021 cents per kilowatt-hour.

The figures which have been given are on cost of power at power station switchboards. As six of the thirteen stations reporting are alternating current stations with transmission lines and sub-stations, these costs must be increased by the addition of sub-station operating expenses. With this addition, the total cost of power delivered to direct current feeders is $47,500.01, or 0.964 cent per kilowatt hour, the lowest cost reported being 0.747 and the highest being 2.024 cents.

The total amount of coal burned in all the stations reporting averages 532½ tons daily, 80 per cent of which is Indiana run of mine and slack. The average cost of all coal burned is $1.89 per ton. The average consumption of coal is 5.56 lb. per kilowatt hour, the highest consumption reported being 10.7 lb. and the lowest being 4.9 lb. per kilowatt-hour.

The power station capacity per interurban car operated averages, as has been stated, about 200 kw., the lowest being 150 kw. and the highest 350 kw.

The roads reporting give a monthly car mileage of city cars of 1,122,060, and of interurban cars of 630,258 car miles. The average power consumption is 1.48 kilowatt-hours per car-mile for city cars and 5.18 kilowatt-hours per car mile for interurban cars. On this basis, the average cost of power per car-mile is 1.43 cents for city cars and 5 cents for interurban cars.

As illustrating the beneficial effect of the careful consideration of operating features in the engineering design and construction of a road, such as reducing curves and grades to the practical minimum, the careful location of sub-stations with respect to their loads, and an economical distribution of copper, some figures on the Indianapolis Northern Division of the Indiana Union Traction Co. as compared with the rest of that system, may be of interest.

The Indianapolis Northern division consists of the lines from Indianapolis to Logansport, Kokomo to Peru, and Tipton to Elwood. This portion of the line is fed from the power station at Anderson 26, 42, 43, 59, 59 and 61 miles, respectively, from the power station, 26, 42, 43, 59 and 61 miles, respectively, from the power station, the average distance of all rotary converters being over 46 miles from the generators.

The rest of the system is fed from the same power station through rotaries at the power station, and through 15,000-volt transmission lines to eight sub-stations, the average distance of all rotary converters on these old divisions being but 15 miles from the power station.

The entire alternating current output of the station is measured by an integrating wattmeter on the generator switchboard, while a second wattmeter measures the input to the step-up transformers supplying current to the transmission lines feeding to the Indianapolis Northern sub-stations only.

Notwithstanding the fact that 12 per cent of the power used on the old divisions is delivered directly from the power station with no alternating current transformer or transmission losses whatever, and that the average distance from generator to rotary is 31 miles greater on the Indianapolis Northern division, the power station output to these new divisions is but 33 per cent of the total, while handling 42 per cent of the total car mileage. In other words, the power consumption per car mile, including all losses from generator to car motor, on the new lines is but two-thirds as much as on the old lines, even though the average transmission distance is three times as great. The class of cars in use on all divisions is the same, and the average schedule speed is slightly greater on the new lines than on the old.

Like many other of the more progressive cities, the city of Portage, Wis., is being pushed to the front through the medium of the extensive advertising of the many advantages it offers. A recent circular which has been sent out by the Business Men's Association shows a view of the new city hall, a map of Wisconsin giving the location of the city, a partial list of the city's industries and several other interesting facts which appeal to the prospective manufacturer.

Detroit, Monroe & Toledo Short Line.

The opening of the Detroit, Monroe & Toledo Short Line between Toledo and Detroit and the inauguration of through limited service on this line Nov. 5, 1904, marks the completion of an interurban railway which has been the subject of considerable discussion and interest for the past few years. Shortly after the completion of the Toledo & Monroe Railway in July, 1901, the Everett-Moore Syndicate decided to build an electric railway between Toledo and De-

TRESTLE OVER OTTAWA RIVER NEAR TOLEDO.

troit, and the owners of the Toledo & Monroe property sold that line to the syndicate rather than go into competition with a new line between Toledo and Monroe. The Everett-Moore road was completed from Toledo to Trenton, Mich., where connection was made with the Wyandotte Division of the Detroit United Ry., but in January, 1902, the Everett-Moore Syndicate became involved in financial difficulties and this property was sold to the Clover Leaf and Grand Trunk railways, providing a desired entrance into Detroit for the one and into Toledo for the other. The overhead material and poles were sold to the new owner of the Toledo & Monroe Railway, which company secured a more direct route to Detroit, took down the poles and lines from the Everett-Moore road and replaced them on its own.

The present company was organized Nov. 19, 1902, with a capitalization of $6,000,000, to take over the Toledo & Monroe Railway, the Michigan & Ohio Railway and the Monroe Traction Co., and to extend the line from Monroe to Detroit, there remaining at that time some 30 miles of the line to be constructed. The officers of the new incorporation were: President, Matthew Slush; treasurer, Charles R. Hannon; secretary, Elisha A. Flinn.

UNDER CROSSING NEAR TOLEDO.

Track.

The total length of the route is 57 miles, of which 3.5 miles are within the city limits of Toledo and 5 miles within the city limits of Detroit. The Toledo & Monroe Ry., which forms the southern [illegible] 4, 1901, [illegible] built [illegible] Toledo & Monroe Ry. appeared in the "Review" for July 15, 1901.

The new section of the line is located with a view to high speed service, its maximum grade being less than one per cent, and it has very few [illegible] that of the old line, being laid with 70-lb. A. S. C. E. rails with "Continuous" rail joints and Crown rail bonds made by the American Steel & Wire Co. The ties, which are of oak and cedar, are laid 2 ft. between centers and the road is rock ballasted throughout.

The Short Line throughout its entire length, with the exception of the route through Monroe, is built on a private right of way. Near the city of Detroit is a short section about one mile in length which involved the expenditure of over $150,000 for construction. Besides buying a right of way through valuable property it was necessary to provide a drawbridge which crosses the Rouge River about 100 yards beyond where the company connects with the tracks of the Detroit United Ry. at Woodmere, also over crossings for three steam roads and under crossings for three steam roads. The elevated crossings are over the Michigan Central and Wabash railroads near Woodmere and the Detroit Southern near Trenton, while three subways take the line under the Lake Shore, Ann Arbor and Michigan Central

[illegible]

railroads at Alexis. In addition to this the company has built a steel bridge over the Huron River at Rockwood, Mich., a steel bridge over Stony Creek and a trestle over the Ottawa River near Toledo. At all points where curves occur there are sidings over a mile long; all cars take the right hand track, thus avoiding danger of collisions. In addition to the sidings at curves there are sidings every two and one-half miles along the entire route, with a complete system of telephones to facilitate the dispatching of trains. The line is double-tracked between Detroit and Wyandotte, the

company expecting to carry on considerable freight business through this point, which stands third among the cities of Michigan in point of freight shipments. The directors have ordered the road double tracked between Wyandotte and Monroe, a distance of 20 miles. At Toledo the line has physical connections with the Toledo Terminal Ry., so that its cars can be switched to any of the various railroads running out of Toledo.

DOUBLE TRACK CONSTRUCTION ON CURVES.

Power.

At the time of the organization of the new company, the power house of the Toledo & Monroe Railway, which is located at Monroe, Mich., contained in its engine room two 600-h. p. cross-compound condensing Hamilton-Corliss engines and two Babcock & Wilcox boilers of 400 h. p. nominal capacity, with Goubert steam separators and feed water heaters and Penberthy injectors. Directly connected to each engine was a 400-kw., 3-phase, rotary-field, 25-cycle Westinghouse generator, the current being generated at 380 volts and stepped up to 15,000 volts, at which pressure it was transmitted to the sub-station about 12 miles south of Monroe, equipped with two 200-kw. rotaries.

In order to provide power for the new section of the road one 400-kw. Westinghouse generator direct connected to a 16 and 36 by 42-in. Hamilton-Corliss engine was installed at the main power station at Monroe, and two new sub-stations, each with two 300-kw. rotaries, were built. The sub-stations are now four in number, located at Erie, South Rockwood, Ford City and one in the main station at Monroe.

STANDARD ROAD CROSSING SHELTER.

The equipment of the power station now comprises the two generating units mentioned, two exciter units, one motor driven and one direct connected engine driven. At the main station there are six transformers for stepping up out-going current to the sub-stations of the same size and voltage as those originally installed. The boiler equipment for the new unit was furnished by the Aultman-Taylor Co., and consists of one 400-h. p. Cahall boiler with Mansfield chain grate stoker and two Mansfield stokers, which will be installed under the two old boilers.

DOUBLE TRACK CONSTRUCTION.

The two new sub-stations are combination stations and passenger depot, the interior of the waiting room and ticket office being shown in the accompanying engraving. These are built of steel, brick and concrete, with tile roofing, and it is the intention of the company to beautify the surrounding grounds. The company also has a very handsome passenger waiting room in Detroit, while in Toledo the terminal is within easy access to the diverging steam and electric lines. One of the accompanying illustrations shows the type of standard shelter which has been erected at all road crossings.

Rolling Stock.

The original equipment of the Toledo & Monroe Railway consisted of five closed passenger cars, two open passenger cars and two combination passenger and baggage cars, built by the Jewett Car Co., of Newark, O. These cars are 42 ft. 4 in. long over all, the body being 33 ft. long, mounted on Peckham No. 26 double trucks and equipped with four Westinghouse No. 56 motors. To this equipment have been added eight passenger cars with smoking compartments, built by the John Stephenson Co., mounted on Peckham M. C. B. trucks and equipped with four Westinghouse 76 motors each; also two express cars.

CHARGING STORAGE AIR BRAKES.

Fare, Etc.

The rate of fare between Detroit and Toledo is [illegible] $1.50 for the round trip, while the round trip on the steam roads is $2.00. The length of time consumed between the two points is 2½ hours for the local cars and 2 hours for the limited cars. Of this time 24 minutes is required to make the 3½ miles in Toledo and 30 minutes to make the 5 miles in Detroit. The Short Line has a contract with the Detroit United Railway and the Toledo Railways & Light Co. under which it pays the former 5 cents per passenger, but is allowed mileage for the use of its cars, and pays the latter 3 cents per passenger. The time consumed on the steam roads is 1½ hours on limited trains and 2 hours 10 minutes by local trains.

W. B. TARKINGTON

The engineering and construction work on the Toledo & Monroe Railway was done by J. G. White & Co., while the contract for the work between Monroe and Detroit was let to the Detroit & Toledo Construction Co., of which C. J. Reilly was president, Charles R. Hannon, secretary and treasurer, and Matthew Slush was a director and was in active charge of the work.

The present officers of the Detroit, Monroe & Toledo Short Line Railway Co. are: President, Matthew Slush; vice-president, C. A. Black; secretary, Elisha H. Flynn; treasurer, Charles R. Hannon; manager and purchasing agent, W. B. Tarkington. The general offices of the company are at Monroe, Mich.

Track and Roadbed Construction and Maintenance, with Particular Reference to the Life and Chemical Preservation of Cross-Ties.*

BY THOS. B. McMATH, CIVIL ENGINEER INDIANAPOLIS TRACTION & TERMINAL CO.

As all present may know, the question of securing good ties is each year becoming more difficult, as timber becomes more scarce the quality offered in ties becomes poorer. Good white and burr oak ties are difficult to secure, and the attention of all railroads is called to the advisability of using treated timber. At present the most satisfactory treatment for prevention of decay in timber is its impregnation with creosote; the additional life of treated timber fully justifies the expense and it is possible to substitute a grade of timber utterly unsuited for ties, yet, which when treated, will show a life double that of the best untreated timber heretofore used.

Wood is composd of a great number of tubes firmly united and of varying sizes, the more open tubes being in what is commonly known as the sapwood; the older tubes are filled with various substances as resin, gum, etc. The sapwood is the living part of the tree, the tubes allowing a free passage of water, while the heart wood, due to changes, no longer allows such free passage of water.

Decay is caused by the entrance of living organisms, as insects, bacteria or fungi, and sapwood being more open, is the more readily attacked. The best conditions for the activities of destroying agents and growth exist in the presence of heat and moisture.

The treatment of timber consists in the introduction of substances poisonous to these destroying agents. Whatever it is must penetrate all parts of the timber and must remain there permanently. Experiments have been made with the creosoting process for about 40 years. Assuming that the results of the present creosoting will be as good as those obtained 20 years ago, we can assume that the life of a tie can be increased by treatment to 20 or 25 years.

Experiments have shown that the undesirable woods, such as red and black oak, owe their quick decay to the open and porous condition of their wood cells. Woods of this character are the ones in [illegible] well with the life of the treated white and burr oak timbers.

[illegible] pine ties that had been in service on street railway track for more [illegible] for about 18 years and still were in a good state of preservation.

Sap pine is the poorest and cheapest grade of lumber in the South on account of its open and porous nature, and is the most successfully treated. The writer was told that the treated ties cost about [illegible] for a 30-ft. pole. He has written to parties for definite prices on these ties and poles delivered in Indianapolis, but has not as yet received a reply.

Local creosoting works have quoted prices, but having an inflated idea of the value of their particular process, their prices correspond.

It is believed, however, that a good creosoted tie can be secured in Indianapolis for less than 65 cents, and that such a tie placed in track would last, under ordinary conditions, double the life of the ordinary white oak tie, especially white oak ties of the quality now obtainable.

The life of a creosoted sap pine pole, considering its greater strength over cedar, would strongly recommend its use.

The features in which track construction and maintenance in cities differ from ordinary steam and interurban railways are: first, the work must be such that no repair is necessary except at long intervals of time, and second, it must be such as to permit the ordinary types of street paving to be applied.

Deep rail sections must be used in order that ties may be low enough to permit the paving of the tracks; instead of using, as in railroad construction, the shallow rail and partly exposed ties, we use deep rails of from 6 in. to 9 in. laid on ties or without ties in combination with concrete, the rails being laid on blocks in trenches which are filled with concrete, forming a beam under and around the rail, the rails being held in position by the concrete beam with the aid of the street paving material. This type of construction has been in use for the past ten years.

In some cities this type of construction has been considered satisfactory, while in others it has been condemned. In Indianapolis we have several miles of track of 9-in. girder rail laid on concrete beam with ties spaced 12 ft. apart and paved with brick laid on a concrete base. This construction is inadequate for interurban traffic. The College Ave. line of this city was constructed with 7-in. T-rails on ties spaced 2 ft. between centers, ballasted with natural cement concrete, which concrete extends from 6 in. below the bottom of the tie to within 5 in. of the top of the rail. The street surface being vitrified brick, with nose brick forming the flange groove adjoining the rail; this construction has proved entirely satisfactory for interurban traffic.

The tracks built last season and now used by the interurban cars on Ohio St. and Capitol Ave., were built with 7-in. T-rails on ties spaced 12 ft. apart and resting on a concrete beam 24 in. wide and 20 in. in depth under each rail. Tie plates were used at intervals of 4 ft. and securely held by anchor bolts extending through the concrete. [This construction is shown in connection with the description of the Traction & Terminal Station, page 36.—Ed.]

It being a deduction of the writer from experience in concrete beam work, that track constructed in the old manner failed from lifting and that such anchorage in addition to holding the track in line and gage, would increase its stability by avoiding vertical movements. The use of the tie plate between the ties permitted the suspension of the anchor bolts in their proper position during the process of concreting, the track having previously been brought to surface and line by tamping the ties. The concrete used was made of the best grade of portland cement and had ample time to set.

The flange groove alongside of the rail was obtained by the use of a special nose block, much larger than the ordinary paving brick, this block being 5 in. wide, 4½ in. thick and 10 in. long, and the rest of the pavement being the ordinary paving brick. The special shape of this block permitted its being laid longitudinally directly upon a mortar bed on the concrete, strips of wood being used to fill the cavity under the head of the rail to prevent the special nose brick from coming in contact with the rail and to reduce the rumble of the passing cars. These wooden strips also act as a semi-elastic material

*Read before the Indiana Electric Railway Association, Indianapolis, Jan. 12, 1905.

[illegible] to the [illegible] the pavement between the rails.

Brick pavements do expand from temperature causes, and if rigidly held by the rail, the brick raises off the sand cushion to the detriment of the pavement, forming a sounding board which increases the noise.

The 7-in. T-rail now used in this city was especially designed for the heavy interurban car. All Shanghai rails previously rolled by the mills were too light in the web for such heavy loads, being designed for ordinary weights of city cars, and as city pavements required the rail to be six inches in height or over, the webs in use were extended in height but remained ⅜ in. in thickness.

As interurban cars use 3-in. tread wheel, it was considered advisable that the head of the new rail should be 2½ in., the web 9-16 in. thick, the rail 7 in. high and base 6 in. wide. This rail weighs 91 lb. to the yard. To the credit to those interested in the designing of this rail it may be said that a subsequent design of rail, for similar conditions, made by a committee from the American Street Railway Association, is very similar, the main difference being that the committee made the head of its rail 3 in. wide.

Perhaps the most trying feature of track maintenance in Indianapolis is the adjustments of gage on special work to fit it for wheels of all varieties. In this city are found all kinds of wheels from ⅝-in. flange and 2-in. tread up to the M. C. B. with 1⅛-in. flange and 4-in. tread. If the guard rail on a curve is placed with the proper width of groove for the big flange, the ⅝-in. flange wheel car never touches the guard rail unless the wheel on the other end of the axle is riding with its flange on the rail. On the other hand, if the guard rail is set with reference to the little flange, the big flange will ride up on top of the guard rail.

We have made it a practice on curves where rolled guard sections are used to gage curves 4 ft. 8⅜ in. and where we have been able to get this condition, we have had no derailment trouble, although the big wheels squeak and it takes power to send them around. Such places we keep well greased.

The outcome of this condition is that the interurban lines must be reasonable about their wheel flanges, and use a flange not over 1 in. deep by 1 5-16 in. thick, so that guard rail sections can be used, and then, all wheels on city cars should be made to conform. The saving in special work renewals would pay for changing all the wheels in two years; the addition of ½ in. on the width of tread of city car wheels, would immediately add 50 per cent to the life of every forg and switch in the track.

Steam railroad companies have standardized their equipment in order that their rolling stock may be interchangeable.

Mr. H. J. McGowan has taken an initial step in interurban railway development in erecting the Terminal station and building, in which we now meet, and in which station enter interurban cars from all parts of the state of Indiana. Arrangements have been perfected by which through buffet parlor cars from Ohió will also enter this station. Indiana has taken the initiative in providing elegant and commodious accommodations for interurban railway patrons.

This association should therefore lead in the work of standardizing all equipment and secure the co-operation of other similar organizations in fixing such standards. Standard car wheel flanges, width of tread, diameter of wheel and standard gage for pressing wheels should be adopted at the earliest possible moment, as cars of different lines are now frequently sent over connecting lines, and all city railroads over which interurban companies operate their cars are vitally interested. The difficulties arising from irregularities in any of the above-mentioned items cause the most disastrous results and, until this is done, special work cannot be intelligently ordered.

Tests of Brillium.

Harold P. Brown, 122 Liberty St., New York, sends data concerning recent tests made with "Brillium," with which he has been experimenting for the last two years.

The Testing Department of the Brooklyn Heights R. R. has recently made power-house tests with "Brillium." The fuel used was locomotive cinders from the Lackawanna railway such as are ordinarily used for ballast, with about 10.6 per cent of No. 3 buckwheat anthracite coal; 44 lb. of "Brillium" to the ton of cinders was used and the boiler was run at about 15 per cent above its rating, with air pressure of ¼ in. under the grate bars. The flue gas temperature averaged 504° and the carbonic acid gas ran from 8.6 to 12.2 per cent. A net evaporation of 6.12 lb. of water from and at 212° was obtained from each pound of fuel. The buckwheat coal by itself gives about 6.75 lb. evaporation.

A recent inspection of the boiler by the Fidelity & Casualty Company shows that it and the grate bars are in good condition after using this fuel for over eighteen months.

Some New Products of the Crane Company.

The Crane Co., of Chicago, which is well known as one of the most progressive concerns in the manufacturing of steam appliances, has recently introduced a number of new devices for which patents have been applied. Among these may be mentioned the improved renewable seat and disk globe and angle valves which are suitable for working pressures up to 250 lb. and are tested up to 700 lb. The renewable parts are made of hard composition, which it is claimed is far better and will last longer than those in the ordinary valves. They are designed specially for hard work where extreme pressure is used and where the wear and tear on the valve is severe. By unscrewing a nut on the bottom of this valve all the parts are accessible and removable from the top, thus making it convenient to substitute a new seat or disk and to replace any worn part. In assembling the valve the seat is replaced, the nut on the bottom tightened, thus holding the seat in place, then the bonnet is screwed on and the valve is ready for use. The Crane renewable seat and wedge straightway valves are another new type suitable for working pressures up to 250 lb. and are tested for 800 lb. pressure. The easy methods for inserting the renewable parts of these valves will recommend them to all users.

Crane self-packing globe, angle and radiator valves are made with Jenkins disk and non-rising stem and embody the very desirable feature of self-packing. Their use fully obviates the trouble and annoyance of escaping steam and water. In the Crane self-packing valves vulcanized rubber is introduced between the metallic parts which makes a perfect seat and completely overcomes the tendency to leak. The threads on the bonnet of the self-packing valves are the same as those in the Jenkins disk valve made by this company, and the old style trimmings may be replaced with the new self-packing device without removing the valve.

The Crane Co. is confident that these valves will meet all requirements, and guarantees them to give entire satisfaction.

A Large Contract.

The National Electric Co., of Milwaukee, Wis., has been awarded the contract for 700 air brakes to be installed under the new convertible cars of the Cleveland Electric Railway Co. Although many of the large cities throughout the country have all their cars equipped with air brakes the Cleveland Electric Railway Co. has placed the largest contract for individual air brake compressors that has ever been placed in this country. The decision was not arrived at until after over two years of experimenting with practically every known type of brake that is manufactured.

Of this order six carloads of the equipment have already been shipped; the balance will be shipped in the course of two months. Thirty cars will be required to load the apparatus to fill this order, not including the pipe and fittings, which will be purchased in Cleveland. An interesting fact that will illustrate the size of this order in comparison with an order for air brake apparatus for steam railway coaches is that 30 carloads of air brake material for steam coaches would mean about 3,000 steam railway equipments. Another item of interest to show the magnitude of the order is the fact that it will require 18½ miles of pipe to equip the cars, each requiring 140 ft. of miscellaneous size pipe, and 60,200 elbows, unions and fittings will be required for joining the pipes.

The compressor ordered is the National Electric Co's. type B-2, with a capacity of 20 cu. ft. of free air per minute. The reason for this large compressor is because the Cleveland Electric Railway Co. intends in the near future to adopt the trailer system during the summer months and rush hours. A new type of slide valve will be used with this equipment. The weight of the complete air brake equipment, including the compressor, is 1,100 lb., and the weight of the compressor is 725 lb.

Recent Street Railway Decisions.

EDITED BY E. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO

[The decisions which have been reported in the Legal Department of the "Street Railway Review" [illegible] Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. [illegible] Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901. Vol. IV from April, 1901, to April, [illegible] sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram, four volumes, $6.50, single volume, $2.00.]

WHEN RAILINGS OR GATES ARE REQUIRED ON CARS

Halverson vs. Seattle Electric Co. (Wash.), 77 Pac. Rep. 1058. Sep. 21, 1904.

It may not be negligence of railway companies, the supreme court of Washington says, to fail to provide railings or grates to prevent passengers from falling or being thrown from the cars, where they are run at the usual rate of speed upon straight or even tracks, where no such protections are usually required; but when an unusal or high rate of speed is maintained around curves, or over rough and uneven roads, then ordinary diligence requires such safeguards, even if they are not required by positive statute.

POWER TO GRANT USE OF STREETS BY ORDINANCE CANNOT BE EXERCISED BY RESOLUTION.

Holst vs. Savannah Electric Co. (U. S. C. C., Ga.) 131 Fed. Rep. 931. July 16, 1904.

Where it is expressly declared in the charter of a city that the control of the streets, paving street railways, and the like, must be by ordinance, the mayor and aldermen being given power and authority from time to time to make, ordain and establish such bylaws, ordinances, rules and regulations as shall appear to them requisite, etc., the United States circuit court, in Georgia, holds that a city street cannot be dedicated for street railway purposes by a mere resolution, over the protest of the property holders.

CONTRACT DISABLING CORPORATION FROM PERFORMING ITS FUNCTIONS, AS ONE WITH CITY TO DISCONTINUE UNPROFITABLE PART OF ROAD, WITHOUT CONSENT OF THE STATE, IS VOID AS AGAINST PUBLIC POLICY.

Thompson vs. Schenectady Railway Co. (U. S. C. C. A., N. Y.), 131 Fed. Rep. 577. Apr. 5, 1904.

An alleged agreement constituted by the action of a receiver in foreclosure proceedings, joined with certain property owners, petitioning the common council to consent to and authorize the discontinuance permanently of the running of cars upon a certain street, and a removal of the track therefrom, which the common council adopted a resolution consenting to, the so-called agreement being made in the supposed interests of the receiver and the parties to the foreclosure, and in order to lift the burden of maintaining an unprofitable part of the railroad, without the consent of the railroad commissioners or of the state to the agreement, the United States circuit court of appeals, second circuit, refuses to sanction or enforce. It says that the right to construct and operate a street railway is a franchise granted by the state upon considerations of the public welfare; and any contract which disables the corporation from performing its functions without the consent of the state, and made to relieve the corporation of the burden which it has assumed, is void as against public policy.

ONE COMPANY MAY BE ENJOINED FROM INTERFERING BY PHYSICAL FORCE TO PREVENT THE RUNNING UPON ITS TRACKS OF ALLEGED IMPROPER CARS BY ANOTHER COMPANY.

Schenectady Railway Co. vs. United Traction Co. (N. Y. Sup.), 89 N. Y. Supp. 931. July, 1904.

The defendant having granted to the plaintiff the right to run its cars over certain tracks, conditioned that it should not operate cars of such excessive weight and size, or propel them at such excessive rates of speed as would [illegible] and subject it to unusual difficulty or expense, it being stipulated that until another type of car might be agreed upon the plaintiff might operate cars forty-eight feet over all, to weigh not to exceed twenty-five tons when loaded, etc., the supreme court of New York, special term, Montgomery county, in continuing an injunction against the defendant during the action, restraining it from interfering by physical means to prevent the operation upon its tracks of certain cars, holds that the defendant had not the right to decide for itself the questions involved in this controversy, and to enforce compliance therewith by physical force; that it should have resorted to the courts for the protection of its rights and the justification of its claims.

REASONABLENESS OF RULE PROHIBITING CARRYING OF DOGS UPON CARS.

O'Gorman vs. New York & Queens County Railway Co. (N. Y. Sup.), 89 N. Y. Supp. 589. July 28, 1904.

A rule excluding all dogs from cars, the second appellate division of the supreme court of New York holds, is not unreasonable. It says that a rule cannot be regarded as unreasonable which tends to the comfort and safety of pasengers, and to the preservation of good order, which it is a duty of a carrier of passengers to be vigilant in seeking. It needs no argument to establish the fact that the indiscriminate carrying of dogs upon the street cars of a large city would be calculated to disturb the comfort and jeopardize the peace and security of the passengers. A rule which discriminated as to dogs would be practically unenforceable, as it would be impossible to expect passengers and conductors to agree as to which dogs should not be carried. Such a rule might well be regarded as unreasonable, as it would necessarily tend to favor one person's dog, while that of another would be rejected as unfit to travel with human passengers. The defendant, not being compelled by the law to carry dogs, could lawfully determine that it would carry none.

CORPORATION OF ONE STATE NOT COMPLYING WITH LAWS OF ANOTHER CANNOT MAINTAIN BILL IN FEDERAL COURT IN LATTER STATE TO GET USE OF BRIDGE BETWEEN THE STATES.

Evansville & H. Traction Co. vs. Henderson Bridge Co. (U. S. C. C., Ky.), 132 Fed. Rep. 402. Sep. 19, 1904.

The United States circuit court, in Kentucky, says that the complainant, an Indiana corporation, which may be described as being an interurban street railroad company, desiring to operate a road from Evansville, Ind., to Henderson, Ky., applied, among other things, for a perpetual injunction restraining the defendant from refusing to it the right to connect its tracks with the track of the defendant, both at the Kentucky and at the Indiana ends of the defendant's bridge over the Ohio river, and from refusing to complainant the right to equip said bridge with wiring and bonding appliances and necessary attachments for constructing, maintaining and operating an interurban street railroad, propelled by electricity, upon, over, and across the defendant's bridge, approaches, and tracks. But the court holds that a demurrer to the complamant's bill must be sustained upon the ground that the bill could not be maintained because, stated briefly, it did not aver nor show that the complainant had complied with the requirements of the constitution and statutes of Kentucky, that foreign railroad corporations must incorporate in that state to be entitled to the benefit of the right of eminent domain, etc

REASONABLE TRANSFER REQUIREMENTS.

Hornesby vs. Georgia Railway & Electric Co. (Ga.), 48 S. E. Rep. [illegible] 1904.

Where a street railroad company voluntarily permits passengers to transfer from one of its cars to another and continue their journey without the payment of additional fare, the supreme court of Georgia holds that it is reasonable to require, as a condition precedent to the exercise of this right, that the passenger shall tender the conductor of the second car a printed transfer check, which [illegible] within a time indicated by punch marks on the check, provided a car upon which the passenger can be conveniently and comfortably transported passes the transfer point within the time so limited. A person who fails to comply with such requirement, and who refuses to pay fare, cannot recover for an expulsion from the car, when he does not show that his failure to have a valid transfer check was due to the fault of some employe of the company having authority in such matters.

It follows that no recovery can be had where the initial car does not reach the transfer point until after the time indicated by the punch marks on the check, and the passenger voluntarily leaves the car before it reaches such point, and make an unsuccessful attempt to walk to the transfer point before the time limit expires. In such a case it is the duty of the passenger to remain on the car, and give the conductor an opportunity to make arrangements for his transportation on the transfer car; and this is true even though it is the custom of the company not to issue new transfer checks where the initial car is delayed.

NO LIABILITY FOR INJURY TO PASSENGER STRUCK IN EYE BY TICKET PUNCH FALLING OUT OF CONDUCTOR'S POCKET—NO DUTY TO GUARD AGAINST CASUALTIES WHICH CANNOT BE REASONABLY ANTICIPATED.

Cheyne vs. Van Brunt Street & Erie Basin Railroad Co. (N. Y. Supp.) 626. July 28, 1904.

As an electric car on which the plaintiff was a passenger was about to turn a corner the trolley pole came off the wire, and the conductor, who had been standing in the front of the car, with the door open, rushed back through the car to the rear platform. Something struck the plaintiff in the eye as the conductor passed, which it was a fair inference was the conductor's ticket punch, which the plaintiff had previously seen in the conductor's outside pocket, and which the conductor returned and picked up after adjusting the pole. But while the occurrence was most lamentable, in view of its serious consequences to the injured pasesnger, the second appellate division of the supreme court of New York says that it does not perceive any ground upon which the defendant company could be held liable. Neither a common carrier nor any other party upon whom the law imposes the exercise of care in the discharge of duty is under a legal obligation to take precautions to guard against casualties which cannot reasonably be anticipated or foreseen. If its officers and agents had no reason to apprehend a peril of this nature, it could not be said that the corporation was guilty of negligence in failing to provide any safeguard against it. It was suggested that the conductor's ticket punch should have been safely secured in some manner; but, even if this had been done, it would have had to be held by a chain or cord sufficiently long for the conductor to use it, and it was not apparent that a fastening of this character would have prevented the accident.

LIMIT TO CONDITIONS WHICH MAY BE IMPOSED BY A COMMISSIONER OF PARKS WHERE A COMPANY HAS A VESTED RIGHT TO CROSS A PARKWAY.

People vs. Kennedy (N. Y. Sup.), 89 N. Y. Supp. 603. July 28, 1904.

The Brooklyn Heights Railroad Company having a vested right to construct its lines to the city limits along Kingston avenue, which right antedated the construction of what was called the Eastern Parkway, which was a parked street or boulevard, the second appellate division of the supreme court of New York says that it must be assumed that the legislation giving control of this parkway to the park department was made subject to the rights which were then in existence, and that it did not confer any authority upon the commissioner of parks to make any restrictions upon the method of operating the street surface railroads which should cross such parkway. The commissioner, as a condition of his consent, could undoubtedly require any reasonable compliance with his suggestions as to the location and construction of the tracks. He might very properly specify the kind of paving which should be laid, and might make suitable regulations in reference to any matters connected with the location or construction of the tracks; but here his discretion ended. He could not go beyond this, and determine how the corporation should discharge its duties to the public in the operation of its lines. That was a matter wholly outside of the scope of the office of a commissioner of parks. Here the company had a vested right to continue its lines across the Eastern Parkway, subject to such reasonable rules and regulations in respect to the location of the tracks, etc., as should be prescribed by the local authorities having charge of such parkway; but when the parkway was reached and an application was made to cross it that was granted coupled with a condition that "no motor cars nor any other cars or conveyances except those used for express, repairs, construction, and conveyance of passengers and material now in ordinary use shall be permitted, and that all cars shall cross the track singly, except where an accident has occurred making it impossible for a car to be conveyed singly; the intent being to forever prohibit the use of trains operated by steam, electricity, or any other power." The court holds that a peremptory writ of mandamus was properly granted, on the relation of a corporation interested in certain real estate and desiring to have the lines constructed across the parkway, to compel the granting of a permit therefor, without such condition.

RIGHTS AND DUTIES OF COMPANY — RIGHT TO RUN CARS SINGLY OR IN TRAINS—DUTY TO PERSONS DRIVING OUT FROM YARDS—DUTY AS TO SPEED, CONTROL, WATCHFULNESS DEPENDENT UPON CONDITIONS—DUTY TO TRY TO PREVENT COLLISIONS.

Butler vs. Rockland, Thomaston & Camden Street Railway (Me.), 58 Atl. Rep. 775. July 26, 1904.

A street railway company, the supreme judicial court of Maine holds, has the lawful right to operate its railway in the location where it has been placed, and run its car singly or in trains upon the track; but it is its duty to do so, having due regard to the safety, not only of travelers upon the street, but of those who have occasion to cross the tracks in driving out from the yards of houses situated along the railway.

The speed at which a car or train may properly be run, the kind of control over it, and the degree of watchfulness imposed upon those in charge must depend to some extent upon the surrounding conditions, such as the nearness of the track to the side of the street and to the houses, the likelihood of persons driving out from the yards, and whether the driveways are so situated that persons driving out over them can see or learn of the approach of cars in season, with due care to avoid collision. The railway company and its servants have a right to assume that all such persons will themselves be in the exercise of ordinary care.

It is the duty of a street railway company at all times to use due care in view of apparent dangers, and those which may reasonably be expected, so to regulate the speed of its cars, so to have them under control, and so to be on the lookout for a team about to cross that those in the teams, if they themselves are in the exercise of due care, shall not be put in jeopardy.

The person in charge of the car must exercise due care and judgment, and the movements of the car must be regulated with reference to the apparent situation. If it be apparent that a collision is likely to occur, it is the duty of the servant in control of the car to be ready to use, and to use, if necessary, and when necessary, all practicable means to prevent it.

AFTER-ACQUIRED PROPERTY AND RIGHTS UNDER LEASES EMBRACED IN LIEN OF MORTGAGE.

Guaranty Trust Co. of New York vs. Atlantic Coast Electric Railroad Co. (U. S. C. C., N. J.), 132 Fed. Rep. 68. Aug. 22, 1904.

A mortgage given by the defendant railroad company recited the form of the bonds secured by it, which declared that the bonds were secured by a mortgage upon "all the certain railroad and other property, real and personal, and franchises of said railroad company, whether now owned or hereafter acquired by it." The con-

veyance clauses of the mortgage limited its lien upon after acquired property to such property, and to such rights acquired by lease from other railroad companies, as should be "connected with or appurtenant to" the railroad of the defendant company specifically described in the mortgage.

The United States circuit court, in New Jersey, holds (1) That the lien of the mortgage embraced rights acquired by leases made after the date of the mortgage to the defendant company by other railroad companies owning railroads connected with the defendant's railroad, and being operated by the defendant company in connection with its own railroad and as a part of its railway system. (2) That its lien also embraced the capital stock of, and a lease acquired from, a new corporation, such new corporation having been created for the mere purpose of subserving the interests of the defendant corporation, which had paid for all the property conveyed to the new corporation, and assumed all its obligations, and the new corporation having issued to the defendant company all its capital stock and executed to the defendant company a lease upon all its property for the term of 99 years, the existence of the new corporation being limited by law to 100 years, and the railroad of the new corporation being operated by the defendant company in connection with its own railroad and as a part of its railway system. (3) That its lien also embraced a line of railroad constructed by the defendant company which was operated by the defendant company, in connection with its own railroad and the railroads on which it had secured leases, as a single railway system. (4) That its lien did not embrace a hotel property which did not appear to be in anywise connected with the operation of its railway system.

VALIDITY OF CONTRACTS WITH STEAM RAILROAD COMPANY WITH REGARD TO BRIDGE AND NOT TO REDUCE FARES.

Raritan River Railroad Co. vs. Middlesex & Somerset Traction Co. (N. J.), 58 Atl. Rep. 332.

A railroad company, incorporated under the general railroad law of New Jersey of 1873, was maintaining certain bridges whereby the highway was carried over its tracks at an elevation; the duty to maintain the bridges being imposed upon the railroad company in behalf of the public by statute. A traction company proposed to construct a line of tracks along the highway, and to that end desired to strengthen and reinforce the bridges, so that they would sustain the increased weight of traffic placed upon them by reason of the maintenance and operation of the traction road. By agreement between the railroad company and the traction company, the former gave consent that the latter might strengthen and reinforce the bridges, and the parties agreed thereafter to share equally the cost of their maintenance and repair; the traction company being given the right to repair the bridges on default of the railroad company to do so, and the railroad company agreeing to pay one-half the cost thereby incurred. The court of errors and appeals of New Jersey holds that this consent and agreement of the railroad company furnished a valuable consideration to support reciprocal covenants on the part of the traction company. It further holds that an agreement made between a railroad company and a traction company, whereby the former gives consent that the latter may construct a traction road across the line of the railroad at grade, and settling as between these parties the mode of crossing, is not void because made without application to the chancellor to define the mode of crossing under the statute.

The court says that it was not necessary to question whether the continuing obligation of the railroad company to keep up the bridges in accordance with the growing demands of travel extended to their reinforcement and maintenance under the extraordinary weight of trolley tracks and roadbed and the operation of trolley cars. Assuming that to be so, the traction company was still (in the absence of agreement of the railroad company) left in the situation of a member of the general public having a great practical interest in the proper performance of this public duty by the railroad company, but without direct means of its own to specifically enforce such performance, and without redress for non-performance unless it should be specially damnified. Under these circumstances, an agreement settling as between these parties that they would equally bear the expense of maintaining the improved bridges, and giving to the traction company the right to do the repairs and charge one-half the cost to the railroad, [illegible] the parties about the matter, and had such value to the traction company [illegible]

An agreement, [illegible] tor, that during a limited period the former company "will not reduce its present rates of fare, unless required by law," the court holds, is not contrary to public policy as established in New Jersey.

A PRACTICALLY NEW ROAD CANNOT BE CONSTRUCTED AS AN EXTENSION WITHOUT THE CERTIFICATE OF THE RAILROAD COMMISSIONERS—HOW STATUTE SHOULD BE CONSTRUED.

New York Central & Hudson River Railroad Co. vs. Buffalo & Williamsville Electric Railway Co. (N. Y. Sup.), 89 N. Y. Supp. 418. July 6, 1904.

In construing a statute with the wide scope of one requiring the certificate of the board of railroad commissioners to precede the construction of a railroad, the fourth appellate division of the supreme court of New York says that a practical and sensible interpretation, rather than a metaphysically literal one, should be given to it. The privilege accorded to a street surface railroad company "to extend its road or construct branches" thereof without application to the board of railroad commissioners must be reasonably construed, having in view the general policy of the state which submits to that body the determination of the necessity of the new road. If the branch proposed to be added to the main trunk will in fact be the corpus itself, if the contemplated extension really will compose the main body, then it will be a parody on the statute to permit the branch or extension to be added without the permission of the railroad commissioners. A company organized to construct and which is operating a street railroad a mile in length ought not to be permitted to add 100 miles, without the consent of the railroad commissioners, on the pretext that the construction is a mere extension of the main line. The term "extension" conveys to the mind an enlargement of the main body, the addition of something of less import than that to which it is attached.

As to the suggestion that the defendant could accomplish its purpose by adding a few miles of the road each year, the court answers that that may be true. No exact rule, like the rate of interest, may be laid down applicable to every case. A proposed improvement in one instance may be clearly construed an extension, and in another it may be equally clear that the extension is intended, in effect, to be a new road. The court appreciates that it often may be very difficult to determine whether a contemplated addition to an existing road is an extension within the scope of the statute or a new road, thus requiring the preliminary certificate of the board of railroad commissioners. Unless there is additional legislation defining what constitutes an extension, the courts must dispose of each case as it is presented on its own merit. In that disposition the policy of the legislature to vest in one tribunal the authority to determine as to the propriety of constructing a road will be a pregnant circumstance; that is, the legislature, in its wisdom having vested a board with this power, the courts, in their decisions, should proceed as far as possible in harmony with the legislative intent, especially as the tendency is to enlarge, rather than to restrict, the powers of that body.

A COMPANY LIABLE FOR INJURIES FROM NON-REPAIR OF PAVEMENT CANNOT BE CHARGED WITH COST OF AGREEMENT WITH CITY FOR REPAIRS IN CONTRACT FOR PAVING.

Fair Haven & Westville Railroad Co. vs. City of New Haven (Conn.), 58 Atl. Rep. 703. Aug. 12, 1904.

This was an application for relief from an assessment against the company for the cost of certain asphalt paving. The supreme court of errors of Connecticut says that the city paid to the contractor a certain sum per square yard for laying the pavement and agreeing to keep it in repair for 10 years, said agreement being secured by a bond to the city. The award of the trial court was based upon this sum. It was clear, therefore, that an amount was included which represented cost of repair.

On the question of the propriety of this inclusion, the court says

[illegible] situation where pavements are laid with a guaranty, as here. It purports to amend the act of 1895 so that not only the cost of laying a pavement, but of an agreement to keep it in repair for a period not exceeding 15 years, might be considered in determining the cost of each square yard which the city might collect of the persons and railroad companies, as provided in said last-named act, which was the act under which the present charge was made against the company. If the necessary effect of the execution of the act of 1897 was to impose upon a street railroad company standing in the position which the plaintiff occupied a double burden, arising out of the duty cast by law upon it to keep in repair the specified portion of the highway through which it operated its lines, or if, in the application of the act to the circumstances of the present case, such became its effect, it was plain that the action of the court could not be supported. It was unnecessary to inquire whether conditions might not exist or be created under which the act might operate not only justly, but also favorably, to all parties, and in violation of no constitutional prohibition.

The plaintiff before the statute of 1897 was under the statutory duty of keeping in repair so much of every highway in which its tracks were laid as was included within them, and a space of two feet on the outer side of the outer rails thereof. The space thus specified corresponded substantially with that for the paving of which the present judgment required the plaintiff to pay the city. Liability for all damages resulting from injuries caused by the failure of the plaintiff in its duty to repair was also imposed upon it. This duty and liability have never been removed by express legislation. The act of 1897 contains no provision for such removal, or a conditional or qualified removal. In the absence of any express provision to that effect, it can scarcely be presumed that the legislature intended that a resort by the city to the course of action authorized by the act should, with respect to the particular piece of highway involved, operate to shift the burden of duty, and consequently of liability, from railroad to city, with all the resulting confusion to the parties and the public with regard to matters of frequently grave concern.

In the present case we find the company, which remains under the duty of maintaining the highway in repair, and the liability for the results of non-repair, called upon to pay the cost of an agreement on the part of a third party to do a certain share of the repairs involved in the statutory duty for a specified term. To this agreement it was not a party. The bond given to secure performance of the agreement did not run to it. Surely there was left upon it, from the point of view of legal rights, some share of the burden which it had been compelled to pay others to assume. Wherefore the cause was remanded for a deduction from the amount of the assessment confirmed and established by the judgment of the court below of the cost to the defendant of the agreement to repair, in so far as said cost related to the pavement for which the plaintiff was charged in said judgment.

INJURY TO INTENDING PASSENGER BY FALL OF TROLLEY POLE AND CAR SIGN—CARE OWED TO PERSON APPROACHING CAR TO BECOME A PASSENGER—WHEN ONE BECOMES A PASSENGER — NEITHER ONE WHO HAS JUST ALIGHTED FROM, OR IS ABOUT TO BOARD, A CAR HAS THE RIGHTS OF A PASSENGER.

Duchemin vs. Boston Elevated Railway Co. (Mass.), 71 N. E. Rep. 780. Sep. 7, 1904.

The turning point of this case was the question whether a foot traveler on the highway, who is approaching a street car stopped to receive him as a passenger, and before he actually has reached the car, is entitled to the rights of a passenger in respect of that extraordinary degree of care due to passengers from common carriers of passengers, at least so far as any defect in that car is concerned. In other words, the question was whether the jury should have been instructed that the defendant owed to the plaintiff (who was injured by the fall of a trolley pole and car sign) the same high degree of care while he was approaching the car, and had not yet reached it, that it would owe to a passenger.

It is apparent, the supreme judicial court of Massachusetts says, that a person in such a situation is not in fact a passenger. He has not entered upon the premises of the carrier, as has a person who has gone upon the grounds of a steam railroad for the purpose of taking a train. He is upon a public highway, where he has a clear right to be independently of his intention to become a passenger. He has as yet done nothing which enables the carrier to demand of him a fare, or in any way to control his actions. He is at liberty to advance or recede. He may change his mind, and not become a passenger. Certainly the carrier owes him no other duty to keep the pavement smooth, or the street clear of obstructions to his progress, than it owes to all other travelers on the highway. It is under no obligations to see that he is not assaulted, or run into by vehicles or travelers, or not insulted or otherwise mistreated by other persons present.

Nor does the court think that as to such a person, who has not yet reached the car, there is any other duty, as to the car itself, than that which the carrier owes to all persons lawfully upon the street. There is no sound distinction as to the diligence due from the carrier between the case of a person who has just dismounted from a street car and that of one who is about to take the car, but has not yet reached it. In the case of each the only logical test to determine the degree of care which the person is entitled to have exercised by the street railway company is whether the person actually is a passenger, or is a mere traveler on the highway. The court thinks that a present intention of becoming a passenger as soon as he can reach the car neither makes the person who is approaching the car with that intention a passenger, nor changes as to him the degree of care to be exercised in respect of its cars as vehicles to be used upon a public way with due regard to the use of the same way by others. The defendant incurs no responsibility to exercise extraordinary diligence by making an express contract, but only by its exercise of the calling of a common carrier; and its obligation as such does not arise until the intending passenger is within its control.

The court is unwilling to go farther than the doctrine stated in Davey vs. Greenfield Street Railway Co., 177 Mass. 106,. 58 N. E. 172, that, when there has been an invitation on the part of the carrier by stopping for the reception of a passenger, any person actually taking hold of the car and beginning to enter it is a passenger. And the court holds that if the instructions allowed the jury to find for the plaintiff only in case the car had reached a usual stopping place, and had stopped to receive him, there was error in ruling that under those circumstances, and before he had actually reached the car, he had a right to have the defendant exercise as to him that extraordinary degree of care due to passengers. So long as he remained a mere traveler on the highway, although walking upon it for the sole purpose of taking the car, the defendant did not owe him any other duty than that which it owed to any person on the highway. Whether one just has dismounted from a street car, or just is about to board one, he does not have the rights of a passenger.

DUTY TO AVOID FRIGHTENING ANIMALS—NOT REQUIRED BY STATUE TO STOP CARS AT RAILROAD CROSSINGS.

Georgia Railway & Electric Co. vs. Joiner (Ga.), 48 S. E. Rep. 336. Aug. 11, 1904.

It is the duty of a street railway company, in operating its cars along a public road, the supreme court of Georgia holds, not to interfere with the rights of individuals using such road by other modes of travel, by making unusual and unnecessary noises, such as are likely to frighten animals along such road; and for damages resulting from a breach of such duty the company is liable.

Section 2234 of the Civil Code of Georgia of 1895 providing that "all engine-drivers and conductors must cause the trains which they respectively drive and conduct to come to a full stop within fifty feet of the place of crossing," where the tracks of separate and independent railroads cross each other, does not apply to a street railway, so as to compel it to stop its cars before crossing a steam railroad track.

The Brooklyn Rapid Transit Co. is planning to purchase a large tract of land near its West End terminal at Coney Island, on which it will build sidings to receive sufficient cars to comfortably accommodate the great crowds carried to that resort.

December Meeting New England Street Railway Club.

The regular monthly meeting of the New England Street Railway Club was held on the evening of December 20th, at Pierce Hall, Copley Sq., Boston, with President Neal in the chair. After the general business of the evening had been disposed of, the members of the club were addressed by Mr. Victor Angerer, vice-president and general manager of Wm. Wharton, jr., & Co., Inc., Philadelphia, on the subject of Special Track Work. The lecture was illustrated by many lantern slides and was received with much interest by those in attendance, among whom were a number of members of the New England Railroad Club.

Mr. Angerer stated at the beginning of his address that he had had some doubts as to the interest of frogs and switches as the subject of an address prior to the October meeting of the club, but that these doubts had been dispelled by the papers read at that time on the general subject of track. (These papers were abstracted in our November issue.) He said that the term "special work" is of comparatively recent origin in railway circles, and that he could not trace it back more than ten years. In steam railroad work the term "Specials" was used in reference to switches and frogs as distinguished from "Standards," but today this term "Special Work" is quite generally understood and used by railway men, although it has not as yet been accepted by either Webster's or the Century Dictionary. Mr. Angerer advised the use of the term "Special Track Work" as being more definite, even at the sacrifice of the time required to speak or write the additional word.

Throwing a picture of a horse car upon the screen, the speaker stated that if street railway men still had to deal with the "corn fed" motor, curves and switches would indeed form an unimportant part of their systems. It would not be necessary to dwell at length upon the special track work of those days. Mr. Gilbert Hodges has told the club how the curves were made out of short cast-iron sections, and how these were improved 32 years ago by Wm. Wharton, Jr's., rolled and cold bent grooved rails made of Bessemer steel. In New England these grooved or guard rails were generally used on the inside of curves only, to guide the cars, and a flat steel bar was used on the outside rail, on which the outer wheels of the cars traveled on their flanges. The switches, frogs and crossings were made of cast-iron, and a little later, by some manufacturers, of chilled cast-iron of a thickness of 2½ to 3 inches, and spiked to wooden stringers, the entire construction being very simple. It gave what was considered excellent and long service in those days. Mr. Angerer then showed a piece of flat curved rail which was in service 19 years in quite an important place in New Orleans. The manager of those days did not have to worry about the rail at all, and the track boss only very little. When the cars ran off the track somewhat too frequently at curves all the latter official had to do was to put in a few additional spikes to hold the rails down and to gage. Renewals were easily and cheaply made. Mr. Angerer said that he was not sure that if it were not for the difficulty of holding up the joints and the tendency of the wooden stringer to rot, many of the audience would not wish, for this feature of easy renewal, to go back to some modified form of this flat rail system, with probably only some better metal than cast-iron in the frogs and switches. In fact, the flat rail system itself has not entirely died out at the present day, and there are still a number of samples of special track work of this kind in American electric car service. In the old days, even in the public streets, and especially at terminals, special track work was often supplanted by other mechanisms, such as transfer tables and turntables. A slide was then shown of this sort of construction, followed by a photograph of a car which contained such a piece of special track work in itself. The car body was mounted on a truck, on which the car could be completely turned around.

The drawbacks of the flat rail system led to the introduction of the girder rail, and in 1877 the first rail of this kind laid in this country was put down in San Francisco. In the early 80's the Johnson Steel Street Rail Co. made a specialty of rolling girder rails for street railways. It was soon followed by the North Branch Steel Co., controlled by Wm. Wharton, jr., & Co., Inc.

Girder rails with and without a base were then put into use, generally mounted [illegible] wooden cross ties, or on the cable railways, which then were largely introduced into the principal cities of the country, mounted directly on the [illegible] from rolled rails corresponding in general form to the girder rails used in the straight track, but provided with a guard to guide the car wheels—in short, "girder guard rails." They were also mounted on chairs.

Switches, frogs and crossings were of three distinctive kinds: First, the old cast-iron or chilled cast-iron work, modified to be set directly upon the cross ties without the interposition of the wooden stringer, and provided with brackets or pockets on the ends to receive the adjoining girder rails. Second, work similar in construction, but lighter, made of cast-steel or mitis steel. Third, work built up of pieces of girder rail, planed and shaped to suit, and then riveted or bolted together, following out the idea of adapting to street railway track the practice of steam railroads in the construction of frogs and crossings out of pieces of rail bolted together. The first kind continued in favor for some time. The surface of the chilled cast-iron was harder than the other two kinds, only the joints were not in keeping with the rest. The second kind, especially in those days, proved too soft or too porous to warrant the greater cost. In the third kind, the built-up work, one great objection was that the bolts and rivets became loose, and not being accessible as in steam railroad track to receive constant attention and tightening up, but being buried in the pavement of city streets, could not get the proverbial "stitch in time," so that the work under the action of team traffic and the light street car traffic shook apart before being worn out. The cable railways and then the early electric roads soon demonstrated that something far better was wanted.

In straight track the question was met by heavier and higher girder rails, up to 9 in. in height, which could be put down without chairs, with longer joint plates and some patent joints that were fairly satisfactory. For the curves, guard rails of similar general outline were soon provided, in some cases taking the same joints as the straight track girder rails. The problem of switch, frog and crossing construction was solved for the time being by several different types of work: First, steel castings made as nearly as possible to join up to the rolled rails, somewhat improved in quality, but still softer and more porous than the rolled rail. Second, steel castings with pieces of the rolled rail electrically welded to the ends, to overcome the objectionable inaccurate fit of the joint plates on the ends of the first kind, and also to reduce the number of joints in a given layout. Third, chilled cast iron, with rolled rails cast into the ends, with the joints, and therefore as good as the rest of the track, but while hard the construction was too brittle. Fourth, rolled rails planed and fitted similarly to the built up work, but instead of being bolted or riveted, they were united by molten iron being run through and around the rails, eliminating the disadvantage of the bolted work, and at the same time giving the same metal, i. e., rolled steel rail, on all surfaces throughout the special track work. Fifth, a combination of cast iron and rolled rails somewhat similar to the fourth kind described but with the cast iron in some parts exposed to wear. Some of these types are still used in places where the traffic is so light that it does not warrant putting down a more expensive kind of work, but all these forms have one common point of weakness. The parts which receive the greatest wear, where the same surface has to bear the traffic of more than one line, or where a narrower surface than the width of the wheel tread has to support the weight of the car, naturally wear down much faster than the rest of the work, and when the wear at these points becomes objectionable, the entire piece has to be removed and replaced. This weakness is inherent in all frogs, including steam railroad frogs built up of ordinary rails, but it is immensely accentuated on street railways by the narrower wheel treads which the companies are compelled to use. The width of the wheel tread cannot be wider than the head of the rails, with-

out danger of striking projecting paving stones on the outside of the rails, and the width of the raid head is again in many cities restricted by ordinance, mostly dating back to the old horse car times. This width of tread is in most cases insufficient to span the groove of an intersecting track at the point of a frog, or of the main track in branching off at the point of a mate. It therefore has always been considered almost necessary in street railway work to provide at intersecting grooves a riser or flange bearing. In this construction the groove is filled up at its bottom so that the flange of the wheel will bear on this filler, and the wheel runs on its flange, where it theoretically loses its tread bearing. In castings the metal of the casting itself is carried up; in built-up work separate pieces of metal are inserted, or the work constructed from specially rolled rails with shallow grooves. But the surface of a wheel flange presents a cutting edge rather than a bearing surface, and consequently these insets in work of this kind are soon cut down, and then the wheels commence to pound and quickly destroy the parts where they have such an insufficient bearing, or where they have to jump across the space of the intersecting grooves.

The attempt to protect these parts led to what has been known for the past ten years as "hard center work," and from that time dates the battle royal between the special track work on one side and the wheels, increasing weight of cars and frequency of traffic on the other side, almost like the battle between armor plate and the gun, projectiles and new explosive substances in somewhat less peaceful pursuits.

Two principal ideas were followed in working up this problem. The one was to provide a separate comparatively small piece or plate, commonly termed the "center," at these points of greatest wear, which, when worn out, could be easily renewed without disturbing the rest of the work. Incidentally, these centers were made of a somewhat harder metal than the surrounding parts. The other idea was to provide a metal in these centers which would so much better resist wear that the parts made of this metal would remain serviceable as long as the surrounding parts made out of the usual Bessemer rail. Various metals were tried, and a multitude of methods of fastening the centers into the pieces were designed and placed in use.

In one case the body of a frog was made of cast steel, with a recess in the center, into which was set a plate of Harveyized steel, with the grooves planed out before Harveyizing; the sides of the recess being undercut, and the sides of the plate beveled or provided with projections, zinc or similar metal being run into the space between the plates and the recess, forming a key to retain the plate in place. The plate could be removed by chipping or melting out this zinc key. The body of this frog was sometimes made of cast iron instead of cast steel, with rails cast in the ends in conformity with the method described in the earlier girder rail special work without hard centers. The zinc key has since been supplanted by various holding devices, such as wedges, or other keepers. Another method consisted simply in bolting down the plates. A further scheme now practiced, is to cast plates of chrome steel with projections, so that a round cylinder of zinc or other soft metal will interlock between these projections and the body of the piece, the idea being that this round cylinder of soft metal can be drilled out, the lock thereby destroyed and the plate lifted.

Another idea is represented by a frog in which the center consists of a piece of Tungsten steel, i. e., self-hardening tool steel. This steel is placed in the mold in the foundry and the cast steel forming the frog or other special piece is cast around it. In cooling and shrinking it secures the center permanently in the structure. This of course can be done only with a metal like self-hardening tool steel, which does not lose its hardness with the heating which it receives in the mold.

Another method is to produce a frog or other special piece with a recess for the reception of the center, carefully machine both, and then, by heating the main body, expand the recess, insert the center and let the main body shrink onto the center similarly to the manner in which a wheel tire is shrunk upon a wheel. It is self-evident that the metal in the center must be machinable, and susceptible of hardening afterward like the ordinary tool steel.

A method, in which incidentally, there is a possibility of the renewal of the center, but which really belongs to the second category, consists of a cast center of manganese steel, provided with lugs which project through the main body of the piece, and by which the center is securely anchored down by means of heavy keys or wedges driven through openings in the sides of the body. A bed of zinc is interposed between the center and the main body to insure a solid bearing throughout. The body of the piece is made of cast-iron or cast-steel, with rails cast in the ends. The renewal of the plates necessitates the removal of a few paving blocks, to get at the openings in the sides in order to drive out the keys. After the zinc is partially melted out, but as it is the intention that such renewal should only be necessary in case of accident to the center or development of a hidden defect in it, this does not present any serious difficulty. In a recent modification of this type of work, large bolts and nuts are employed to hold the center down, instead of nuts and keys. These bolts and nuts are entirely surrounded by the zinc, which also forms the bed, in order to keep them from turning and rusting. Should the renewal of these centers become necessary, it can be accomplished without the removal of any paving blocks, by melting or chipping out the bolt heads, and unscrewing them with a socket wrench.

Still another method of protecting the points of greatest wear without the use of a separate center is found in locally Harveyizing the surface of these parts in ordinary steel castings which constitute the pieces.

Mr. Angerer then exhibited several specimens of the various metals employed for centers. The first was a piece of Harveyized steel center. Harveyizing is a case hardening process of ordinary steel, in which, however, the hardness is carried to some depth below the surface. The line of demarcation visible on the sample shows that the hardness penetrated to a depth of about ⅛ in. The surface is quite hard, so that a drill will hardly touch it, but right below the line it is quite soft. It can easily be drilled below the thin, hard shell. The sample showed cracks and a flaking tendency of this brittle shell, where it was struck by the blow that broke it. The second sample was a piece of chrome steel, in the natural casting as used in centers. It is rather soft throughout, and the sample was quite porous. A forged piece of the same metal showed greater density, but it was not unduly hard, at the same time showing considerable strength and being rather brittle. The third sample was a piece of tungsten steel, which is known to machinists as self-hardening tool steel. It is susceptible of being made exceedingly hard, so that an ordinary drill will not touch it. It is very brittle and sensitive to shock. Mr. Angerer easily broke a piece of this metal with a small hammer to illustrate this point. The fourth sample was regular carbon tool steel. This can be hardened to withstand the drill, but it becomes more brittle as the hardening proceeds, and in the large, irregular mass of a center does not seem to lend itself well to thorough and uniform hardening. Fifth, nickel steel was shown. The speaker stated that nickel steel had not, to his knowledge, been used to any extent in centers for street railway special work, although it has been used in rails. It is known for its great strength, but is also brittle and not as hard as would be supposed. It can be drilled quite easily.

The sixth and last sample shown was of manganese steel. The October meeting of the club brought out many interesting points in connection with this steel in service, through Mr. Steward's paper on the maintenance of elevated track in Boston. Mr. Angerer said that he hoped it was with pardonable pride that he made the statement that the company with which he is connected, after many experiments, first realized the merits of manganese steel for track purposes, although others had also experimented with it. When properly treated manganese steel is generally recognized as the best known metal for the purposes described.

Manganese steel was invented, or discovered, by Mr. R. A. Hadfield, the great iron master of Sheffield, England. He confided his patent rights and processes for use in the United States to the Taylor Iron & Steel Co. of High Bridge, N. J., from which Wm. Wharton, jr., & Co., Inc., acquired the right for the use of manganese steel in track work. Mr. Hadfield discovered that an alloy of over 6 per cent and less than 20 per cent of manganese possessed the remarkable property that while already very hard, when heated to a high temperature and suddenly cooled by plunging in water, it, in exact reverse to the action of the usual hard steels, became more ductile, and tougher, without losing its inherent relative degree of hardness. This combination of hardness and toughness, when in proper relation, produces its great wearing qualities. Incidentally, manganese steel of the composition mentioned is non-magnetic, by which property it can easily be recognized, as practically all other alloys are magnetic. Mr. Hadfield's first patent covered an alloy

with the percentage of manganese stated. This patent expired a couple of years ago, and the production of an alloy of this description is public property. It has consequently been used by a number of different manufacturers with success. Mr. Hadfield's invention was not alone the discovery of this alloy, but also the proper development of its properties through treatment, to produce the highest and best combination of hardness and toughness suitable to such purpose, and for which he obtained a number of subsequent patents. The proper treatment of manganese steel is in itself an art which can only be learned by years of experience, somewhat on the line, but of course on a higher plane, of the art of the experienced tool dresser, of producing a good tool from a piece of given tool steel where others fail.

Mr. Angerer then performed a number of interesting experiments before the club on different pieces of steel, drilling them for a definite period, comparing the holes and impressions, bending them by pipe levers, striking them with hammers and testing their magnetic properties with an electro magnet. The drill was driven by belt from a small 110-volt motor, and the spindle lever weighted so that the same pressure would always be applied to the work.

Manganese steel is a metal exceedingly difficult to handle in the foundry. As its hardness is great and its shrinkage is enormous compared with ordinary steel making, the production of intricate castings is quite a serious problem. In making the curved rails for the Boston Elevated Ry. Co. the molds had to be 20 ft. 7 in. long in order to obtain a casting 20 ft. long. The ultimate strength of manganese steel is very great, the maximum elongation being 50 per cent, after proper treatment. The drawback to its more general use for various purposes is that it cannot be machined, and all finishing has to be done by grinding with emery wheels. When the metal is treated properly it can be bent almost double, while less-treated specimens break more or less readily. The drilling test produces hardly any impression on the metal, while the same drill in the same time of one minute will drill a deep hole in the ordinary Bessemer steel rail.

There are many articles in which manganese steel is used with great success, such as stone crusher jaws, dredger pins, and points, screens for coal mines, mine car wheels, etc., and of late years for burglar proof safes, with which some remarkable tests have been made, providing practically dynamite proof construction. Mr. Angerer then stated that any of the members who may have had the experience of a visit, or fear the visit of cracksmen to the car barn safe where the day's receipts are supposed to be locked up, would undoubtedly be interested in the doings of the Manganese Steel Safe Co. of New York.

The results obtained from the use of hard center work can now be pronounced satisfactory in a general way, and probably no street railway would consider the use of anything else in important and complicated layouts. Some steam railroads have also adopted hard center work for their tracks in streets and for sidings. The renewal of the centers has sometimes not proven an entire success. If both lines crossing the center are about equally worn, a good job can be made by the renewal, but where one line is worn considerably more than the other, only one line can be made fairly good by the renewal, as the difference in wear can in no practical way be compensated for in the new center.

The idea of having the center remain serviceable as long as the surrounding parts has been practically accomplished by the manganese steel centers, except in cases where defects have developed. One curious result appeared through the fact that it is impossible to construct the center in exact proportion to the wear at each point of its surface. These parts of the center which carry the wheel on its full tread do not wear down as fast as either the point or the parts of ordinary steel beyond the center, so that after some service these places appear as hills in the track and make the cars ride a little roughly, apparently calling for a renewal of the center, although the center is not by any means worn out. A better way to remedy this trouble is to grind the high places off from time to time to re-establish the surface of the track.

In special track work the joints have given remarkably little trouble, due undoubtedly to the greater stability of curves over straight rails, and the great stability of the heavy special pieces. The ever-increasing weight of the pieces, however, is a source of much worriment to the track man, and the handling of the pieces is attended by great difficulty. Modern appliances, such as cranes, are now introduced to facilitate this. The bugbear of special work is the compromise joints at the end of [illegible] to the previous sections of rail used in the straight track. No matter how carefully a compromise joint is fitted in the shop to available pieces of rail, the rail in the ground is liable to vary from these, and an inferior joint is produced. This difficulty has to a large extent been overcome by the use of compromise rails, i. e., short pieces of the sections to be connected with, joined together by some welding process, like cast-welding.

The weakest part of special work today is the tongue switch, or better, the pivot part and the heel of the tongue. The tongues themselves, made of hard forged or manganese steel, with hard metal beds, wear well enough, but the pivots and the supports at the heel end have to a great extent proved insufficient to withstand heavy service. It remains to be seen what is the best solution of this problem. Where the curve is comparatively little used, an unbroken main line switch can often be installed to advantage, and the great wear at the heel from the main line traffic be obviated.

In late years the improvements in special track work of all kinds have mostly consisted in the strengthening of each piece to meet the ever-increasing weight of cars and in the finer working out of details. The lines of special work layouts, to insure the smooth running of cars on curves, have been greatly improved by the introduction of easements or spirals on the ends of curves, although this has to a large extent been overdone. Mr. Angerer then showed a slide illustrating one of the simplest spirals, with changes of curvature every 3 ft. 6 in., and intended to be used for curves up to 62 ft. 6 in. central radius. By simply dropping out the first few radii a 100 ft. radius switch can be set into this spiral without disturbing the alignment of the balance. Spirals for curves of larger radii are derived from this base spiral by multiplying the base functions by 1½, 2 and 3 respectively, and these four spirals cover the entire field up to curves of 500 ft. radius. There are several systems of spirals in use, prescribing ten or more different spirals to cover this range. Each manufacturer and many of the large street railways have systems of their own in regard to spirals, requiring different calculations for each one to apply them to special work layouts; while practically, when laid down alongside of each other the lines of all these different spirals for a curve vary less than ¼ in. at any one point. Some uniform standard in street railway spirals is badly needed. Mr. Angerer stated that he would be glad to present this data of a simple spiral to any one of the audience who would communicate with him.

Summing up the development of special track work as used in paved city streets, this progress has been marked by four distinct periods. First, the flat rail period prior to 1884. Second, the early girder rail period, with cast-iron or built-up switches and frogs, from 1884 to about 1891. Third, the intermediate girder rail period, during the development of electric railways, with work of rails cast together, or cast steel in special pieces, from 1891 to 1895, and, fourth, the hard center work period. In one place in Boston, Washington and Hanover streets, each of the latter three periods has been illustrated. The work of the second period was installed in the summer of 1890. The material weighed 82,500 lb. and cost about $3,100, or an average of 3¾ cents per lb. It was worn out and renewed with the work of the third period in the spring of 1893, having lasted about 2 years and 9 months. The material in this layout weighed about 100,000 lb., and cost a little below $5,000, or 5 cents per lb. It lasted until the summer of 1897, or a little over 4 years. It was replaced by manganese steel hard center work, which has been in service ever since, with the exception of a few centers and about three pieces out of a total of 76 pieces, which were renewed within a year or so. This layout has lasted nearly 7½ years—a gain of about 100 per cent in the service obtained. The material weighed 142,500 lb. and the cost in 1897 was about $5,700, or only about 4 cents per lb., notwithstanding the expensive metal used in the centers. However, 1897 was a year of cheap material. Pig iron was then $11 to $11.50 per ton. T-rails sold at $20 per ton at the mill and girder rails at $24. Today this layout would, on account of the use of a heavier rail and some strengthening of the pieces, weigh 155,000 lb. and cost about $7,700, or a little less than 5 cents per lb.—an increase of over 25 per cent since 1897; while of the raw materials, pig iron has increased 50 per cent to $16.50 or $17 a ton, and T and girder rails increased 40 per cent to $28 and $34 per ton respectively.

It is impossible to state how long such a piece of work should last. It depends on the amount and condition of traffic, weight of

cars and passengers, speed, weather conditions and the tendency of the wheels to slide or turn at some points. No uniform basis can be established. Mr. Angerer stated that he had tried by means of careful impressions taken of track in the street to average the wear of manganese steel centers per car, but he found it impossible. The results he obtained varied from .0012 in. to .0020 in. of vertical wear per 10,000 cars. Mr. Hadfield in making similar tests observed a vertical wear of from .0008 in. to .0028 in. per 10,000 cars at different points of one layout. Variations of from 100 to 200 per cent do not admit of any conclusion. A difference of opinion also exists as to when a piece of special work should be considered "worn out." An illustration was then shown of a piece of special work which had sustained a traffic of 2,570,000 cars, and which appeared but little worn. On the other hand, the extent to which rails are sometimes allowed to wear down in special work is remarkable.

The next step in the development of special track work in city streets is problematical. Whether it will be work made throughout or at least on the entire surface of a metal like manganese still seems doubtful. The points of greatest wear would then last no longer than they do now. In some special cases such a construction might be desirable, but for general use it would seem that the period of the hard center work is likely to be extended for a good many years to come.

When the electric street railways branched out into the country, where they were not restricted by the regulations of a city or bothered by the city pavement, the use of T-rails and the general practice of steam railroads were naturally followed. Split switches are now commonly used on such track, as are spring rail frogs, which are the best kind to take care of traffic of different kinds of cars with large and small wheel flanges on the same track. Where team traffic upon the highways is liable to encroach upon the track, tongue switches, built up of T-rails and fixed frogs have to be used.

The good results of using hard center work in city streets soon called for an adaptation of this idea to T-rail special work. Hard centers were bolted in between the rails, forming the frogs or crossings, or fastened in some other way, similar to the girder rail work; or, as the pieces could be made comparatively light, they were cast solidly out of hard metal, such as manganese steel. This construction lent itself particularly well to complicated layouts. In these improvements in T-rail special work the street railways were naturally the pioneers. The steam railroads, naturally and rightly more cautious in adopting anything new, that on trial might prove unsafe for their heavy loads and high speeds, were slow in adopting similar methods to increase the life of their crossings and frogs. They were first induced, after witnessing a number of extremely severe tests in the shop, to try a metal like manganese steel in crossings of electric railways over steam railroad tracks, when the engineers of the Philadelphia system suggested that instead of the crossings being built up out of numerous rails, the three rails and filler usually constituting the steam railroad part of the crossings should be made in one piece of manganese steel. These crossings, proving eminently successful under the heavier steam railroad traffic and high speeds, finally led to the trial of the metal in regular steam railroad frogs. A test frog was put into the tracks of the Pennsylvania R. R. at Philadelphia in a place in which the maximum life of an ordinary steel rail frog had been not over three months. The manganese frog remained in service 4 years and 14 days. It was then worn down at the point about 5-16 in., but the rails on the ends were worn considerably. After being taken out it was sent back to the shop; new rails were fitted into the ends; the central part was then bent up to the extent of the vertical wear in a hydraulic press, and the entire surface was ground level at a comparatively small cost. The frog was then as good as new, and was put back in the track on June 30, 1904. There are now over 3,000 of these frogs in use on steam roads, as well as many manganese crossings. Manganese steel has also been put into the guard rails of steam railroad tracks, and tests are now being made with split switches having manganese steel point rails.

Mr. Angerer then showed several slides illustrating the manganese steel rails on the Boston Elevated, one of which, on a sharp curve in the subway, has already outlasted 25 ordinary rails with but one-third the wear. The Pennsylvania R. R. is also experimentally trying manganese steel rails. Before putting manganese steel rails into the subway, some of the rails, cast in 20-ft. sections, were subjected to remarkable tests. A rail was curved cold to 20-ft. radius, half of this rail was then straightened out again and curved the reverse way to 20-ft. radius; the other end was curved down to a radius of only 10 ft., and there was not the least sign of a fracture.

Conduit railways have had to deal with the problem of the slot for the admission of the grip or plow in addition to the track rails, in connection with their special work. This addition makes the special work infinitely more complicated in its construction, as well as difficult in installation. The first conduit railways were not usually the cable roads, the general construction of the slot part being similar to that used in the present electric conduit railways. The track portion underwent the various phases described in girder rail special work. Various mechanisms are used for the slot switch and means for throwing it simultaneously with the track switch. The hard center principle has been extended to the point where the track crosses the slot, either by a hard metal plate fastened as described under hard center work, or by solid manganese steel rails joined to the slot rail.

Very often it is considered advisable to again set up the special work on the street before putting it in place, although it has already been set up at the factory. As it takes much longer to put in a piece of special work of this kind, no chances can be taken of any delay. Owing to the greater depth of the excavation for conduits, many obstructions are met, such as rock and pipes in the street, sometimes a perfect network of the latter, especially at busy street intersections, where the most intricate special work is usually required.

The manufacture of all classes of street railway special work requires an enormous amount of detail work, of which one who has not visited such a manufacturing plant has no conception. The manufacture of frogs and switches for steam railroads seems like child's play alongside of the manufacture of street railway special work, and simply on account of the standardizing that steam railroad work has undergone.

The making of the working plan of each layout involves intricate calculations and a careful consideration of all conditions. As it finally passes into the hands of the tracklayer, it must contain data for properly locating the work in the street, as well as the fitting of the work in the shop. Each detail should be designed to suit the rolling stock in use at the particular place, and therein lies one of the greatest difficulties of the special work manufacturer. There seems to be no limit to the different sizes of wheels, wheel flanges and wheel bases of cars in use, and yet each of these factors, combined with the radii of the curves, calls for a different groove. The truck of a car on a curve stands on a chord to the circular line, and the wheels take a skewed position with regard to the running line of the rails. This calls for a wider groove than would be required to pass the flange of the wheel on the straight track. Just how much wider this should be for a given flange, radius, diameter of wheel and wheel base can easily be determined by graphical development of the flange on the angle of the skew. A table worked out on this principle of the width of grooves called for by the combination of some of the representative wheel flanges in use, and the prevalent wheel bases, together with the radii of curves (the diameter of the wheels being omitted as a negligible factor), exhibits the great variety in the widths of grooves. The tendency of wheel makers of late has been to increase the thickness of the wheel flanges, of a given depth, which has proved very troublesome in the making of special work. A piece of special work can be made to suit but one of these combinations, and other cars with other wheel bases, and particularly with other wheel flanges, that are run over the same work, will considerably shorten the life of the work from what it would be if only one kind of cars and wheels were used on it. It is the same case of a piece of machinery which wears faster when the working parts fit too tightly.

Mr. Angerer stated that he was not at this point referring to the problem which has developed in late years of running cars which because of their speed are equipped with larger flanged wheels over the tracks in the hearts of cities, which are built to receive the smaller flanged wheels usually necessary to comply with city regulations. This problem is yet to be solved. The solution may lie in wider wheel treads for both city and interurban cars, but for that the tracks throughout the city streets would have to be equipped with a rail that would admit of the wider treads. Some cities, like Philadelphia, have made a start in this direction. It may also involve deep but thin wheel flanges for both kinds of cars, with wheels of cast steel, probably, instead of cast iron.

The inspector of special work laying out at the factory must be

the most careful, experienced and painstaking man about the place, as the reputation of the maker is at stake. The work must be as nearly right as it can be made, to suit the various conditions, as far as they have been made known. As an instance of detail difficulty, where there were marked changes of grade in the street where the work is to be installed, it must be fitted together in the shop, not on a plane, but with these grades reproduced, and the rails given an extra bend or twist to suit; otherwise a complaint that the rails are twisted is sure to come in. Great care is also necessary in the loading and shipping of some of these bulky pieces.

In conclusion, Mr. Angerer called attention to the necessity of establishing standards in equipment as far as it relates to special track work. Besides the spirals, wheels, wheel bases, etc., already discussed, there are now in use nearly 100 sections of girder rail in this country, besides many obsolete sections which are no longer rolled. One-fourth of this number of sections would cover all requirements and satisfy all city regulations. It lies with individual street railway engineers and with the various street railway associations to do for the street railways what the Master Car Builders and American Society of Civil Engineers have done for the steam railroads. It would be of the greatest advantage to the street railways themselves. It would probably enable them to buy cheaper, their wants could be more quickly supplied, and the life of the equipment itself would doubtless be prolonged. The recommendations of the American Street Railway Association made some years ago were probably too radical for adoption. Probably more than one standard would be required for different conditions, but a very few would meet all the requirements.

Indiana Electric Railway Association.

First Regular Meeting Held at Indianapolis, Jan. 12, 1905—Fifty Members in Attendance—Interesting Papers Read.

The first regular meeting of the Indiana Electric Railway Association, organized last month, was called to order in the Traction & Terminal Bldg., Indianapolis, Jan. 12, 1905, at 10:20 a. m., Mr. A. L. Drum acting as temporary chairman. The first business transacted was the election of officers, which resulted as follows:

President, Charles L. Henry, president Indianapolis & Cincinnati Traction Co.

Vice-President, J. W. Chipman, general manager Indianapolis & Eastern Ry.

Secretary, Paul H. White, general manager Indianapolis & Martinsville Rapid Transit Co.

Treasurer, W. F. Milholland, treasurer Indianapolis Traction & Terminal Co.

Members Executive Committee: A. L. Drum, general manager Indiana Union Traction Co.; C. C. Reynolds, general manager Indianapolis & Northwestern Traction Co.; Gardner F. Wells, general manager Terre Haute Traction & Light Co.

Finance Committee: Charles Murdock, vice-president Ft. Wayne & Wabash Valley Traction Co.; W. G. Irwin, general manager Indianapolis, Columbus & Southern Traction Co.

President Henry took the chair and introduced Mr. A. S. Richey, who read a paper on "Cost of Electric Railway Power Production and Transmission in the State of Indiana."

[Mr. Richey's paper will be found on page 43 of this issue.]

In discussion Mr. Drum emphasized the necessity of carefully considering the relative advantages of different systems, citing two examples of bad judgment. In one case a railway and lighting company in a city of 100,000 inhabitants, distributing on the alternating current system, had for a long time ignored the advice of its engineer to substitute the three-wire system, using direct current; but was finally forced by fear of competition to make the change; the result was that by the three-wire underground distribution the transmission loss which had been 45 per cent was reduced to only 12 per cent, the saving more than paying interest on the $300,000 expended to make the change.

In the other case a railway company installed a three-wire direct-current transmission system, the trolley wire voltage in one section of the city being 500 positive and in the other section 500 negative; experience showed that the only saving in copper was that a lighter line could be used between the ground return (the neutral) and the power house, which was a distance of only 100 ft. This scheme was promptly abandoned.

Mr. Drum believed the solution of the power question was to install efficient boilers, engines, generators and transformers. In the Indiana Union Traction system there was practically no difference in cost between using natural gas under 4 ounces pressure at 8 cents per 1,000 cu. ft., and coal at $1.35 per ton. Several companies were now substituting efficient for wasteful engines and boilers.

Mr. Richey stated in answer to a question by Mr. Shlesinger that the better showing on power consumption made by the newer lines of the Indiana Union Traction Co. was to a considerable extent due to better bonding, heavier rails, more feeders, better grades, and better located sub-stations. In giving figures the urban car-miles run had been reduced to the same basis as if entire service had been interurban.

Mr. Drum, as showing the need of care in choosing a basis of comparison, cited the case of a company which used that of the ratio of wages to coal burned. One station engineer, when called onto the carpet to explain his high operating ratio, said he could reduce the ratio if desired; the wages were as low as possible, but he could easily increase the coal consumption.

The chair expressed the belief that of all the elements entering into the cost of power, the item of wages was one of the most serious, and that this should be met by using apparatus that would reduce the amount of man power needed.

The meeting then adjourned until 2:30 p. m.

At 1 o'clock the party was taken to the power house and shops of the Indianapolis Traction and Terminal Co., returning to the meeting hall at 2:30 p. m., when the meeting was again called to order.

Mr. Thomas B. McMath read his paper on "Track and Roadbed Construction and Maintenance, with Particular Reference to the Life and Chemical Preservation of Cross Ties."

[This paper will be found on page 47.]

Mr. Thomas Elliott, of Cincinnati, stated that eleven years ago he had had experience in treating timber with creosote. Ties placed in the ground then had been taken up recently and found to be in good condition. Those ties had been of pine, costing 17 cents each, and had been filled with 5 gallons of creosote at 8 cents per gallon, making the cost after treatment 57 cents.

Treated ties he considered did not hold spikes so well as untreated timber, and did not stand wear so well. This was no disadvantage, however, for use in city streets.

Poles and cross arms had also been treated by him with cresote. The life of the timber had been greatly increased but its insulating power reduced.

The timber treating plant referred to by Mr. Elliott had cost between $5,000 and $6,000, and comprised a treating tank 7 ft. in diameter by 40 ft. long, capable of holding 200 ties, two storage tanks of 6,000 gallons capacity and the necessary pressure pumps. A charge of 200 ties could be treated every 24 hours.

A green tie would absorb 5 gallons of creosote when under 150 lb. pressure for 4 hours. A seasoned tie would absorb 10 to 12 gallons under the same conditions.

Dr. Louis Duncan, of New York, stated that on some of the New York conduit construction with which he had been connected, short wooden stringers had been placed between the metal yokes in order to support the track rails throughout their entire length. This timber had been treated with 12 lb. of creosote per cu. ft., and it showed no deterioration after 8 years. He favored the use of cheap timber treated in localities where good ties are scarce.

The chair offered the suggestion that electric railway companies

should plant trees and raise their own ties against the time when it would be impossible to buy good ties. He did not favor using poor ties—the freight and labor expended on a poor tie are as great as in a good one.

Mr. L. M. Clark then read his paper on "The Construction and Maintenance of Cars and Equipment."

[This paper will be found on page 58.]

Following Mr. Clark's paper, there was a general discussion, some of the points mentioned being the most desirable length of car, the use of rubber cushions between trolley base and car roof to prevent noise and reduce vibration that would destroy the connecting wires, sleet cutters, and the practicability of providing a water supply for car closets.

In connection with sleet cutters, Mr. Paul H. White described the practice in Grand Rapids, Mich., where a section of chain is wrapped around the trolley wheel, and reported to break a heavy coating of sleet in a very satisfactory manner.

Mr. Norviel, general agent at Indianapolis for the Indianapolis & Northwestern Traction Co., explained the rate situation, and urged the appointment of a committee to take up the matter of handling baggage. He stated that between Indianapolis and LaFayette his road made a round trip rate of $2 and on limited trains charged 20 cents extra each way, making the total fare $2.40. If the passenger had baggage each way it would cost him 25 cents each way, making $2.90 for the round trip, while the steam road had met the original rate for two rides between LaFayette and Indianapolis and now charged only $2 for one round trip or two single trips.

Mr. J. L. Matson, of the Indiana Union Traction Co., stated that he had found the mileage made by steel wheels and steel-tired wheels to vary from 3,000 to 11,000 miles per 1-16 in. of wear, or maximum and minimum for the entire tire of 240,000 and 135,000 miles respectively. This short life was due to flange wear, 7/8-in. flanges being turned down when they calipered 3/4 in. The make of wheels was not stated.

The meeting closed with brief statements from Dr. Duncan and the chair on the outlook for single-phase lines.

Mr. Henry said that he wished to go on record to the effect that electric railways would in the future haul heavy freight and lots of it.

He added that his single-phase line would be in partial operation within ten days.

Adjourned at 4:15 to meet Feb. 9, 1905.

Charter Members I. E. R. A.

Indiana Union Traction Co.—Jas. A. Van Osdol, general attorney; E. C. Carpenter, claim agent; I. M. McQuilkin, comptroller; A. W. Brady, president; Charles A. Baldwin, superintendent transportation; R. J. Dunbar, assistant purchasing agent; A. S. Richey, electrical engineer; R. J. Custer, acting engineer maintenance of way; W. C. Sampson, secretary; A. L. Drum, general manager; J. L. Matson, superintendent motive power; W. K. Schoepf, vice-president.

Indianapolis Traction & Terminal Co.—Hugh J. McGowan, president; W. F. Milholland, secretary and treasurer; T. B. McMath, civil engineer; Charles Hogate, electrical engineer; P. A. Hinds, purchasing agent; E. B. Peck, vice-president Indiana Co.

Citizens Street Railway Co., Vincennes—B. G. Hudnut, president; Geo. E. Henry, manager.

Angola Railway & Power Co.—C. C. Wood, manager.

Indianapolis & Eastern Ry.—F. M. Fauvre, president; J. W. Chipman, general manager; D. H. Robinson; W. K. McKown, general passenger agent; C. E. Morgan, auditor.

Indianapolis & Martinsville Rapid Transit Co.—C. F. Smith, president; Henry Eitel, vice-president; P. H. White, general manager; E. G. Hendrickson, auditor; H. L. Swartz, master mechanic.

Consolidated Traction Co.—Edward Hawkins, vice-president.

Indianapolis, Columbus & Southern Traction Co.—W. G. Irwin, vice-president; Hugh Th. Miller, secretary; George A. Saylor, superintendent; R. O. Boyer, special agent.

Ft. Wayne & Wabash Valley Traction Co.—Charles Murdock, vice-president; C. D. Emmons, general superintendent; E. C. Folsom, superintendent transportation; M. J. Kehoe, chief engineer; F. C. Rapp, master mechanic.

Indianapolis & Cincinnati Traction Co.—C. L. Henry, president.

Indianapolis & Northwestern Traction Co.—C. C. Reynolds, general manager; L. M. Clark, master mechanic; F. D. Norviel, general agent; R. G. Williams, civil engineer; O. P. Spilman, train despatcher; G. K. Jeffries, superintendent.

Ft. Wayne, Van Wert & Lima Traction Co.—H. F. Dicke, superintendent.

Richmond Street & Interurban Ry.—H. B. Smith, president; Albert Gordon, superintendent.

Terre Haute Traction & Light Co.—G. T. Wells, manager.

Muncie, Hartford & Ft. Wayne Ry.—L. J. Shlesinger, superintendent.

Robert P. Woods.	E. L. Schmock.
R. W. Waite.	J. R. Cravath.
H. E. Dalton.	Daniel Royse.
W. J. Coleman.	

The Construction and Maintenance of Cars and Equipment.*

BY L. M. CLARK, MASTER MECHANIC INDIANAPOLIS & NORTHWESTERN TRACTION CO.

The subject of this paper covers a wide field, including a variety of details and methods, governed by various conditions and circumstances. The writer will not attempt to note the changes incidental to the growth of the American street railway, but will treat lightly on the subject in connection with the high speed work of today.

The car body involves materials, details of design and dimensions to conform to the requirements of the service, the general tendency being towards the standard steam railway coach.

Special attention should be given to the lower side frames to secure great strength as they form a solid foundation to support the upper sides and roof, making the car able to withstand vertical strains and blows. The reinforcement of lower front and frames for draw bar heads, especially if the cars are intended to ever operate in trains, is important, as well as the solid attaching of bumpers, the uniformity of dimension and accurate fitting of windows and doors, especially in front ends. The interior should be divided into two compartments, smoking and passenger, with the addition of a third compartment for baggage if required.

Interior finishes consisting of quartered oak in the smoking, mahogany in the passenger, and ash in the baggage compartment and rear vestibule are desirable.

The painting of the exterior should be according to M. C. B. specifications; the Pullman Co's. standard color is recommended. The side and end windows should be guarded on the outside by three to five tubes, preferably of polished brass, held by suitable brackets, arranged so that they can be dropped down for the purpose of cleaning the windows.

A comfortable temperature inside could be easier maintained at a considerably less expense by the use of extra sash provided for side windows. Gothic glass for the upper side and deck windows presents a pleasing effect.

The seats should be of the high back, reversible pattern with bronze grab handles, upholstered in leather for the smoker, and in olive green or crimson plush for the passenger compartment.

Cars should be operated in one direction wherever possible, a better design, convenience and uniform flange wear being important advantages.

A separate compartment located on the forward end, right side, having a rear door, forward and right side windows, controller, operating valve, compressor governor, switchboard, etc., should be provided for the motorman. Hot water heating systems well installed, including heaters of sufficient capacity, are especially desirable for reasons of economy.

Other additions include toilet room, water cooler, parcel racks, fire extinguishers, etc., together with iron cuspidors, flag receptacles and coal boxes.

Trucks.

There are many designs of trucks on the market adapted to various speeds and loads, each possessing its advantages or disadvantages. An M. C. B. truck having heavy side and end beams,

*Read at the first meeting of the Indiana Electric Railway Association Jan 12 1905.

transoms and equalizing bars, thoroughly braced and reinforced to prevent getting out of square or alignment, accurately fitted journal brasses, wedges, boxes of pedestal, a good system of [illegible] independent inside hung brakes, non-chattering brake head hangers, inside motor suspension, roller side bearings, solid bolster, 33 to 36-in. wheels, 5½ to 6½ in. axles, and a wheel base of from 6 ft. to 7 ft. is recommended. Steel tired wheels are preferable on account of possessing a greater factor of safety, flexibility of handling, quiet running and freedom from flattening.

Solid axle gears are also recommended. The matter of selection of motors and gearing largely depends on the requirements. For motors of 75 h. p. or larger, multiple unit control has the following advantages over type L-B or R controllers: Ease of handling on the part of operator; less vestibule space required; better service rendered; ability to operate motor cars in trains. Special attention should be given to the installation of electrical conductors to secure permanence of insulation and protection against mechanical abrasion. All electrical devices, such as switches, cut-outs, main switch and circuit breaker should be arranged on a panel located in the motorman's compartment.

The matter of brakes, both hand and air, is a very important detail, and should receive careful consideration. The diameter of brake cylinder should conform to the percentage of weight of car to be controlled. The capacity of reservoirs should be so proportioned that a full service application of brakes will cause a reduction of pressure of not less than three nor more than four pounds.

The capacity of compressors should be sufficient to supply all air required for the operation of brakes, whistles and sanders under normal conditions and not operate in excess of 30 per cent of each hour that the car is in service. High piston speeds are objectionable for reasons of greater wear of reciprocating parts, and the comparatively high temperature of air supplied to reservoirs, causing an excessive amount of moisture in the system.

The sizes of pipe employed for reservoir and train lines should not exceed a volume greater than is consistent with the quick response of brakes in emengency application and full release. All tees, elbows and other sharp turns should in all cases be avoided, whenever possible, as well as water pockets and leaks. The range of reservoir pressure should be from 12 to 15 lb., the compressor being cut out at a point not exceeding 5 lb. in excess of the emergency brake cylinder pressure, which should correspond to leverages, braking motor axles 100 per cent and trailer axles 90 per cent.

Effectual hand brakes should be in operative condition on cars at all times, and there is no reason why such brakes cannot be installed and maintained.

The arrangement of apparatus under car body, such as compressor, reservoir, brake cylinder, rheostats, etc., should be such as to allow the direct connection of brake staffs by means of chains and pull rods to a main lever, which in turn is connected to a multiplying lever chained to cylinder push rod.

For motor cars operating in trains, automatic air brakes are preferable to straight air brakes for reason of smoother and more flexible handling.

Further additions to equipment include air sanding devices properly installed and maintained, oil and tool boxes, retrievers, arc headlights, roller bearing trolley bases, illuminated destination signs, car telephones, classification signals and markers.

Maintenance.

After a car has been on the road 24 hours, or has run a given number of miles, say 200, it should be placed over a pit in the car barn and receive a thorough inspection by a car inspector whose duty is not to repair, but to report the exact condition of every detail on an inspection card, which, when employed in connection with a motorman's defect card, should show the absolute condition of cars and their equipment at regular intervals. An O K should be placed opposite defects noted on the inspection card after having been repaired, and when the entire car has been O K'd by the foreman of repairs, the cards should be sent to the master mechanic's office, from which a record of body, truck, motor, control and trolley troubles can be kept.

After a car has been thus inspected and repaired, it should be thoroughly cleaned inside and out. Trucks, wheels, motors, compressors, etc., can be kept in good condition by frequent wiping with oily waste.

The electrical equipment [illegible] portant. The circuit breaker, controllers, contactors, reverser, rheostats, motors and electrical conductors are delicate apparatus and should receive the [illegible] verser fingers, circuit breakers out of adjustment or burned, loose or burned contacts, defective insulation, unevenly worn or rough commutators, worn motor bearings, armature field coil and brush holder troubles can and should be readily located by inspection and remedied at once.

The treads and flanges of wheels should be watched, also the axles, to know that crystallization is not present.

All trucks should be carefully inspected to ascertain that they are not out of square, a flange wear [illegible] companies whose cars are operated around numerous short radius curves and over a quantity of girder rail and special work

The side bearings should be examined to see that there is a clearance on both sides, otherwise there will exist a displacement of weight, causing flanges to wear excessively on heavy side.

Considering that the car is operated in one direction only, if the two axles of a truck are out of alignment with it, flanges on two wheels diametrically opposite will wear. If one axle is in alignment and the other out, the flange of lead wheel on side of truck having the shorter wheel base will wear very fast. Truck brakes should be frequently adjusted and a uniform amount of slack maintained. The tension of release springs should be sufficient to cause brakes to release in full.

All bearings should be regularly lubricated with a good quality of oil of a consistency conforming to the season of year.

Long fibered wool mixed with japanese fiber in the proportion of 5 to 1 forms a reliable and durable packing waste, we having records of journal and motor armature bearings which have run over 80,000 miles on the original waste placed in boxes.

For gear lubrication, a graphite grease mixed with a cushion of ground cork or fiber is recommended.

The air brake equipment should receive intelligent attention.

Operating valves and compressor governors should be regularly cleaned and oiled once each month. Compressors should be inspected, cleaned, and, if necessary, oiled at least once a week, brake cylinders every twelve months, and at all times the governors should be watched to know that the proper reservoir pressures are maintained, that the reservoir gages are correct and all cut-out cocks, joints, etc., free from leaks. Chime whistles should be kept clean and in tune. Sanding devices should be kept in operative condition, and hot water heating systems given proper care to guard against deposits of sediment and leaks.

You can readily understand that the subject of this paper is one upon which a great deal more can be said; but I have attempted to set forth only the main ideas that appeal to me in the construction and maintenance of cars and equipment.

Lewiston & Southeastern Electric Railway Co., Ltd.

Construction work on the Lewiston & Southeastern Electric Railway's Co's. line has been commenced and the line is now being built from Lewiston, Idaho, through the Tamany and Wana sections, thence across Mason Prairie to Westlake. From Westlake a branch will be built to Nez Perces City, passing through the Nez Perces Prairie via Ilo and Dublin. The main line continues from Westlake to Grangeville, Idaho, via Cottonwood and Denver. Grangeville will be the southeastern terminus of the road, where a water power plant for generating the electricity will be built on the Clearwater River. The total length of the line is 110 miles; it will be of standard gage and heavy steel rails will be used in track construction. At Lewiston the road connects with the Snake and Columbia River steamers, giving excellent connections to all points on the Pacific Coast. The principal traffic of the road will be wheat, timothy hay, lumber and live stock.

The Spokane Traction Co., Spokane, Wash., has submitted a proposition to the postoffice authorities providing for the carrying of mail on the Traction company's cars. The boxes on the cars will be emptied by the postmen at the nearest point to the post office.

Personal.

MR. GEORGE O. NAGLE, general manager of the Wheeling (W. Va.) Traction Co., spent Christmas holidays visiting relatives in Chicago.

MR. WILLIAM ROCKWELL, of Amsterdam, N. Y., has been appointed superintendent of the Mauch Chunk, Lehighton & Slatington Street Railway Co., Mauch Chunk, Pa.

MR. CLOYD MARSHALL, superintendent of electrical machinery, in the Department of Electricity, of the Louisiana Purchase Exposition, has just been appointed superintendent of the power department of the Union Electric Light & Power Co., of St. Louis Mr. Marshall was granted a gold medal by the superior jury of the Louisiana Purchase Exposition in appreciation of his services in connection with the Exposition and as secretary of the Electricity Department, a well-deserved distinction. Mr. Marshall is a graduate of Purdue University and after acting as assistant in the electrical laboratory of the University became electrical editor of the "Street Railway Review." In 1898 Mr. Marshall accepted the position of designing and testing engineer for the Jenney Electric Manufacturing Co., after which he took up experimental work for the Railway Materials Co., of Chicago. In 1901 he became plant engineer and later engineer of the sales department of the C. W. Hunt Co., New York. The latter position he resigned to accept the appointment in the Department of Electricity of the World's Fair. Mr. Marshall is widely known as a progressive engineer and business man, and he takes with him in his latest advancement the best wishes of a large circle of friends.

CLOYD MARSHALL.

MR. DAVID FOX, general manager of the Rutland Street Railway Co., Rutland, Vt., has been elected president of the company. He also retains his position as general manager.

MR. RUSSELL ROBB, who has been associated with the firm of Stone & Webster, Boston, Mass., has become a member of the firm. Circulars announcing this change are dated Dec. 31, 1904.

MR. JOHN B. JUDGE has been appointed superintendent of the lines of the Consolidated Railway Co. in New Haven, Conn., including the Wallingford extension, vice Mr. Theron R. Hull, resigned.

MR. CHARLES E. FLYNN, vice-president and general manager of the Conneaut & Erie Traction Co., Girard, Pa., was a caller at the "Review" office on the occasion of a recent business trip to Chicago.

MR. WILLIAM D. BRICKELL has been elected president of the Columbus, New Albany & Johnstown Traction Co., to succeed Mr. Daniel J. Ryan, who has been elected vice-president and general counsel.

MR. E. S. DIMMOCK, manager of the Cape Breton Electric Co., Ltd., Sydney, N. S., has been appointed general manager of the Canton-Akron Railway Co., Canton, O., to succeed Mr. George W. Rounds.

MR. H. W. HARRIS, superintendent of the Norfolk (Va.) Railway & Light Co., has resigned his position to become superintendent of the Michigan Traction Co., Kalamazoo, Mich., vice Mr. S. J. Dill, resigned.

MR. WILLIAM C. CARTER, who has been in the employ of Stone & Webster at Brockton, Mass., has been appointed superintendent of overhead construction by the Houghton County Street Railway Co., Hancock, Mich.

MR. C. H. STOCUM, who for some years past has been connected with the Brooklyn Rapid Transit Co., has been appointed general manager of the Westchester Traction Co., also of the Danbury & Harlem Railway Co., with headquarters at Ossining, N. Y.

MR. S. M. KEEBLE, of St. Louis, was recently tendered a banquet at the Missouri Athletic Club by representatives of the electrical industry of St. Louis, the occasion being the resignation of Mr. Keeble of the position held by him with the Frank Adam Electric Co., to become general sales manager for the Cutter Co., of Philadelphia.

MR. REAGAN HOUSTON, president and general manager of the San Antonio Traction and the Gas & Electric Companies, San Antonio, Texas, has resigned. He will be succeeded by Mr. Emerson McMillan, as president of the corporations, and H. M. Littell, as general manager.

MR. HARRY V. SANGER has resigned the position of general superintendent of the Wheeling Traction Co., Wheeling, W. Va., and the position has been abolished. Mr. J. Marsh has been appointed superintendent of transportation, performing the duties heretofore performed by the general superintendent.

MR. CHARLES SEIBERT has been appointed acting master mechanic of the Grand Rapids, Grand Haven & Muskegon Interurban Railway Co. in charge of mechanical and electrical departments, vice Mr. E. B. Kirk, who has resigned to become master mechanic of the Winnebago Traction Co., Oshkosh, Wis.

MR. A. H. HAYWARD has resigned his position as general superintendent of the Dayton, Springfield & Urbana Electric Railway Co. to become general manager of the York County Traction Cc., and has been succeeded by Mr. C. A. Alderman, who will also retain his position as chief engineer of the Appleyard lines.

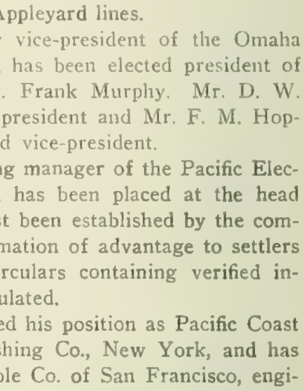
MR. GUY C. BARTON, formerly vice-president of the Omaha & Council Bluffs Street Railway Co., has been elected president of the company to succeed the late Mr. Frank Murphy. Mr. D. W. Wattles succeeds Mr. Barton as vice-president and Mr. F. M. Hopkins, of Columbus, was elected second vice-president.

MR. H. S. KNEEDLER, advertising manager of the Pacific Electric Railway Co., Los Angeles, Cal., has been placed at the head of an industrial bureau which has just been established by the company. The bureau will furnish information of advantage to settlers and business men; pamphlets and circulars containing verified information will be published and circulated.

MR. C. W. WHITNEY has resigned his position as Pacific Coast representative of the McGraw Publishing Co., New York, and has become identified with the Abner Doble Co. of San Francisco, engineers and manufacturers of tangential water wheels and needle regulating nozzles. Mr. Whitney will have charge of the Abner Doble company's publicity department.

MR. H. M. LITTELL, general manager of the Rapid Transit Co. of Chattanooga, Tenn., has resigned his position to become vice-president and general manager of the consolidated street railways and electric and gas lighting plants of Austin, Texas, effective January 1st. Mr. Littell will be succeeded as general manager of the Rapid Transit Co. by R. W. King, formerly superintendent of the comapny.

MR. ELMER M. WHITE was on January 1st elected secretary of the Street Railway Accountants' Association of America, to succeed Mr. W. B. Brockway. Mr. White was born at Northbridge, Worcester Co., Mass., Sept. 14, 1857. In 1860 his parents removed to Hartford and his early education was received in the schools of that city. After leaving high school in 1872, he took a course in a business college and engaged in bookkeeping until 1877. For the next six years he served as a traveling salesman. In 1883 Mr. White took up estate accounting and in 1885 became connected with the Hartford & Withersfield Horse Railway Co., the predecessor of the Hartford Street Railway Co., with which he has been identified ever since. In 1890 Mr. White was appointed cashier of the Hartford Street Railway Co., which position he now holds.



ELMER M. WHITE.

MR. W. L. STRETLOW, superintendent of the Lake Shore Electric Railway Co., has resigned that position to become superintendent of the Springfield & Xenia Traction Co., vice Mr. J. W. Parker, who has been appointed superintendent of the Springfield, Troy & Piqua Railway Co. Mr. Stretlow has been succeeded by Mr. L. K. Burge, who has been appointed superintendent of transportation of the Lake Shore Electric Railway Co.

MR. JOHN F. OHMER, vice-president of the Ohmer Fare Register Co., entertained the officers and heads of the departments of the company with a banquet at the Phillips House, Dayton, O.,

Tuesday, December 27th. Mr. Ohmer presided and Mr. E. B Grimes, assistant general manager, was toastmaster. The former was presented with a silver smoking set by the traveling representatives of the company, while the latter received a cut glass ink well surmounted by a sterling silver top.

MR. WILLIAM G. WOOLFOLK has resigned the position of superintendent of the Knoxville Traction Co., Knoxville, Tenn., to become superintendent of the Philadelphia & West Chester Traction Co., vice Mr. F. C. Davis, deceased. Mr. Woolfolk is a graduate of Yale University Engineering School, has had considerable experience in the shops of the General Electric Co. and in the management of the Portsmouth Street Railway Co., Portsmouth, Va.

MR. CALVERT TOWNLEY has been appointed assistant to the president of the Consolidated Railway Co., New Haven, Conn. For some years Mr. Townley was general agent of the Westinghouse company, and has had to do with the equipment of the Boston Elevated system, the Brooklyn elevated and surface systems and the Manhattan and subway systems in New York City. He has also been employed by the Pennsylvania R. R. in its heavy traction construction in New York and Long Island.

MR. E. S. LEA has resigned as sales manager for the De Laval Steam Turbine Co., and opened an office at 42 Broadway, New York, to practice as consulting engineer. Mr. Lea was one of the first to appreciate the importance of the turbine field and has been connected with the De Laval company for four years. He is a member of the American Society of Mechanical Engineers, and also an associate member of the American Institute of Electrical Engineers, and of the American Society of Naval Engineers.

MR. ERNEST GONZENBACH January 1st assumed charge of the Sheboygan Light, Power & Railway Co., of Sheboygan, Wis., as general manager, succeeding Mr. H. A. Strauss, resigned. Mr. Gonzenbach is well known in the railway field, especially in connection with high speed interurban work, having been electrical engineer for the Albany & Hudson R. R. during construction and operation, and for the Aurora, Elgin & Chicago during construction. Mr. Gonzenbach resigned as engineer of the Youngstown & Southern Railway Co. to go to Sheboygan.

MR. ROBERT J. FLEMING, civic commissioner of assessment and property of the city of Toronto, Ontario, has been appointed general manager of the Toronto Railway Co., vice Mr. E. H. Keating, who will devote his time to matters relating to the engineering department of the company. Mr. Fleming was born at Toronto on Nov. 23, 1854, and after receiving a business education entered into partnership with T. W. Elliott in the coal and wood business, which he subsequently abandoned for the real estate business. His municipal career commenced in 1886, when he was elected an alderman for St. David's ward; in January, 1892, he was elected mayor, being reelected the following term. In 1894 and 1895 he was unsuccessful, but in 1896 he was again elected to the position. Aug. 5, 1897, he was appointed assessment commissioner for the city, which position he held until his resignation to become general manager of the Toronto Railway Co.

MR. C. C. LEWIS, who for the past two years has been chief engineer of the Schenectady Railway Co., has resigned to enter the employ of J. G. White & Co., Ltd., of London. Mr. Lewis has been engaged principally to take charge of the work to be carried out by this company at Montevideo, Uruguay, in electrifying the tramways at that place. Mr. Lewis has had an extended experience of over 15 years in railway work, having been connected with the Broadway cable work, afterwards in Baltimore converting the line of the Baltimore City Passenger railway from horse to cable, in Washington on the electric conduit work of the Metropolitan lines, and in Buffalo as engineer of the International Railway Co. In 1902 he accepted the position of chief engineer of the Schenectady Railway Co., having charge of the construction and maintenance work as well as the rebuilding of the electric line between Schenectady and Albany and the construction of the Troy and Ballston line.

Obituary.

MR. W. FORMAN COLLINS, vice-president and business manager of the Electrician Publishing Co., died very suddenly on the morning of December 21st. The funeral services were held at Trinity Church, Chicago, on Friday, December 23rd.

New Publications.

JOLIET, ILL., [illegible] ...ned to further the [illegible] attractive descriptive article of this thriving city situated on the Desplaines River, 40 miles from Chicago. The article is profusely illustrated with views of the streets, churches, industries, etc., and deals in a general way with the railroads, street cars, industries, building material, fuel, light, water power, banks, churches, public institutions, parks and building sites of the city.

REPORT OF THE TWENTY-THIRD ANNUAL MEETING OF THE AMERICAN STREET RAILWAY ASSOCIATION, held at the Transportation Building, Louisiana Purchase Exposition, St. Louis, Mo., Oct. 12, 13, 1904, is now being distributed among the members of the association. As usual the report is published in very neat form, and shows an excellent arrangement of subjects, including the officers of the association from its organization to date, the minutes of the meetings of the executive committee, report of the proceedings of the annual meeting, list of members and delegates, papers read and the discussions, and the constitution and by-laws of the association. The secretary is to be congratulated upon the excellence of the publication and upon the despatch with which the work has been done.

PROCEEDINGS OF EIGHTH ANNUAL CONVENTION, STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Size 5¾ x 9 in.; 190 pages; appendix 70 pages. The report of the eighth annual convention of the Accountants' Association held in the Transportation Building, World's Fair Grounds, St. Louis, Mo., Oct. 13, 14 and 15, 1904, contains besides a verbatim report of the convention, a list of officers of the association since its organization; all papers read before the convention; the report of the joint committee on blanks for shop records and accounts; the report of the standing committee on a standard system of street railway accounting; the question box; register of delegates; constitution and by-laws of the association; list of members of the association; index; summary index of previous reports.

STATISTICS OF RAILWAYS IN THE UNITED STATES, being the sixteenth annual report of the interstate commerce commission for the year ending June 30, 1903. Published by the government printing office, Washington, D. C. This work is in the same general form as the previous reports of the Interstate Commerce Commission and shows the classification of railways, equipment and number of employes. It also gives the complete statistics of the capitalization of the railway properties of the United States, as well as their earnings and expenses, and general summary of results. The work is almost entirely statistical, also the information as given in tabular form. The book concludes with two indexes, one of which is an alphabetical index of all the railroads in the country, and the other a general index of subjects.

REPORT OF THE SECOND ANNUAL CONVENTION OF THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION, ST. LOUIS, MO., 1904. Size, 6 x 9 in.; 165 pages. The publication includes, besides the minutes of the second annual meeting of the association held in the Transportation Building, World's Fair Grounds, Oct. 10th, 11th and 14th, a list of the officers of the association since its organization; registrations of members and delegates; list of new members who joined during the convention; papers read before the convention and their discussion; the question box; the constitution and by-laws and list of members of the association. A very fine portrait of ex-president Edwin W. Olds, adorns the frontispiece, while a novel feature of the cover design is a reproduction of the badges worn at the last convention.

LETTERS FROM AN OLD RAILWAY OFFICIAL TO HIS SON, A DIVISION SUPERINTENDENT. By Charles De Lano Hine. The Railway Age, 5 x 7½ in., 179 pages. Price, $1.50. This very interesting and instructive publication has received much favorable comment not only from the press but from many railroad officials throughout the country, all of which it deserves. The volume consists of 24 letters which originally appeared in the Railway Age from time to time and touches upon all the branches of the operating department in a manner both bright and interesting, professional slang of the road being dispersed throughout the chapters in a most effective manner. While there is a vein of pleasantry and humor running through these letters, which makes them bright.

[illegible] young railroad man will find invaluable information and instruction therein and keep them for reference and refreshment at frequent intervals.

ANNUAL STATEMENT OF THE COMMISSIONER OF EDUCATION to the Secretary of the Interior. Advance sheets from the United States Bureau of Education. Chapter XXXVIII, Manual and Industrial Training; Chapter XXXIII, Universities, Colleges and Technological Schools; Chapter XXXVII, Statistics of Secondary Schools. These recent publications of the Bureau of Education and the report of the commissioner of education are a collection of such statistics and facts as show the condition and progress of education in the public schools and colleges of the United States. To obtain the items of information required to tabulate the statistics of the schools of the United States 25 different forms of inquiry were sent out to school officials and institutions. The items of information called for in these forms number in all 740, and the different schedules sent in to be tabulated amount to 19,894. One may judge from this the scope of the report and advance sheets.

THE BOSTON TRANSIT COMMISSION'S TENTH ANNUAL REPORT FOR THE YEAR ENDED JUNE 30, 1904. Cloth, 107 pages, with maps and illustrations; 6 x 9¼ in.; published by the Commissioners, B. Leighton Beal, secretary. The report first deals with the East Boston tunnel, construction work on which was substantially completed with the exception of the street covering for the Atlantic Ave. station due to a controversy between the company and the commission as to which party should bear the expense of the installation of the elevators and the necessary machinery. The report next deals with the exhibit at the Louisiana Purchase Exposition, the exhibit made by the commission at the Paris Exposition and the Pan-American Exposition being brought up to date and sent to the Louisiana Purchase Exposition. Following this is the report of the condition of the debt and of the sinking funds for the various divisions of the work of the commission at the date of the report. The report of the chief engineer, H. A. Carson, is next given, which is practically a brief sketch of progress on the East Boston tunnel during the past year, including the details of construction, character of the excavated earth, relocation of pipes and conduits, reconstruction of the sewerage system and tests of concrete beams.

THE ELECTRIC TRANSMISSION OF ENERGY, by Arthur Vaughan Abbott, C. E.; 664 pages; 109 tables; 365 illustrations; 16 full page engravings and 10 folding diagrams; price $5.00. Published by D. Van Nostrand Co., New York. The fourth edition of this book which has been recently published has been entirely rewritten and enlarged. After touching upon the elementary principles of distribution in general and properties of wire the author devotes several chapters to the construction of aerial circuits. This is followed by several chapters on underground and special railway circuits in regard to all of which the author goes into considerable detail. The various electric instruments and methods of electrical measurement commonly used are discussed at considerable length. Afterwards the subject of continuous current and alternating current conductors is considered. A special chapter is devoted to the subject of polyphase transmission and a final chapter is devoted to the cost of production and distribution. The author has collated various methods of circuit construction which have been sanctioned by the best practice and the book is up to date and is not burdened with obsolete and antiquated matter. The mathematical portions have been treated as simply as possible, the simplest formulæ being given without any attempt to deduct them and only the simplest applications of the calculus are involved. The book will be found to cover the field of electrical transmission very thoroughly.

ELECTRIC LIGHTING, Volume I; The Generating Plant. By Francis B. Crocker, Ph. D.; 47 pages; 213 illustrations; sixth edition; published by D. Van Nostrand Co., New York. The first edition of this book appeared in 1896 and has been used as a text book for several years in a number of engineering schools. The present edition has been practically rewritten and many illustrations of the earlier type of apparatus have been replaced and much new matter has also been introduced. This portion of the work relates only to generating plants and therefore the work applies to a certain extent to railway, power and other electric plants. After a brief history of electric lighting and a chapter on units and measurements, the work takes up the classification of different kinds of lighting plants and their location and general arrangement. The books then considers the equipment of the power plant, beginning with the building, boilers, engines and other prime movers, and follows this with the principles of dynamo electrical machines and a number of chapters on the electrical equipment of lighting stations. Among these chapters the subjects of storage batteries, switchboards, electric measuring instruments and lightning arresters are included, covering the entire equipment of an electrical lighting plant. The plan adopted in the book is to follow up the sequence in which the electrical current is generated, transmitted and utilized, and the most modern practice in generating plants for electric lighting is well covered in this book.

SELF PROPELLED VEHICLES, by J. E. Homans; second edition; 644 pages; 461 illustrations; price $2.00. Published by Theo. Audel & Co., New York. This book is a practical treatise on all the types of automobiles in use at present and is designed for the practical information of owners and operators of machines who do not care to make more of a study of mechanics than is necessary for the handling and operation of their own automobiles. As it is obviously impossible within reasonable space to include specific descriptions and directions for the management of the large number of practical motor carriages now on the market the author has confined himself to explaining the theory, construction and operation of typical machines as briefly and thoroughly as possible and has produced a work which cannot fail to be of use to any one handling automobiles. The book opens with a description of the different types of automobiles on the market and an analysis of the advantages of the different kinds of machines. This is followed by a historical chapter giving a review of the early types of machines, after which the general theory and construction common to all classes of automobiles are explained and illustrated. Following this are very complete descriptions of gasoline engines, electrically propelled machines, steam engines, and boilers. One of the most important chapters is that on gasoline vehicle operation which is very complete and contains a large number of useful hints. The book concludes with a complete subject index which will prove of great advantage for ready reference.

POOR'S MANUAL OF RAILROADS IN THE UNITED STATES, thirty-seventh annual number, 1,600 pages; 24 colored plate street and group maps, and 44 maps of leading railroads; price $10.00. Published by Poor's Railroad Manual Co., 6 Williams St., New York. The statements presented in Poor's Manual for 1904 are arranged in four sections, the first comprising statements of all steam railways in the United States, Canada and Mexico; the second comprises statements of all the street railways and traction companies in the United States; the third comprises statements of the leading industrial corporations and organizations auxiliary to the railway interests; and the fourth contains statements showing the finances and resources of the United States and the individual states and the chief counties, cities and towns in the country. The introduction to this book gives the general exhibits of the railroads of the United States for the fiscal year of 1903 and shows the length of railroads completed on Dec. 31, 1903, to be 207,783.82 miles, and there was completed since the close of the fiscal year 897.83 miles. This gives a net increase of mileage of all railroads in the United States for the calendar year of 1903 as 4,774.61 miles. The general statistical information contained in the present number of Poor's manual is of the same character as that of the previous issues but has been brought thoroughly down to date. This work is too well and favorably known to financiers and the investing public to need special description. It is unique in being the only publication of its kind which has been thoroughly successful in presenting complete and reliable information in regard to railroads, and with each succeeding year new matter has been added which constantly increases the value of the manual as a reference book.

A contract has been awarded to the Joliet, Plainfield & Aurora Railroad Co. for the handling of United States mail between Aurora and Joliet, three trips being made daily except Sundays and holidays.

The Pacific Electric Railway Co., Los Angeles, Cal., has just finished planting a poppy field 16 ft. wide along its tracks for a distance of about two miles between Monrovia and Alhambra junctions. When the poppies begin to bloom they will be widely advertised by the railway company.

J. A. Hanna Co.

Twenty years ago Mr. J. A. Hanna entered the street railway field as storekeeper for the J. G. Brill Co., and last month the company bearing his name assumed the sales agency for the entire output of the Niles Car & Manufacturing Co. in addition to the western agency of the Peckham Manufacturing Co., which latter he has held for nine years. During this period the 10-ft. to 16-ft. horse cars have gradually devolved into the 50-ft. to 60-ft. electric interurban cars, and Mr. Hanna has sold successively Brill, Jewett and the Stephenson cars and the McGuire and Peckham trucks in various parts of the country without the loss of a day's time and under improved conditions at each change. Mr. Ford A. Richards, who was previously connected with the Peckham company, and has been in the employ of Mr. Hanna for the past three years, is associated with the new company, and will assist Mr. Hanna as salesman. In view of the financial conditions now generally prevailing, Mr. Hanna is optimistic as to the business for 1905, and believes that all makers of street railway material will be running at full capacity before summer. His decision to take the Niles car agency was largely influenced by the advice of a number of railway men now using Niles cars. As the plant of both the Peckham and Niles companies are modern and finely equipped for economical production and their products are widely and favorably known, it would appear, in connection with the large acquaintance of Messrs. Hanna and Richards, that the new firm will receive a generous patronage.

Electrical Equipment of the Williamsburg Bridge.

The electrical equipment of the double track road over the New Williamsburg bridge, which is to be operated by the Brooklyn Heights R. R. Co., has just been completed by J. G. White & Co.,

VIEW OF SPECIAL OVERHEAD TROUGHING.

of New York, who did this work for Naughton & Co., who had contracted for all the track and overhead work. All of this work is of standard construction throughout and is of unusually heavy style. The Manhattan overhead construction is of steel lattice girders supported on steel poles and also attached to the bridge structure proper. The work [illegible] this terminal. The details of the special overhead troughing at this place are shown in the accompanying illustration. Along the approaches to the bridge [illegible] the double track. [illegible]

VIEW OF ROADWAY AND BRACKET ARM.

structure and the two trolley wires are supported by a span wire running under the bracket arm.

There are about 10,000 lineal feet of single troughing, built of oak, fitted with expansion joints at intervals. This is supported every 20 ft. on transverse girders by cleats and at intermediate points by special hangers attached to cross beams fastened to the longitudinal girders. The trolley wire is No. 000 phono-electric type supported every 15 ft. by specially designed insulating hangers.

As there is an expansion and contraction of about 14 in. at each anchorage a specially designed expansion joint has been devised for the trolley wire. This operates very satisfactorily, causes no sparking of the trolley wheel and requires no insulated section. The joint is 8 ft. in length.

There are eight miles of overhead positive feeders and seven miles of negative return feeders along the track. These are all standard weatherproof aluminum cables of 782,000 cm. section.

On the Brooklyn approach near the bridge tower is erected a steel frame switch-house covered with corrugated iron from which point the overhead and track feeders extend. On the Brooklyn plaza two steel poles are erected for the overhead work. This work was done according to the Brooklyn Heights R. R. specifications, necessitating special patterns of overhead material.

The work was constructed for the department of bridges of New York city, under the direction of Mr. Kinsey L. Martin, engineer in charge of the Williamsburg bridge, and the entire construction reflects great credit upon the sub-contractors, J. G. White & Co.

The street railway of Padua, Italy, is to be taken over by the municipality.

The Board of Health, of York, Pa., has deputed ten conductors in the employ of the York Traction Co., to enforce the anti-spitting ordinance pertaining to trolley cars. The conductors are authorized to make arrests for violations of the ordinance coming under their notice.

Park Seats.

The increasing number of street railway parks and pleasure resorts has considerably augmented a demand, already existing in connection with stations and waiting rooms, for various pieces of iron and wood work which should not only be attractive to the eye, but, being necessary for public use, should be strong and durable. Among the essentials for park and station requirement are benches or settees, several type of which are illustrated herewith. The makers of the settees shown are M. D. Jones & Co., 71 and 73 Portland St., Boston, one of the oldest concerns in this business, and one whose products are found in public and private grounds in all parts of the country.

FIG. 1—CENTRAL PARK BENCH.

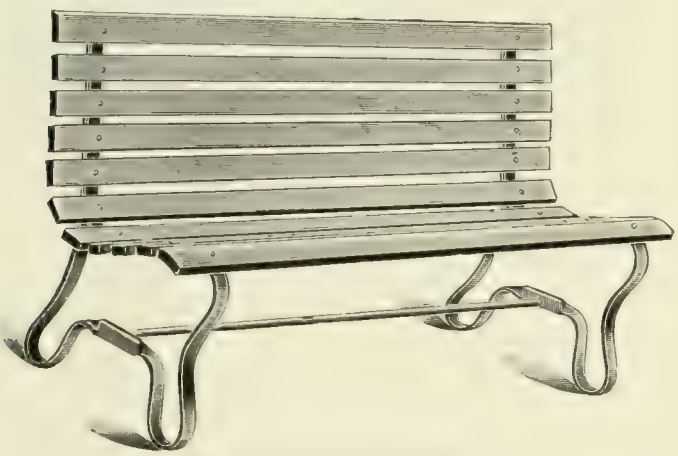


FIG. 2—WROUGHT IRON SETTEE.

Fig. 1 is what is generally known as the Central Park settee, a type that the firm has made for over 30 years. This is quite a strong design, with cast iron legs and hard wood slats, and is made in 5-ft. and 7-ft. lengths; the 7-ft. benches have three legs instead of two. These settees can be packed knocked down for shipment.

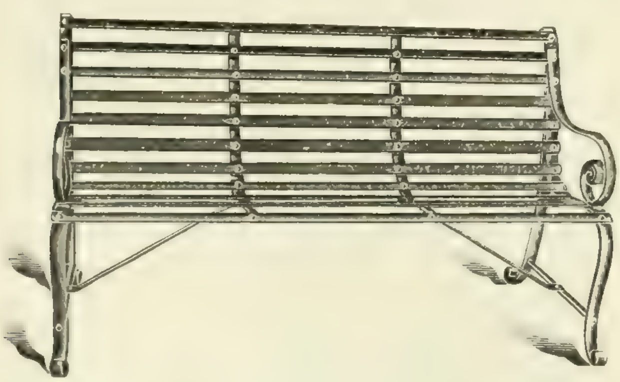


FIG. 3—ALL-STEEL SETTEE.

Fig. 2 is the Jones wrought iron settee, a design that has been manufactured for several years. The legs in this type are of wrought iron; to these are bolted 11 slats of hard wood, making a seat for public use that is very strong and durable.

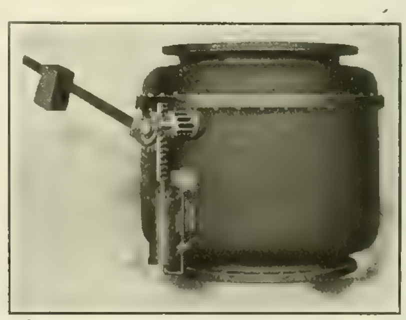
Fig. 3 shows the Jones all-steel settee, which is made in the standard 5-ft. and 7-ft. lengths, and can be made any length required. This type of bench is coming into general use and besides parks is especially adapted for street railway, elevated and subway stations.

Jones & Co. also makes seats of rustic design, using laurel roots and cedar.

M. D. Jones & Co. manufacture all kinds of ornamental iron and wire work adapted for public and private grounds, such as small and large ornamental vases in iron, ornamental fountains and drinking fountains, garden borders, wire fences, arches, trellises, rustic wood arbors, vases, etc.; also for conservatories and inside window gardens, plant stands, brackets, rustic wood hanging baskets, etc. The firm publishes a complete illustrated catalog, sent on application.

Davis Combination Back Pressure and Relief Valve.

A recent invention of Mr. G. C. Davis, of the G. M. Davis Engineering Co., 144 Milwaukee Ave., Chicago, is that of a combination back pressure and atmospheric relief valve, which is illustrated herewith. This valve is designed to automatically change from vacuum conditions to pressure and from pressure conditions to vacuum, thereby obviating the necessity for two valves and the extra amount of piping that is often entailed to arrange for running an engine condensing at one time and non-condensing at another. As in the well-known Davis standard noiseless back pressure valve, there is also embodied in this valve a differential semi-balanced disk. The upper or main disk is of the full area of the inlet pipe and seats on steam metal and babbitt surfaces. The lower or semi-balanced disk has no positive seat but operates in a large dash pot and is made tight with bronze expansion rings. The diaphragm attachment and accompanying connections make possible the automatic features, with which —in combination with the different seats—it is able to hold a back pressure up to 20 lb. or a vacuum of 29 in. without changing or adjusting any part of the valve. A 10-lb. weight is required on the lever arm, a feature which appeals to the users of single seated valves.



DAVIS BACK-PRESSURE VALVE.

A large number of these valves have been installed in street railway power plants in connection with the Curtis turbines, ranging in sizes from 12 in. to 24 in., among which may be mentioned the following: Public Service Corporation, Newark, N. J.; Chattanooga Light & Power Co., Chattanooga, Tenn.; Binghamton Light, Heat & Power Co., Binghamton, N. Y.; Northern Ohio Traction Co., Akron, O.; Columbus Railway Co., Columbus, O.; Saginaw Valley Traction Co., Saginaw, Mich.; Oshkosh Electric Light Co., Oshkosh, Wis.; Meridian Light & Railway Co., Meridian, Miss.; Pennsylvania Railroad Co., Greenville, N. J.; International Light & Power Co., El Paso, Texas.

Fifty new cars are now being built for the Cincinnati Traction Co., and larger platforms are being put on 50 of the old cars.

The Rockford, Beloit & Janesville Interurban company and other interurban companies in northern Illinois are arranging a through train service between Janesville and Illinois cities to run in opposition to the steam railways.

Semi-Convertible Cars for Jersey Central Traction Company.

The accompanying illustration shows one of a number of cars recently completed by the J. G. Brill Co. for the Jersey Central Traction Co. The cars are the builders' patented semi-convertible type and are for service between Keyport, Matawan and Red Bank, towns of eastern New Jersey, Keyport being on Raritan Bay. The lines are 18 miles in length and an 18-mile extension to South Amboy is under construction. The lines serve a large population which is considerably increased during the summer season. The seating capacity of each car is 40 passengers, the seats being of the step-over type 36 in. long and the width of the aisle 22 in. The windows at the rear of the car, which are raised into roof pockets, give an idea of the appearance of the car when open for summer service. The low window sills, the height being 24⅝ in. from floor to top of sill, are considered to be a decided advantage in a car of

BRILL CAR FOR JERSEY CENTRAL TRACTION CO.

this type, and all the semi-convertible cars of this type are being built with low window sills. The lower sash measures 26½ in. over the frame and the upper 17¼ in., both together weighing 17 lb. As there are ten windows to a side, there is 170 lb. weight of sashes when raised in each side roof, three-quarters of which weight bears vertically on the tops of the posts. This excess of weight, though small, is amply compensated for in the extra strong construction, including a heavier letterboard than usual. The general dimensions of the cars are: Length over end panels 28 ft.; over vestibules 37 ft. 5 in.; platforms, 4 ft. 8½ in.; width over sills, 7 ft. 10½ in.; over posts, at belt, 8 ft. 2 in.; from under the side of side sills over trolley board, 9 ft. 9¾ in.; sweep of posts 1¾ in.; thickness of corner posts, 3¾ in. and of side posts 3¼ in.; from center to center of side post, 2 ft. 8 in.; side sills, 4 x 7¾ in., with 12 x ⅜-in. plates on the inside; end sills, 5¼ x 6⅞ in. Most of the load of the platforms is carried on angle iron center knees which extend well back of the body bolsters, thus relieving the ends of the car from platform strains. The cars are furnished with the builders' patented specialties, among which include the following: Angle iron bumpers, radial drawbars, "Dedenda" gongs, "Retriever" conductor's bells, "Dumpit" sand boxes, track scrapers, window sill arm rests and ratchet brake handles. The cars are mounted on Brill No. 27-G trucks with 4-ft. wheel base, 33-in. wheels and 4-in. axles.

World's Fair Awards.

In addition to those awards mentioned in the "Review" for November and December, the following were made to the exhibitors at the Louisiana Purchase Exposition:

J. A. Fay & Egan Co., of Cincinnati, O., which manufactures woodworking machinery, was awarded a medal on the fine operation of one of its tools. The company had no regular exhibit, but some of its tools were shown and operated by other concerns for exhibiting their various products, which required some woodworking tools.

The National Carbon Co., Cleveland, O., has been awarded a grand prize for all carbon products exhibited by this company, including carbon brushes for motors and generators, Columbia dry batteries, Columbia carbons for long burning enclosed arc lamps, carbon electrodes and telephone specialties.

The Shepherd Engineering Co., of Franklin, Pa., has been awarded the gold medal for its engines by the Philippine Government Board at the Louisiana Purchase Exposition, for their excellency of de- [illegible] periority.

The Sloan Sleet Cutter.

The W. R. Garton Co. [illegible] patent for which is pending. It embodies new features and new characteristics [illegible]

SLOAN SLEET CUTTER.

devices used for this purpose, there are no loose parts to lose or become misplaced, and it can be placed in position or taken off the trolley in a very few seconds. It is very readily applied, and the readiness with which it is attached and removed is one of the particular features. Another of the very striking and desirable points is that of the hump on the back. This serves a purpose which is highly appreciated by railway men, viz., that it overcomes the possibility of the sleet cutters wedging in the bridles, frogs, crossings or other angular points in the overhead construction. Actual experience has proven that this cutter will save overhead material and construction where other cutters have proven defective.

This cutter has been in actual service for about one year, during which time the manufacturer was eliminating all points of weakness and adding those which were found necessary. The sleet cutting shoe is detachable and is readily placed in position and held there by means of two screws. The cutter is so arranged as to snap into place, the hook on the bottom of the cutter conforming to the groove in the wheel and the outer end of the cutter being attached to the pole by means of a spring snap. These can be carried on cars and taken off or detached in a moment's time, and, as there are no loose pieces, the likelihood of some part being missing is entirely obviated. The cutter is very slight, consistent with necessary strength, and the general outlines are pleasing and consistent with good construction and necessary rigidity.

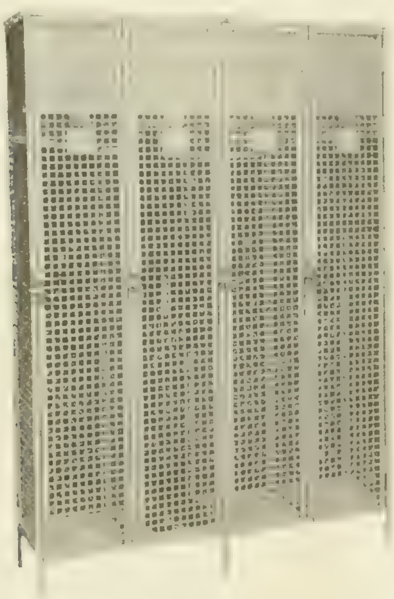
Forty Kuhlman Cars for Rochester.

The Rochester Railway Co., of Rochester, N. Y., has within a short time added to its equipment 40 new cars built by the G. C. Kuhlman Car Co. Twenty of these cars are semi-convertibles built under the Brill patents, and 20 have sashes which drop into pockets in the side walls. All the cars are mounted on Brill trucks; those of the semi-convertible type are carried on No. 27-G trucks, while those with the dropped sash windows are on No. 34 type. The general dimensions of both styles of cars are the same and are: Length over end panels, 28 ft.; over vestibules, 39 ft.; width over sills, 7 ft. 6½ in.; over posts at belt, 7 ft. 9 in. The side sills are 4 x 7¾ in. and end sills [illegible] ness of corner posts, 3¾ in., and of side posts, 3¼ in. Cherry in natural color constitutes the interior finish and the ceilings are of birdseye maple. Seats are of the Brill step-over type 36 in. long, and the aisles of the semi-convertible cars are 22 in. wide. All the cars are equipped with track scrapers, sand boxes, platform gongs,

brake handles, and bumpers of Brill manufacture. The arrangement of seats in the car with windows which drop into wall pockets is that shown in the Rochester cars illustrated in the "Review" for [illegible] page [illegible]. Longitudinal seats extending half the length of the car are placed at diagonally opposite sides with transversely placed double seats opposite. This arrangement provides a wide aisle and, at the same time, balances the load. The Rochester Railway Co. operates nearly 250 cars and has a trackage of more than 150 miles. The lines enter the city from all directions and converge at the business center. Several of the finest amusement parks in the country are owned and operated by the railway company; one of them is at Sodus Bay and is reached by a line 40 miles long which traverses the picturesque valley of the Genesee River.

Steel Lockers.

The problem of disposing of wearing apparel of employes while engaged in their daily labor has long been a troublesome one for the managers of factories, stations, stores and other places where a large number of people are employed. The introduction of all steel lockers, however, has practically overcome all the objections met with in the old style of wooden lockers. The latter have always proved unsanitary, and the dust and dirt from umbrellas, boots and clothes has proved one of the most objectionable features. The lack of ventilation in case the clothing was a little damp soon made such lockers mouldy and foul smelling. The pen-dar metal lockers made by Edward Darby & Sons Co., of Philadelphia, are constructed entirely of steel, thus doing away with the most objectionable features of wooden lockers.



[illegible] PEN-DAR STEEL LOCKER.

One of the many forms of lockers made by this company is illustrated herewith. The frame and supports of these lockers are of angle iron braced and riveted, and the fronts, sides and bottom are of open mesh, permitting a free circulation of air. The backs and tops are of sheet steel. Each locker has a shelf, nickle plated coat hooks and a three-point combination lock, which fastens at the top, bottom and side of the door with one motion. Duplicate keys are provided and each set is mastered. They are made in groups of any convenient number. These lockers have been highly endorsed by Fire Underwriters because, being of open mesh, the contents can be inspected at will and any fire starting within a locker can be instantly discovered. If necessity for fumigation should arise an entire locker room can be treated without removing a single garment from its locker. They are furnished in neat and attractive styles and the great number of these lockers installed is ample proof of their desirability.

The employes of the York County Traction Co. and the York Street Railway Co., York, Pa., have incorporated under the title, "Beneficial Association of Street Railway Employes."

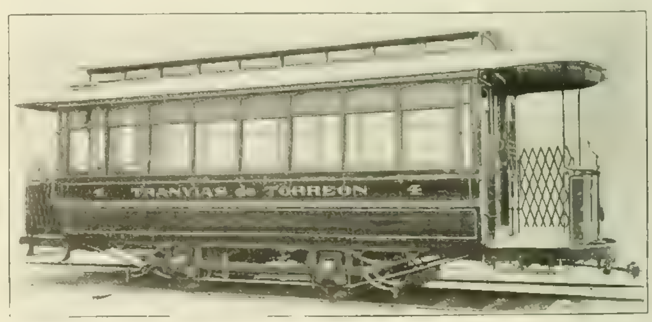
New Cars for Torreon, Mexico.

The American Car Co. has lately shipped a number of open and closed cars to the Tranvias de Torreon, Mexico, two of which are shown in the accompanying engravings. Torreon is one of the principal commercial and railway centers of northern Mexico and is about 400 miles north of the city of Mexico. The closed cars, which have 20 ft. 8 in. bodies and are 28 ft. 8 in. over the crown pieces, have transverse seats upholstered in cane and are of the step-over type furnishing a seating capacity of 32. The lower sashes of the windows are arranged to drop into pockets in the side walls and the upper sashes are stationary. Double corner posts are used with glass set in between, which give a pleasing appearance as well as provide extra strength.

OPEN CAR FOR MEXICO.

The distance between the side posts is 29 in. and the sweep of posts is 5 in. The width over sills is 7 ft. 5 in.; over posts at belt, 8 ft. 2 in.; side sills, 3½ x 5⅜ in.; end sills, 3½ x 6⅝ in.; thickness of corner posts, 3½ in.; of side posts, 1¾ in.; seats, 33 in. long; aisle, 18½ in. wide. Folding gates of the Brill patented type are provided at the platform entrances and are hinged to the car body. The height from rail to platform step is 18½ in. and from step to platform 13 in.

The open cars are 27 ft. ½ in. over crown pieces. From bulkheads over crown pieces is 3 ft. 2 in.; width over sills including sill plates, 6 ft. 3 in.; over posts at belt, 7 ft. ½ in.; sweep of posts, 5 in.; from center to center of posts, 2 ft. 8 in.; side sills, 3¾ x 7 in. with 7 x ½-in. sill plates; thickness of corner posts, 3⅝ in.; of side posts, 2¾ in.; from rail to step, 17¼ in.; from step to car floor, 15¼ in. All the cars are equipped with angle iron bumpers, ratchet brake handles, "Dedenda" gongs, of the Brill make, and the open cars have Brill patented round-corner seat-end panels. The trucks are Brill No. 21-E type having 7-ft. wheel base and 33-in. wheels, and are equipped with 35-h. p. motors.



CLOSED CAR FOR MEXICO.

The employes of the Santa Barbara Consolidated Railway Co., Santa Barbara, Cal., have organized a club for the purpose of pleasure and study. The plan is to lease rooms, which will be suitably furnished, and the local instructor of the International Correspondence School will have charge of the classes in instruction.

Package and express service has recently been inaugurated on the lines of the Stark Electric Railroad Co. between Canton, Louisville, Alliance, Damascus and Salem, O., and arrangements are contemplated with other electric lines by which Akron, Massillon Navarre, Canal Dover, New Philadelphia and Uhrichsville will be reached.

The Lima Insulator.

The W. R. Garton Co., 118-132 West Jackson Boulevard, Chicago, has recently closed a contract with the Lima Insulator Co. of Lima, N. Y., to act as its exclusive general western agent. The Lima company is manufacturing a high grade of high tension porcelain insulators, giving especial attention to details with a view to securing results of the highest standard. The accompanying engraving shows the insulators which are being placed upon the market by the Garton company, being gas fired, of excellent white and brown porcelain and of an attractive form. The W. R. Garton Co. has spent several years giving close attention to the requirements of high tension work and are prepared to serve the trade intelligently and faithfully in this particular, and the Lima Insulator Co. will gradually increase its facilities until it is able to meet the demand of prompt deliveries of the very large increased trade which is anticipated for the coming year.

DIFFERENT TYPES OF LIMA INSULATORS.

New Sturtevant Generating Set.

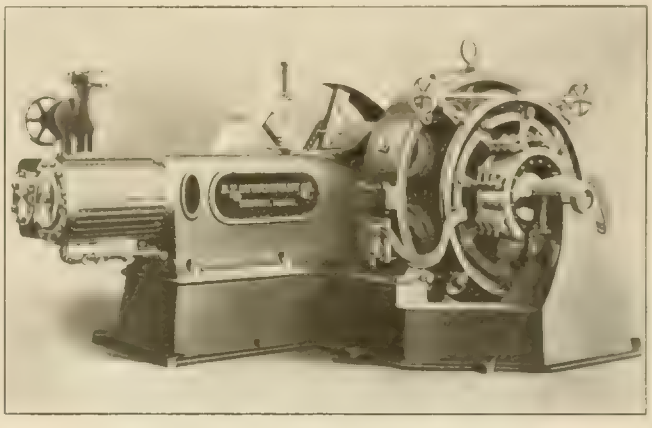
In response to the demand for a high-class generating set at reasonable cost, the B. F. Sturtevant Co. of Boston, Mass., has developed the type, illustrated herewith.

The general design of the engine embodies all the latest improvements to the horizontal type. The reciprocating parts are substantially constructed and counterbalanced with lead load disks. A feature of construction is that of forging the crankshaft solid in one piece and shrinking the disks onto it. A special arrangement of the Rites' governor gives a regulation within 1 to 1½ per cent from full load to no load, and by a modification of the Marshall valve gear an adjustment of the cut-off from zero to 70 per cent is attained. The main bearings, crank pin, valve stem and slides of this engine are well babbitted with the Sturtevant white metal. A recent and important improvement is that water-shed partition which prevents the water from the piston rod stuffing box from reaching the interior of the engine frame, and the oil on the reciprocating parts from being thrown out into the engine room. The main body of the engine is enclosed on both sides by movable plates, as may be seen from the illustration, and the crank webs are enclosed by a cast iron hood having two holes with removable covers, one for the purpose of cleaning the crankpin box while the engine is in motion and the other for removing the box without taking off the large hood. Between the water-shed partition and the front end of the cylinder, is a hand hole for reaching the stuffing box bolts without communication to the oil spaces.

There are two oiling systems for this type of engine, the gravity or tank system and that by forced pump lubrication. With the gravity or tank system, shown in the illustration, an oil tank supplies the pipes leading to the parts to be oiled. At each point where the oil is delivered is a little gage glass and valve for regulating the flow at that point. A valve just below the tank regulates the entire oiling system.

With the pump, or forced lubricating system, a pump is located in the base of the engine and is operated by the crank-shaft. Oil is delivered from this pump to the main bearings and from the main bearing through [illegible] pin. From this point the oil is conducted up through a hole in the connecting rod to the crosshead pin. A separate set of pipes conveys the oil from the crosshead guides to the valve stem guides. The pressure of oil in the bearings under this system will vary from 12 to 18 lb. per sq. in. The mechanical efficiency of the engine is so materially increased by this system of lubrication that its demand is rapidly increasing.

The generator of this set is of the eight-pole type, and is capable of carrying momentary over-loads of 50 per cent without any shifting of brushes or flashing of the commutator and an over-load or 25 per cent for a period of two hours without undue heating. After a continuous run of ten hours at full load, the increase in temperature above that of the surrounding air never exceeds 40° C upon the armature and field coils, and 45° C., upon the commutator. The average temperature rise is about 33° to 35° C. Before being shipped, the generator is given a break-down test of 1500 volts, alternating for sixty seconds between the conductors and the frame of the machine to test the insulation.



STURTEVANT GENERATING SET.

The magnet frame is of the very best grade of cast iron, split horizontally. The pole pieces are of wrought iron with cast iron shoes or horns and are secured to the magnet frame by through bolts. Any of the pole pieces may thus be removed to repair the field coils. The latter are wound up in two sections, with an air space between the shunt and series coils. The shunt winding is of double cotton covered magnet wire of highest conductivity, thoroughly insulated and so treated as to be practically waterproof. The series winding is of solid copper bars, insulated in the same manner as the shunt coil.

The armature is of the ironclad, form wound, ventilated drum type, having a core built up of charcoal iron plates, which plates, after being thoroughly japanned, are mounted upon a cast iron spider and securely held in position by end flanges. No bolts pass through the armature laminations. The armature spider has an extension

[illegible] and commutator one unit.

The armature conductors are solid copper bars, without joints except at the commutator end. When these bars are formed they are insulated by material not perceptibly affected by heat or ordinary atmospheric moisture.

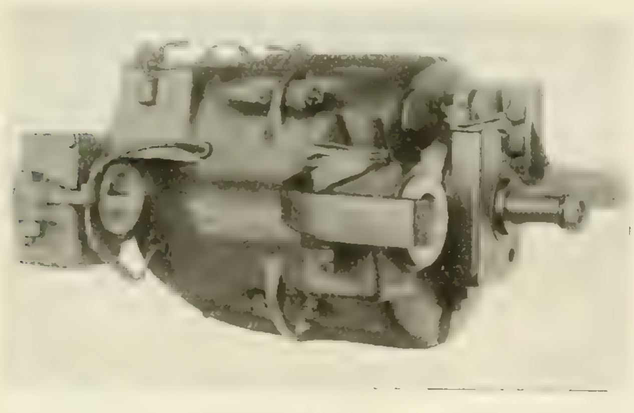
In the construction of the commutator, only drop-forged or drawn segments are used, these being secured in cast iron shells of spider construction and clamped in place with a steel ring. No cast segments of any nature whatever are used. The segments are insulated with the best quality of carefully selected mica of a degree of hardness to allow the mica and segment to wear uniformly, obviating trouble from high mica. The end insulation consists of micanite rings, and the whole commutator is assembled while hot, under great pressure. Carbon brushes only are used, the commutator being so proportioned and the brushes of such size as to allow at least one square inch of brush area to every 30 amperes carried. These brushes are carried in holders of most approved construction, each mounted upon a self-contained brush rigging so arranged that the entire set of brushes may be rotated completely around the commutator.

Hand wheels are furnished for adjusting the brushes in position, these hand wheels being so located that the brushes may be adjusted from either side of the generator.

Westinghouse Railway Motor No. 92-A.

The Westinghouse No. 92-A railway motor, a general view of which is shown herewith, is designed to perform the same class of service as the No. 49 motor, but differs from the latter in several important details. Its design closely resembles the Westinghouse Nos. 93 and 101 B motors.

The new model is designed for both city and suburban service. In city service a double equipment is suitable for operating single or double truck cars weighing from 14,000 to 15,000 lb. without equipment or load. In this service with stops 1/8 to 1/4 of a mile apart a double equipment with gear ratio of 14 to 68 will produce schedule speeds of 10 to 13½ m. p. h. with 500 volts pressure and a straight level track. A four-motor equipment will operate a double truck car



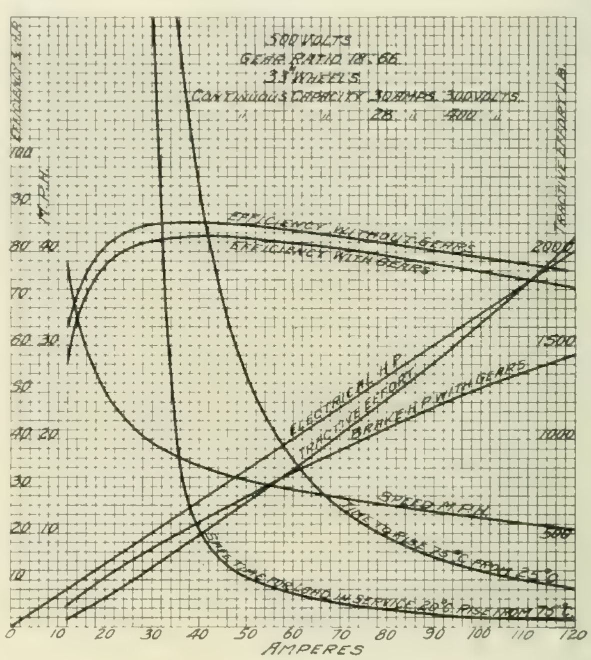
WESTINGHOUSE NO. 92-A MOTOR.

weighing 30,000 lb. attaining practically the same speeds just mentioned. The No. 92-A motor has a nominal rating of 35 h. p. for one hour but this is only an approximate indication of its suitability for a given service

A study of the accompanying curves is necessary to determine the suitability of this motor for any particular condition of service. This motor has a continuous capacity of 30 amperes at 300 volts or 28 amperes at 400 volts. A shop test of 24 hours at these loads showed that the temperature rise in the windings will not exceed 75° C. In actual service the better ventilation will reduce this rise in temperature considerably.

The frame is approximately cylindrical and consists of two steel castings accurately fitted. These are hinged together allowing the lower frame to swing downward. The armature may be swung down with the lower frame or may be retained in the upper frame. Access to the commutator or brush holders is provided by an opening in the upper frame which is closed by a dust proof lid. Hand holds are provided in the lower field which are closed by watertight covers. The four poles project inward at an angle of 45°. These are built up of annealed punchings riveted together between wrought-iron end plates and bolted to the frame. The field coils are wound with copper strap insulated with asbestos and mica and several layers of tape. The coils are machine wound and are interchangeable and are held in place by flat steel springs.

The armature is of the slotted drum type built up of circular punchings of soft steel mounted on a cast-iron spider. Special attention has been given to providing air ducts through the armature to insure good ventilation and a uniform temperature throughout. It is wound with machine formed coils, heavily insulated, which are imbedded in slots on the armature.



CHARACTERISTIC CURVES OF WESTINGHOUSE 92-A MOTOR.

The commutator is of the straight bar type without necks and comprises 123 bars of hard drawn copper.

The cast brass arms bolted to the upper frame carry the brushes. The latter are copper plated carbon and each is ½ x 1½ in. in section. The armature bearings are of large size, each bearing consisting of a cast-iron bushing in one piece lined with babbitt. Each bearing is carried in a housing of cast-iron which is held in place by tap bolts through both the upper and lower frames, and turning is prevented by a key. These housings contain an oil and waste reservoir covered by metal caps held by springs.

The axle bearings consist of iron shells divided horizontally and lined with babbitt. Each is eight inches long and may be made for any diameter of axle up to five inches. Lubrication is obtained in a manner similar to that of the armature bearings.

The No. 92-A motor is designed for cross-bar suspension. The pinions are forged steel, the gear, which is in two parts, is of cast steel, the face being five inches. The gear case is of malleable iron in two castings. This is made to bear very hard service and the gears may be run in oil if desired. The motor complete with gear case weighs 2,320 lb. and a two motor equipment with two controllers weighs approximately 5,680 lb. A four motor equipment with controllers, etc., weighs about 10,900 lb.

Street railway employes at Binghampton, N. Y., were recently tendered a reception at the Binghampton Public Library in order that they might become acquainted with the many valuable books on electricity and the many advantages that institution holds out to them.

Les Tramways Florentins, which is a joint stock company with a capital stock of 8,250,000 lire ($1,650,000), began operation Apr. 6, 1880, and now has 48 miles of steam and 28 miles of electric road in operation. The traffic manager is Alfredo De Bonia, and the chief engineer Domenico Spallicci.

Accidents.

December 17th, during a snow storm, a north bound car on the Allentown & Slatington Street railway had a head on collision with a south bound car, five miles from Allentown, Pa. Two persons were killed and of the 60 passengers on the north bound car it is stated, very few escaped injury.

December 24th, one man was killed and nine others injured in a crash between an outbound Eighth and Central St. car and a Northern Pacific switch engine at Minneapolis, Minn. The accident was due to a misinterpretation of the signals between the crossing watchman, the motorman and the engineer.

December 25th, nine passengers, the motorman and the conductor of an electric car on the Camp St. line were injured at Providence, R. I. The car got beyond the control of the motorman going down a hill, at the foot of which the car jumped the track and ran into a pole on the west side of the street.

December 30th, an eastbound Wabash freight train crashed into a Halsted St. car of the Chicago Union Traction Co., and of the 10 passengers five were injured, one seriously.

December 30th, in the destruction by fire of the repair shop of the Chicago Union Traction Co. at Washington Boul. and Harding Ave., two firemen were killed and three injured in fighting the flames.

Tranvias de Salamanca.

The Ferrocarril Urbano de Salamanca is the name of the company which controls the street railway of Salamanca, Guanajuato, Mexico. The line, which is 1,500 meters in length, starts at the principal square of the town and runs to the Mexican Central and Mexican National railway stations, passing through the principal streets. The motive power is animal and the equipment of the road consists of two coaches for handling passengers and two platform cars for handling freight. The principal offices of the company are at Calle del Angel No. 18, Salamanca, and the officers of the company are: President, general superintendent and purchasing agent, Federico Garma; secretary, Enrique Santa Maria; treasurer, J. Dolores Gonzales; manager, Pedro Vasquez.

LINE IN SAN VICENTE VALLEY.

This company also controls the railway in the hacienda of San Vicente, situated in the valley of Santiago, state of Guanajuato. This line is 2,250 meters long, principally for service in the hacienda of San Vicente, although the company handles business for the neighboring haciendas, delivering both freight and passengers at the Garma station of the Mexican National R. R., where the line connects with that railway. The company has for this service a tramway car with a capacity for 25 persons, and for freight service two platform cars with a capacity of 12 tons each. The traction power is animal; the gage is narrow, being 924 mm. and the rails weigh 7 kilograms to the yard, these being purchased from manufacturers in the United States. A fine shaded road leads from the railway station to the hacienda of San Vicente, as may be seen in the accompanying engraving.

Badges for Interborough Employes.

With the [illegible] of the [illegible] Rapid Transit Co. [illegible] New York [illegible] made [illegible] badges for the [illegible] 9,000 employes [illegible] accompanying illustration [illegible] is made of German silver, the letters are embossed and the figures are brazed on. The [illegible]

INTERBOROUGH RAPID TRANSIT CO. BADGE.

The American Railway Supply Co. has its headquarters at 24 Park Place, New York City, and manufactures baggage checks, hotel checks, number plates, pay checks, tokens, medals, breast badges, cap badges and buttons, and all sorts of stamped and embossed metal work. The company also carries a line of numbering machines, dating stamps, registering or counting machines, seals, hotel trucks, lanterns, ticket punches, metal letters and figures, office mail bags and heavy mail bags for railroad use.

A New Trolley Wire Finder.

The accompanying engraving is that of a new trolley wire finder which has recently been invented by Reed & Babcock, of 714 Macedonia Ave., Muncie, Ind., and which has just been placed upon the market by its inventors. The design of this device is of such simplicity that its construction and operation may readily be determined from the illustration. It consists of a U-shaped piece of metal, which fits on the trolley spindle between the harp and the

REED & BABCOCK TROLLEY FINDER.

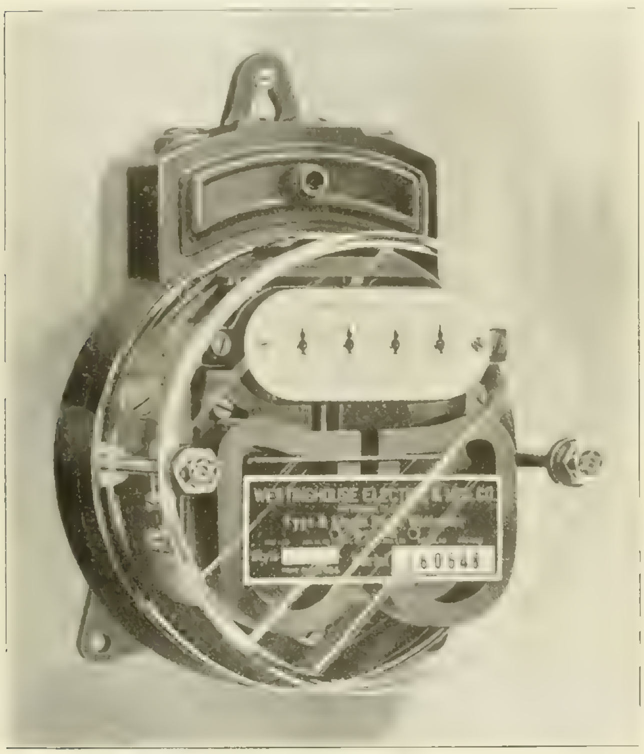
trolley wheel. [illegible] is pulled down by the conductor [illegible] wire it throws the finder into a vertical position, as shown. The normal position of the finder is horizontal, the weight of the ends of the prongs being such as to cause it to return to this position as soon as the trolley wheel is on the wire, and the rope hangs slack. The device has been tested by local street railway men at Muncie and pronounced to be very successful.

A class of students from Purdue University, LaFayette, Ind., recently visited the central power station of the Indiana Union Traction Co. at Anderson and the power house of the Indianapolis & Northwestern system [illegible] their operation.

Type B Single Phase Integrating Wattmeter.

The newest pattern of Westinghouse integrating wattmeter is the type B, which is designed for use upon single phase circuits of 7,200 and 10,000 alternations. In all its essential features it complies with the Westinghouse standard designs which employ the principle of shunting. The greater portion of the field due to the shunt winding and allowing only a short portion to combine with the series field to produce a torque on the disk.

The accompanying illustration shows one of the new instruments with a glass cover, and they are also made with metal covers. It is compact in form and the front connections on top of the meter case add materially to convenience in installation. It is a sealed meter with the original calibration preserve under the makers' seal and it requires no adjustment when put into service. It is only necessary to connect the line wires to the four terminals and to take the initial reading of the meter to put it into use. Four binding posts are used for connecting up both sides of the circuit



[illegible]

to the meter. The shunt connection is permanently made inside the meter.

All the working parts of this meter are attached to a single casting which insures strength and rigidity, perfect allignment and also reduces the liability of injury from jarring.

Two magnets are used which permit the adoption of a wide air gap, thus eliminating the danger of the disk rubbing. The adjustments are conveniently located and easily made. At full load the disk makes 25 revolutions per minute. The meter records directly without the use of a constant and its accuracy is not affected by reasonable variations in voltage. It is claimed to record correctly from two per cent of full load to fifty per cent overload, and under all conditions of power factor and wave form.

The essential feature of the ball bearing of the older types, which consist of a steel ball between two cup-shaped sapphire jewels, is retained for the lower bearing in this meter. For the upper bearing the shaft which supports the disk is drilled out at its upper end slightly larger than the pin which is attached to the upper screw and at one point its depth its diameter is reduced to form a bearing for the pin. At the bottom of the hole is placed a piece of felt impregnated with oil and capillary attraction causes the oil to creep up and oil the bearing.

Newspaper reports state that the Cripple Creek Central R. R. proposes to equip its line with electricity.

The Drummond Detective Agency.

Probably few electric railway officials realize the work, methods and results accomplished by a first class street railway detective agency. The common error is in the supposition that the services of such an agency are only necessary in times of strikes and violence, or in cases of special leakages or defrauding, not realizing that their value lies in systematic every-day work in the various departments of a road, in apparently prosperous and peaceable times.

This work is divided into three distinct branches, namely, spotting, strike breaking and accident defrauding cases.

The Drummond Detective Agency make a specialty of furnishing employes, well skilled in any of the departments of electric railway work, who apparently are employed by the road, the same as other employes, apparently paid the same as other employes and doing equally as good and proficient work. These men associate with, work with and become on an equal footing with the road's regular employes, thus being enabled to report any trouble brewing, dissatisfaction, or threatened strikes, furnishing the officials of the road with the names of the trouble makers or agitators, so that by laying off those employes a serious strike may be nipped in the bud.

This part of the spotting amounts to strike breaking, although the Drummond Detective Agency also furnishes men for strike breaking, after a strike has been declared. But the proper spotting of a system as furnished by this company will usually avert a strike.

One branch of its work consists in investigating and shadow work in cases of defrauding a railway by fake damage suits. As is well known there are many instances of injury where large damages are paid, when in reality the plaintiff was slightly injured and in some instances where the injury was caused other than by the railway company.

This agency is located at 1 Ann St., New York City, and is in charge of Mr. A. L. Drummond, ex-chief of the U. S. Government Secret Service.

West Penn Annual Banquet.

One of the many features which have brought the officers and employes of the railway and lighting departments of the West Penn Railway & Lighting Companies in closer touch with each other, and an affair to which both look forward with a great deal of interest, is the annual banquet. The companies have recently sent out passes to the many employes and friends of the companies passing the bearer for the year 1905 along the line of prosperity, health and happiness, on the reverse side of which is an invitation to the annual banquet which was held in Pritchard's Hall, Connellsville, Pa., Wednesday night, December 28th, at 2:00 a. m. Those in charge have put forth their best efforts to make this affair more enjoyable this year than before, and among other things provided special cars from the Uniontown and Iron Bridge barns to convey the guests to the banquet hall.

In order to further stimulate interest in the construction of the Cedar Rapids, Waterloo & Northern railway, hundreds of buttons containing the picture of a trolley car in the center, above which are the words, "Urbana, Brandon, Shady Grove and Jubilee" and underneath "The Farmers' Favorite Line. United We Stand," are being distributed.

The city council of Cleveland, O., has authorized the Cleveland Electric Railway Co. to begin an experimental service for an indefinite length of time to determine the profitableness of a 3-cent fare within a radius of two miles from the center of the city. No transfers will be given on the 3-cent fares and the company has the right to abandon the experiment at its discretion.

The report of the Secretary of the Commonwealth of the state of Pennsylvania shows that the street railway business of that state is rapidly increasing. During the two years which ended Dec. 1, 1904, charters were granted to 194 street railway companies as against 54 granted to steam railroads. In addition to this there were also 364 certificates granted extending the routes of street railways.

STREET RAILWAY REVIEW

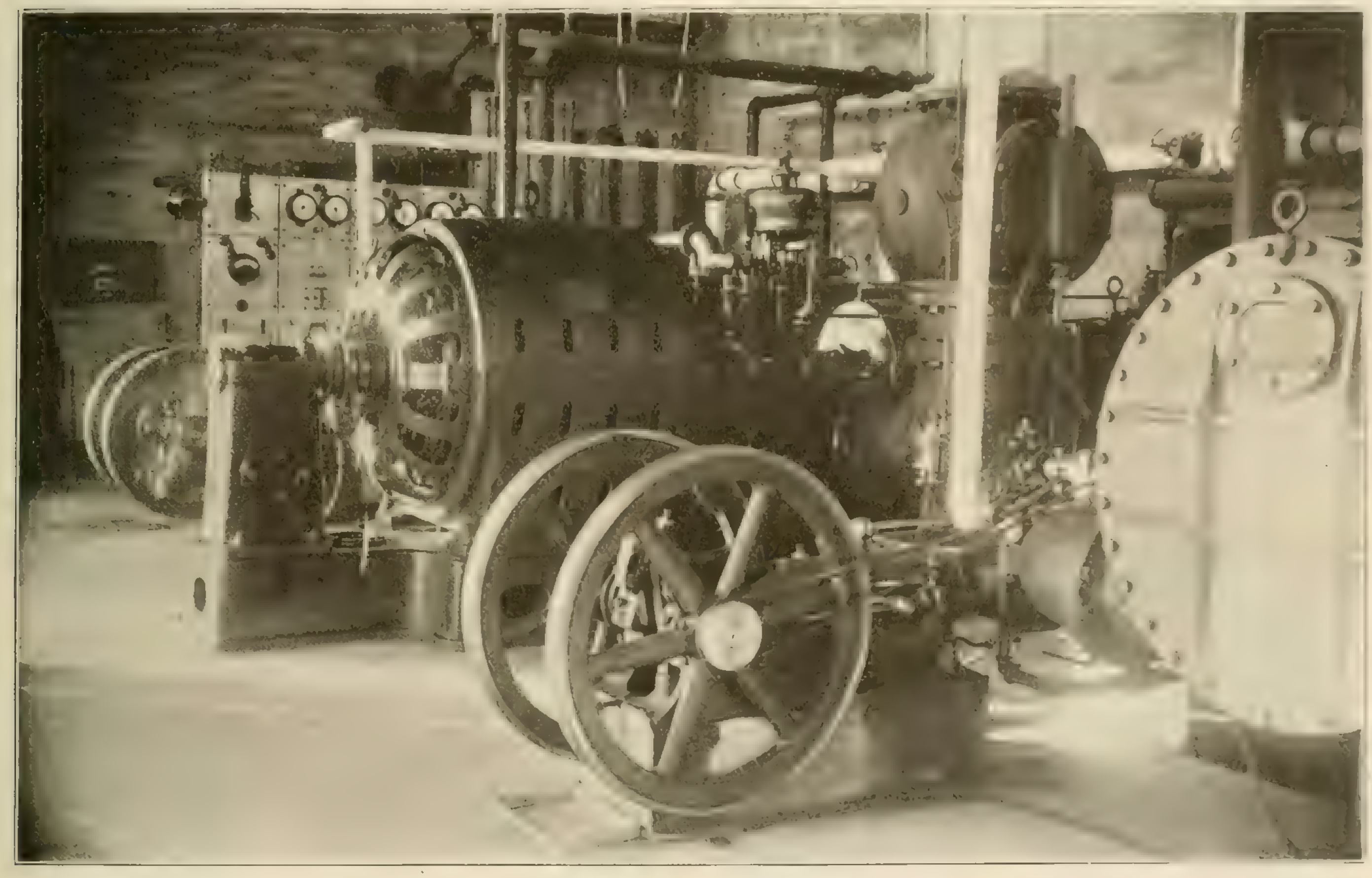
Vol. XV FEBRUARY 15, 1905 No. 2

The Iowa & Illinois Railway Co.

Describing the Line, Power Plant, Rolling Stock and Operating Methods of the Recently Completed Interurban Line Between Clinton and Davenport, Iowa.

The new interurban line between Clinton and Davenport, Ia., was formally opened to traffic Nov. 20, 1904. This road, which is 36 miles in length, practically parallels the Mississippi Valley for the entire distance between its terminals and for a number of miles runs close to the Mississippi River, whose numerous wooded islands and winding banks make the trip over the new interurban full of interest and offer at frequent intervals many charming rustic views.

Starting at Clinton the cars of this company operate around a loop upon the tracks of the State Electric Co. for a distance of



INTERIOR OF POWER HOUSE, IOWA & ILLINOIS RAILWAY CO.

one mile. From the loop in Clinton the company operates over its own private right of way for a distance of 33 miles to the city of Davenport, where it operates over a loop on the tracks of the Tri-city Railway Co. for a distance of two miles.

The population of Clinton is 27,000 and of Davenport, 40,000, while Rock Island and Moline have together about 50,000. On the route are the small towns of Princeton, LeClaire and Pleasant Valley. The rural population in the territory tributary to the line is an important item but the greater portion of the traffic is expected to be through business and accordingly the line has been designed with an especial view to high speed operation. The grades do not exceed one per cent except at one point where there is a two per cent grade [illegible] Northwestern railway at [illegible] three degrees.

The cuts along the [illegible] known as [illegible] cut at Princeton [illegible] thousand yards of earth were removed from this cut and used in making an approach [illegible] 15-ft. rock cuts on either side of Budd Creek near Princeton, whose combined length is 1,000 ft. The only other cut along the line is one at a station called Tile Works where there is a short 25-ft. cut. There are several long fills upon this road and considerable trestle work, which is being filled in as rapidly as possible. There is one fill at Shaffton three-fourths of a mile long and 15 ft. high and another south of Le Claire one mile long varying from 10 to 15 ft. in height. The most noticeable work of this character is a combined trestle and bridge at Wapsie, the whole being 3,100 ft. long, of which 2,300 ft. of trestle is to be filled. There are a number of other trestles and bridges along the line all of which have been designed for carrying a 40-ton car. There is a plate girder viaduct 350 ft. long at Comanche, a 150-ft. through truss bridge at Wapsie; 100-ft. through truss bridge over Budd Creek and

a [illegible] ft. through truss bridge and 700 ft. of temporary trestle to be filled at Pleasant Valley. The foundations of all culverts are of concrete and the smaller ones are built with 24-in. to 36-in. pipes with from one to four pipes to a culvert, the pipes being laid between concrete head-walls. The larger culverts are open and have concrete abutments connected by I-beams. There are three

VIEW OF THREE-MILE TANGENT.

surface crossings, and one over-head crossing with the Chicago & Northwestern railway at Comanche. Only one of the surface crossings, is with a main line road; the latter is a crossing with the Chicago, Rock Island & Pacific at Shaffton. Of the other two surface crossings one is with a double switch track of the Davenport, Rock Island & Northwestern at a place called Quarry, and the other is a single switch track crossing with the same line at Bettendorf.

Roadbed and Overhead Work.

The track is laid with Illinois Steel Co. 70-lb. T-rails of A. S. C. E. section in 30-ft lengths. The joints are staggered and are made with six-bolt fish plates. The track is bonded with the American Steel & Wire Co's. 9-in. U. S. bonds of No. 0000 capacity, two bonds being placed at each joint. The holes for the bonds were drilled on the ground. Spring switches and frogs are used throughout the main line track and the switches are provided with dwarf target stands carrying standard steam railroad lights. The track is laid on No. 1 oak ties 6 x 8 in. x 8 ft. spaces 24 in. between centers. Crushed rock ballast is used and is laid six inches deep under the ties. This ballast is procured from the railway companies' quarries at Comanche, where they have erected a stone crushing plant for this purpose. Some of the ballast is also procured from another crushing plant at Le Claire. At present the road is only partially ballasted, but the work of ballasting is being carried on as rapidly as possible and the roadbed is expected to be entirely completed during next spring. The overhead construction is bracket work except at curves and turnouts where span construction is used. The poles are 30 and 35 ft. long, 7 in. in diameter at the top and were selected to standard specifications. The brackets are extra long (11 ft.) and extra heavy, the poles being set 8½ ft. from the track center to avoid any possibility of accident from this source. All of the over-

EXTERIOR OF SUB-STATION AT PRINCETON.

head material was supplied by the Mayer & Englund Co. of Philadelphia. There are two No. 0000 round trolley wires carried in 20-oz., 15-in. clinch and soldered ears which are supported in heavy malleable iron yokes; these are attached to the brackets by short suspension. The high tension lines consist of three No. 4 hard drawn copper wires supported in the form of an equilateral triangle on No. 17 Locke glass insulators, the two lower wires being mounted on 4 x 5 in. two pin arms and the upper wire on a single pin arm at the top of the pole. The lower insulators are on 12-in. locust pins with two-inch shanks and the upper insulator is on a 16-in. pin, and the wires transposed one-third of a revolution every mile. The poles also carry a telephone circuit on wood brackets just below the strut from the main bracket. At all stations, turnouts, spurs and crossings, jack-boxes are placed on brackets attached to the poles in such a position that they can be readily reached from the car. Each car carries a telephone which can be attached to the jack-boxes at the regular telephone stations and telephone connections can be made at any point along the line, by means of emergency poles carried on each car. The telephone line is transposed at every fifth pole.

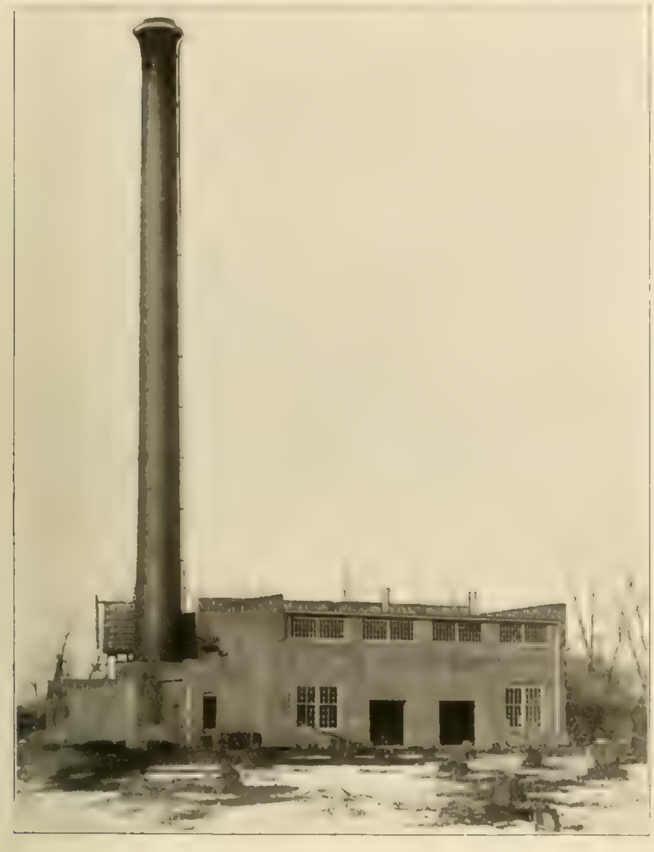
A dispatching system with the dispatcher located at Princeton using the Egry triplicate system of dispatching orders will be inaugurated. Stromberg-Carlson telephones are carried on the cars.

OVERHEAD CROSSING WITH CHICAGO & NORTHWESTERN RAILWAY, AT COMANCHE.

In addition to the over head lines already mentioned there is a No. 0000 direct feeder which extends from Pleasant Valley to Nutting, a distance of 3.2 miles.

Power House and Sub-station.

The power house of the Iowa & Illinois Railway Co. is interesting as being the only one in this country which is operated entirely by



EXTERIOR OF POWER HOUSE.

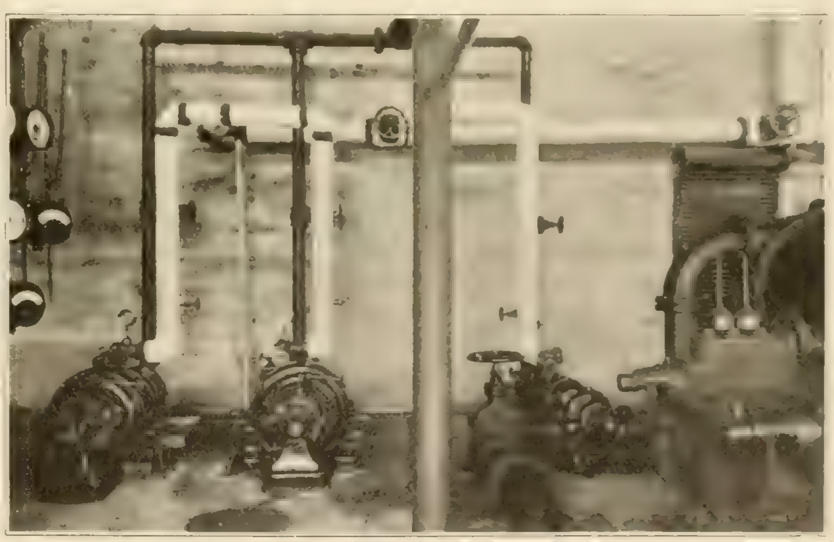
steam turbines for both the principal units and the auxiliaries. The power station building which is shown in the accompanying illustration is decidedly small for the capacity of the equipment which it contains. This building is made entirely of concrete which was molded in place, the walls being 13 in. thick, reinforced by 17-in. pilasters. It is situated on Mill Creek, a small tributary of the Mississippi, which location is upon the line of the road and 3½ miles from the Clinton terminus. The building is divided into three rooms, the first being a boiler room 39 x 55 ft., second a generator room 32 x 55 ft., and third a small transformer room 10 x 15 ft. The opening between the boiler and engine room is provided with a fire-proof rolling steel shutter. There is no communication between the transformer room and the other part of the building, the transformer room being entered only by means of outside doors. At one side of the building alongside of the transformer room, is erected an independent self-supporting steel stack, the foundation for which is 14 ft. sq. by 28 ft. deep, and is built of concrete. The stack is 140 ft. 6 in. high above the floor of the building, is 10 ft. in diameter at the bottom, 7 ft. 3 in. at the top and is lined with sand-lime brick. It was built by the Coatesville Boiler Works. The entire interior floor space of the building measures 72 ft. 5 in. x 55 ft.

The boiler room is equipped with three Babcock & Wilcox boilers of 200 h. p. each, and space is left for the addition of one more boiler of the same capacity. The boilers are provided with tubes for superheating the steam, and also have extended furnaces in which the coal is first ignited in front and the fire then pushed back to the rear part of the grate. This method of firing has been found to be most advantageous [illegible] part of the country. The [illegible] is brought in carload lots to the boiler house upon a coal trestle running back of the boiler room. The coal is delivered at Clinton by the steam railroad [illegible] pany's lines by a large express car used as a locomotive. A spur track leading to the trestle is built from the main line of the road to the power house. Standard size coal cars are easily handled by this electric car.

The steam header extends straight across the boiler room over the rear of the boilers and is connected by means of long bends to the boilers on one side and to the turbines in the generator room, the latter bends passing through the concrete partition wall between the two rooms. The steam header and all the high pressure piping are supplied with Mitchell rolled joints, and Chapman gate valves are used throughout. The boilers are fed by two Barr pumps 7½ x 4½ x 10 in. in size and these pumps are connected so as to feed either the boilers or the house tank. The draft of the boilers is regulated by a "straight line" damper regulator, built by William P. Dennis, of Philadelphia, and placed in a brick smoke flue built along the rear of the boilers and connecting to the stack. In the space between the two batteries of boilers is located a Cochran open heater into which the auxiliaries exhaust. In the basement there are two Alberger pumps, 4½ x 3¼ x 4 in. in dimensions, which raise the water from the hot well to the heater. This water is obtained from Mill Creek across which a 5-ft. dam has been built at the rear of the power house and having an 8-ft. wing dam parallel with the rear wall of the building. It may be mentioned here that the boiler feed and hot well pumps and the air pumps for the condensing system are the only pieces of machinery in the building having reciprocating motion.

The two main generating units consist of Westinghouse-Parsons turbines direct connected to 400-kw. Westinghouse generators running at 3,600 r. p. m. and generating current at 13,200 volts, 7,200 alternations. These are believed to be the first small turbine units built to generate current for 13,200 volts. These turbine units are supplied with Alberger condensers of the dry vacuum system type. These condensers are erected alongside of the turbines on the main floor and occupy as much or more space than the entire generating unit.

The maximum overall length of the turbines is 12 ft. 4 in., the maximum width 4 ft. 6 in. and maximum height 7 ft. 6 in. The total weight of the turbine is 20,000 lb. These figures include only the turbine itself and not the generator direct connected to it. Except for the air pumps which are connected to the condensers it is difficult to see any motion of machinery in the station, even when it is



AUXILIARY MACHINES.

in full operation as the generator armature revolves so rapidly that the motion is unnoticeable.

The condensers are fitted with 10-in. suctions and each condenser has 2,000 sq. ft. of cooling surface. The circulating pumps have 4-in. suction pipes. The circulating water is handled by two

pumps operating at 2,400 r. p. m. driven by 8-h. p. De Laval turbines which run at 24,000 r. p. m.

A separate view is given herewith of the two exciter units and one of the circulating pumps, all of which are driven by small De Laval turbines and the small size of these units is very noticeable, occupying as they do but three or four square feet of floor space. [illegible] volts; the turbine speed is 24,000 r. p. m.

[illegible] suction and discharge pipes are carried in this same duct with the high tension wiring. The high tension lines which run out of the building are supplied with Westinghouse high tension switches of the stick type and the Westinghouse low equivalent lightning arresters. The high tension wires are carried out through a drain-tile which is built in the wall and insulators at either end keep the wire taut through the pipe. On one side of the stack foundation a small brick addition has been built which is used for an oil room and for waste and other inflammable material.

IOWA & ILLINOIS RAILWAY INTERURBAN CAR

near the exciter sets and stands about 6 ft. from the end wall of the building. The generator panels each contain oil switches, three ammeters and two voltmeters on the high tension lines, an ammeter and voltmeter for the exciter, and one total wattmeter.

The rotary switchboard includes two panels for the rotary converter, one containing an ammeter, a power factor meter, a starting motor switch, a main switch, a synchronizing plug and a General Electric recording wattmeter. The direct current panel contains a circuit breaker, a direct current ammeter, two single pole switches and a rheostat. The rotary converter is located in one corner of the building and is used for feeding the end of the

An automatic oiling system is provided for the turbine units consisting of a pump on the base of each machine and which is operated in connection with the governor mechanism. These pumps are of a comparatively large capacity and maintain a heavy stream of oil through bearings of the turbines and generators. The oil then flows by gravity to a reservoir from which it is again raised by the pump and used over and over.

There are two sub-stations upon the line other than the sub-station equipment contained in the power house. One of these is located at Princeton, almost at the center of the road, and the other is at Pleasant Valley, which is nine miles from the Daven-

CAR BARN AND STORAGE YARD, IOWA & ILLINOIS RAILWAY

trolley line near the station. It is a 300-kw. Westinghouse machine running at 720 r. p. m. and giving 650 volts direct current. It is equipped with an induction motor for starting. The transformer room contains three 100-kw. Westinghouse oil-cooled step-down transformers, reducing the 13,200-volt current to 393 volts, 7,200 alternations, for the rotary.

The high tension wiring from the generators to the switchboard is carried by heavily insulated wires which run in a pipe duct built along the center of the floor of the generating room; the

port terminus. An exterior view of the Princeton sub-station is shown herewith. This is a small building which is of just sufficient size to hold the present equipment. Pleasant Valley sub-station is about the same size, but is built of concrete. The equipment of both stations is identical. Each contains a 300-kw. 10-pole Westinghouse rotary converter which runs at 720 r. p. m. and is fitted with an induction motor for starting. The auxiliary apparatus is of the usual standard pattern, and neither of the sub-stations contains any unusual features of engineering interest.

Rolling Stock

The company's rolling stock is unusually handsome and consists at present of four motor cars, three trailers, one express car, one electric locomotive, two flat cars and six center dump ballast cars. All of the passenger cars and the express car were built by the John Stephenson Co.; each class of passenger cars has been standardized and is absolutely uniform both in design, decoration and equipment. The motor cars are 56 ft. long, over all, and have a seating capacity for 60 people. The trailers are 45 ft. long, over all, and the express car 40 ft. The motor cars are mounted on Baldwin Locomotive Works standard motor trucks No. 134, and the trailer cars on No. 128 standard trailer trucks of the same make.

dark figured [illegible] quets. [illegible] [illegible] interior is somewhat unusual; the principal compartment occupies a little more than half the length of the car and in front of this is a smoking compartment. Between the smoking compartment and the front vestibule, which is of just sufficient size for the motorman's cab, is a baggage compartment. The latter is a small room about 8 ft. long having sliding doors at each side and is used for carrying trunks and express packages. This compartment is provided with [illegible]

IOWA & ILLINOIS RAILWAY COMPANY.
CAR BARN.

DAILY REPORT FOR 190

CARS										EQUIPMENT REPLACED.														
On Road	In Barn	At Road Wait	In For Repairs	[illegible]	Washed	Inspected	Car No.	Truck No.	Motor No.	Wheels	[illegible] Bearings	Ax. Bearings	A. C. Brg. Pin End	A. C. Brg. Gear End	Arm. Coils	Commutators	Fields	Motor Brushes	Pump Brushes	Gears	Pinions	Trolley Wheels	Lamps	Brake Shoes
							TOTALS																	

MISCELLANEOUS SUPPLIES	
DESCRIPTION	QUAN.
QUARTS CAR OIL	
QUARTS HEADLIGHT OIL	
POUNDS CAR FUEL	
POUNDS BOILER FUEL	
POUNDS WASTE	

OTHER WORK DONE

MEN EMPLOYED			
NAME	ON DUTY	OFF DUTY	HOURS

REMARKS

NOTE—Under head "Equipment Replaced" show all replacements. [illegible] in front of figures indicating that new part replaces part scrapped, [illegible]
Under head "Other Work Done" note painting, varnishing, overhauling equipment, work on bodies, seats, heaters, wiring, repairs to work cars, etc.

SIGNED M. M.

The motor cars have 36-in. wheels and the trailers 33-in. wheels; these are steel tired wheels having 3-in. treads, 7/8-in. flanges, and are mounted on 5½-in. axles having standard M. C. B. journals. The locomotive was built in the shops of the Iowa & Illinois Railway Co.

The cars are equipped with Westinghouse straight air brakes with the exception of the express car which is provided with both Westinghouse straight air and automatic air brakes. The automatic air brake on this car was considered necessary as the express car is at times used for hauling several cars in a train. The cars are also equipped with Van Dorn couplings, radial draw bars and Nichols-Lintern pneumatic sanders. The exteriors of the cars are painted Pullman green trimmed with gold striping. The interior finish is

the compartment is not occupied with baggage. The seats in this compartment will accommodate eight passengers. The cars are run with the same end always forward and are only provided with a motorman's cab at one end. The rear platform is about five feet long. The baggage compartment is on the motor cars only and not on the trailers. The cars are all equipped with toilet rooms which are lined with sheet lead both on the floors and for a height of five feet on the side walls. They are heated by hot water, the Baker "Mighty Midget" heaters being located on one side of the motorman's cab. The seats are of the Heywood Bros. & Wakefield stationary type covered with imitation leather having the backs edged with bronze. The curtains are dark green pantasote with fixtures made by the Curtain Supply Co. The windows have plate glass, and

storm sash which are fitted on the outside for winter use. The deck sash and transom sash have green art glass. The cars also contain tanks for drinking water, Pennsylvania Railroad standard basket racks and candle lamps in bronze. The electric equipment of the motor cars comprises four G. E. No. 73 motors of 75 h. p. each and G. E. L-4 controllers.

The lighting is by means of incandescent lamps of which there are 45 in the motor cars and 30 in the trailers and the lamps are evenly distributed over the arches of the roof, giving a uniform and very ample light throughout the whole car. The rear platforms are provided with Edwards step-lifts, the steps have Mason safety treads and are edged with bronze. All of the swing doors are provided with Blount door checks which insure the doors being kept closed and prevent any slamming. Electric signal bells are provided with push buttons at each seat and International double registers are used. Each car is also provided with a wattmeter for keeping check on the current consumption of the cars and the efficiency of the motormen.

The express car was specially designed and has some unusual features. In addition to the sliding side doors in the center of the car, end doors are placed on the front end of the vestibule to one side of the center of the car. The vestibules are very narrow, being just sufficient in size to provide a motorman's cab, and there is a sliding door in the partition between the cab and the body of the car which opens directly in front of the end doors. This leaves a straight opening through each end of the car into which rails, poles and similar articles which could not be loaded through the side doors can be readily slid into the car from the end. The interior of the baggage car is all in one compartment painted white, having longitudinal benches running each side of the car which fold up against the side. The car is neatly finished inside, the seats being put in with the idea of using it for passengers in case of emergency

Discipline.

The management of the company has prepared a book of rules and regulations for conductors and motormen which are based upon the A. S. R. A. standard rules, but which are modified somewhat, especially in the matter of signals, to agree very closely with the steam roads' code. Two commendable features of this book of rules are that the general rules cover only 34 pages 3¾ x 5¾ in. in size and the book is furnished with an alphabetical index of subjects so that the rules covering any particular subject may be found at once by referring to this index. Each book of rules is numbered and a copy is given to each motorman and conductor along with his badge, ticket punches and other articles for which the employe gives a receipt. In case of the motorman the outfit includes a tool box and such tools which might be found useful in repairing temporary break-downs on the road.

A regular system of watch inspection has been inaugurated which provides for a weekly inspection of all watches of the uniformed force. On the appointment of a man as motorman or conductor he is given an order on the company's official watch inspector to have his watch inspected. The regular form on which this order is entered is shown in one of the accompanying illustrations. It is divided by perforations into three parts, the upper part of which simply contains the name, occupation of the man and date. The

Form 79-2000-12-5-04 Allco

IOWA & ILLINOIS RAILWAY COMPANY.

Sub-Station No.

Daily Report for 24 Hours Ending 12 Mid . 190

TIME	IN SERVICE	SWITCHBOARD — INSTRUMENTS — D C AMMETER	IRO WATTMETER	D C VOLTMETER	P F METER	WATTMETER CONST — READING	DIFFERENCE	K W H	CIRCUIT BREAKER OUT	MISCELLANEOUS
1 a m										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
1 p m										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
TOTAL										
AVER										
MAX										
MIN										

SUPPLIES

QUAN	DESCRIPTION	ACC'T NO

MEN EMPLOYED

NAME	ON DUTY	OFF DUTY	HOURS

WEATHER—6 A. M.

12 NOON

6 P. M.

12 MID.

REMARKS

SIGNED M. M.

second part of the order is a memorandum to be retained by the watch inspector and the lower part is the inspector's report which is returned to the office of the company. The inspector also keeps a register which is printed on a sheet $8\frac{1}{2} \times 14\frac{1}{2}$ in. on which each employe signs his name and inserts the date when his watch is presented for weekly examination. These register sheets containing the signatures are forwarded to the general manager at the end of each quarter.

A modified Brown system of marking instead of suspensions was

I. & I. No. 18. 500-9-27-'04. Allen.

Motorman	Badge No.
Conductor	Merits

REPORT.	Date.	Debit.	Credit.	Balance.

RECORD OF MERITS AND DEMERITS.

adopted February 1st, for disciplining the car service employes. On the adoption of the Brown system the management offered the following reasons for its adoption and explanations of the working of the system: Under the layoff system a man would be suspended from duty for breach of rules, thus losing his pay, and under that system men who attended to their duties, thus holding a first class record, and who performed meritorious acts could not receive the recognition justly due them, although a good record should be of benefit to them when being disciplined for some breach of rules or for an accident.

I. & I. Form 42. 400-12-12-'04. Allen.

NO.

NUMBERS			DATE			
Car	Truck	Motor	On	Off	WORK DONE	MILEAGE

RECORD OF WHEELS, GEARS AND LARGE BEARINGS

By the merit system the man who strives for a good record by attending to business or by performing meritorious acts, receives from time to time merits which may materially assist him in times when he may deserve discipline.

On the other hand the man who persists in disregarding rules, is careless regarding accidents, or is generally inattentive to his work, continually lowers his record until as a natural and proper result of his unfitness he is discharged. The man who may be unfortunate but not intentionally careless nor heedless has through this system an opportunity to return to his old standing.

IOWA & ILLINOIS RAILWAY COMPANY.

MONTHLY CAR MILEAGE REPORT. FOR MONTH OF 190

DAILY MILEAGE												SUMMARY										
CAR NO		CAR NO		CAR NO		CAR NO		CAR NO		CAR NO		MOTOR CARS			TRAILER CARS			EXPRESS MOTOR CARS			GRAND TOTAL	
Daily	Total from Jan 1	Daily	Total from Jan 1	Daily	Total from Jan 1	Daily	Total from Jan 1	Daily	Total from Jan 1	Daily	Total from Jan 1	Daily Total	Total from Jan 1	Increase or Decrease	Daily Total	Total from Jan 1	Increase or Decrease	Daily Total	Total from Jan 1	Increase or Decrease	Daily	Increase or Decrease

The operation of the system stated briefly is as follows: Each man at the start has a clear record and 100 merits to his credit. As he receives merits or demerits they will be added or deducted from the merits standing to his credit, and when merits or demerits are given him he is notified of the same on a form prepared for that purpose, at the bottom of which is a stub which is to be returned to the company acknowledging receipt of the communication. The record is kept strictly private in a small loose leaf ledger to which no one except the general manager has access, and it is left entirely to each employe whether anyone else knows his record or not. This record book is $6 \times 8\frac{1}{2}$ in. in size and the page headings are shown herewith.

The following list of [illegible] ing to the majority of [illegible] marks for every contingency this list is subject to change from time to time, such changes being posted on the bulletin board.

Immediate Discharge.

Disloyalty to company.

False statements.

Intoxication or drinking while on duty.

Smoking while on duty.

Dishonesty.

Gross, ungentlemanly conduct.

Running off interlocker switches without good proof that leverman was careless.

Disobeying dispatcher's orders or running by signals at danger or not indicating clear tracks.

Incompetency.

Merits—

Securing names and addresses of witnesses who saw accident, other than those on accident report	2 to 10
Assistance rendered in case of accident such as to bring commendation from passengers	2 to 10
Politeness and attention to passengers calling for special commendation from them	2 to 10
Complete and perfect accident reports	2
Good judgment and work in handling layouts or blockade	2 to 10
Special and meritorious acts calling for recognition from company	2 to 50
Careful handling of car	5
Clear record for one year's service	10
Other acts deserving of credit in judgment of general manager	2 to 50

Demerits—

Failure to turn in report on time	5
Missing, first time	10
Second time in one year	20
Third time in one year and loss of day each time if extra man takes car.	[illegible]
Failure to report accidents	[illegible]
Incomplete and poor accident reports	[illegible]

IOWA & ILLINOIS RAILWAY COMPANY.

POWER HOUSE.

Daily Report for 24 Hours Ending 12 Mid 190

TIME	TIME IN SERVICE: TURBOS 1	2	CONDENSERS 1	2	EXCITERS 1	2	BOILERS 1	2	3	4	SWITCHBOARD: GENERATORS MAX AMPS	VOLTS	EXCITERS MAX AMPS	VOLTS	WATTMETER CONST READING	DIFFERENCE	K W H	PRESSURES AND TEMPERATURES: STEAM LBS	VAC'M INS	DRAFT INS	TEMPERATURES: INJ'T'N WATER	HOT WELL	FEED WATER	STEAM	FLUE GASES	AIR	FEEDWATER METER AT 100° FAR CUBIC FEET × 60.32 POUNDS: READING	DIFFERENCE	POUNDS
1 a. m.																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													
1 p. m.																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													
TOTAL																													
AVER																													
MAX																													
MIN																													

SUPPLIES: COAL	
BALANCE FROM PREVIOUS DAY	
RECEIVED	
CAR	
TOTAL	
BURNED	
BALANCE FORWARD	
ASHES REMOVED PER CENT	
TOTAL COMBUSTIBLE	
QTS. CYLINDER OIL	
QTS. ENGINE OIL	

OTHER SUPPLIES: QUAN	DESCRIPTION	ACCT NO

WEATHER 6 A. M.	
12 NOON	
6 P. M.	
12 MID	

SUMMARY	
K. W. H. GENERATED	
POUNDS COAL BURNED	
POUNDS WATER EVAPORATED	
POUNDS WATER PER LBS. COAL	
POUNDS COAL PER K. W. H.	
POUNDS WATER PER K. W. H.	
K. W. H. OUTPUT SUB-STATIONS	
CAR MILES RUN	
K. W. H. PER CAR MILE	

MEN EMPLOYED: NAME	ON DUTY	OFF DUTY	HOURS

REMARKS

SIGNED M. M.

I. & I. Form 11 10-12-8 4 Allen

IOWA & ILLINOS RAILWAY COMPANY.

MONTHLY POWER HOUSE REPORT. FOR MONTH OF 190

DATE	POWER HOUSE OUTPUT: K W H	Per C M	Total From Jan 1	Week	Increase or Decrease	COAL: Burned	Per K W H	Total from Jan 1	Week	Increase or Decrease	WATER: Pounds Evaporated	Per lb Coal	Per K W H	Total from Jan 1	Week	Increase or Decrease	SUB-STATION OUTPUT: K W H	Per C M	Total from Jan 1	Week	Increase or Decrease	Average Temp	WEATHER	
1																								
2																								
3																								

Accidents when avoidable in the opinion of general manager	10 to discharge
Talking to others than proper officers of company about accidents	20
Failure to make safety stops at crossings	10 to 50
Running crossings without proper flagman's or conductor's signal	20
Failure to properly flag railroad crossings where required	20
Fast running over crossings, switches, around curves, and along streets requiring slow speed	5 to 20
Keeping current on when passing over crossings except when absolutely necessary	5 to 10
Not ringing gong when passing car	5
Passing standing car on streets without first stopping	10 to 20
Starting car without proper signal except to avoid collision	20
Not obeying conductor's signal	5
Failure of conductor to give proper signals	2 to 10
Following car in front too close	10
Headlight and signal lamps not burning	5
Leaving car without taking reverse lever or notifying motorman	10
Reversing car except to avoid accidents	5 to 20
Careless and indifferent operating of car	5 to 20
Feeding current too fast	5 to 10
Not having proper tools	5 to 10
Running without sand in boxes	5 to 20
Running ahead of schedule time	10
Failure to report delays	5
Failure to promptly investigate at once line down or obstruction to cars	5 to 20
Allowing unauthorized persons to ride in front vestibule	10 to discharge
Running away from passengers	5 to 20
Failure to report trouble with car or appliances	5
Giving bells too quick, before passengers are safely on or off	5 to 30
Inattention to passengers	5
Unnecessary conversation with passengers	5
Unnecessary conversation with motorman	5 to 20
Dirty car	5
Untidy condition of dress	5
Reading on duty	10
Sitting down on duty except as provided in bulletins	10
Profanity on duty	10
Failure to announce stations, streets and transfer points	5 to 10
Errors in punching transfers and cash receipts	5 to 10
Other acts detrimental to the service in opinion of general manager	2 to discharge

Every man will be given an opportunity to appeal to the general manager against any assignment of demerits which he may consider unjust, but such an appeal must be made within five days of his notification of the same.

The rules covering accidents are practically the same as those in force on most street and interurban railways, but the form for accident reports has been considerably condensed and is made out on a sheet 6½ x 7 in. in size which calls for the following specific information:

Date Time of Day Weather
No. of Car Conductor Motorman

Place where accident occurred.

Name and address of person injured or owner of property damaged.

Position of person or vehicle injured at time of accident.

Nature and extent of injury.

In what position did person fall?

Was person or persons under the influence of liquor?

Direction in which car was going.

At what speed Was motor reversed?

Was car starting, stopping or running?

Direction in which other vehicle was going.

Position of conductor at time of accident.

Position of mot[illegible]

Was the motorman [illegible] warning of approach of the car?

Condition of track.

Condition of street.

Condition of car, mot[illegible]

Under these questions are a number of blank lines with the general instruction to give full det[illegible] the conductor and motorman of the car. On the back of the card are spaces for the name and [illegible]nesses. The idea of condensing the accident report to this extent was this: In many cases where a very large number of questions are asked and the outline of a [illegible] parts of the body injured, the motorman or conductor is apt to become confused by the number of the details called for and it is believed that by condensing the inquiries so that they include only the most essential points and by giving the men an opportunity to explain the accident in their own language, a more comprehensive report will result.

Power House and Car Barn Reports.

Owing to the fact that the power plant of the Iowa & Illinois Railway Co. is unique and that but little data on the cost of operation of a station using steam turbines throughout is available, the management has prepared a very complete set of forms for keeping account of the performance of the stations, the exact output of the plant measured at the sub-station switchboards, the cost of supplies and the amount of labor charges.

The first form to be considered is the power house daily report which is shown in one of the accompanying illustrations. This, like all of the other forms, is arranged for binding in loose leaf ledgers and the size of the sheet is 21 x 12 in. It is arranged for hourly readings of all the station instruments and includes the time in service of each machine, switchboard readings of each instrument, pressures and temperatures of steam, vacuum, draft, water, flue gases and air, and readings of the feed water meter. The supplies of coal burned, ashes removed, lubricating oils and miscelloneous supplies are entered and from this data are figured the summary of operations for each day. The form also includes a space for the number of hours of labor to be charged for each day's operation. While the form provides for hourly readings of all meters, the wattmeters, water meters and some other instruments are read at intervals of six hours.

The form of the daily sub-station report is also shown herewith and is practically the same as the switchboard division of the power house report. These two forms are filled out daily and forwarded to the general office where the different values are figured out and entered on a monthly power house report, the heading of which is shown herewith. At the bottom of this report are four lines which are used for entering the total, average, maximum and minimum values of any heading for the month. By means of these reports it is intended to keep a very accurate record of the performance of the power plant, and the results tabulated will at the end of a year's operation include very complete and valuable data on the economy of this type of station.

There is a duplicate form used for entering materials received which is filled out by any authorized person who receives and opens goods, the original being sent to the office and the duplicate being held by the person who signs for the goods. This form is checked with the materials order and with the invoice and is then filed with the duplicate order. In taking goods from the store room a requisition in duplicate is used which gives the quantity and description of the goods, the account to which they are to be charged and the place where they are to be delivered. After these goods have been used should there be any surplus it is returned together with a return requisition in duplicate giving the quantity, description, account number and requisition number on which they were drawn. By means of these requisitions and return requisitions the storekeeper is able to keep track of the exact amount of material withdrawn and returned to stock.

There are three useful forms used in connection with the track and overhead repairs, all of which are 10 in. long by 4 in. wide, made into pads which can be conveniently carried in the pocket. One of these is used by the inspector of track and overhead work who enters each day a report of the section of the line inspected and notes the general conditions

When any trouble is reported the foreman of the section gang takes charge of the repairs and each day reports the work done and the number of men employed and enters this on one of the forms mentioned. Both of these inspection and repair reports go to the roadmaster who attaches them to a daily report which is sent to the office. The roadmaster reports the work done on each section, also the conditions on each section reported by the inspectors, the trouble reports attended to, and any other information which may refer to the work of his department.

Tickets.

The city tickets, transfers and passes are of the usual form. The tickets sold on the cars are of the duplex pattern. A color scheme is employed for these tickets, red being the color for northbound cars only and blue being used only on southbound cars. The single trip ticket southbound is printed in blue, the duplicate part being given to the passenger as a receipt for his fare. The single trip northbound ticket is exactly the same except that it is printed in red.

Iowa & Illinois Railway Co.

ORDER FOR WATCH INSPECTION No

Name

Occupation

Date

ORDER OF EXAMINATION To be retained by Inspector.

No

Dear Sir The bearer *is employed as*

Please examine his watch and if it is, in every respect, up to minimum standard of excellence required by the Company, viz: A grade equal to what is known among American movements as seventeen jewel patent regulator breguet hairspring lever set adjusted to heat, cold and position and in such repair as will in your judgment, enable it to run within the maximum variation allowed, viz 30 seconds per week for the next six months ensuing, fill up and sign the attached certificate and return same to this office on or before the tenth of the month following this date

Gen'l Manager

Date

This Certificate to be returned immediately BY INSPECTOR to official issuing same.

Iowa & Illinois Railway Co. *No*

This Certifies *that on* *I examined*
the watch of
occupation
employed on the *Division, and found it to be equal to the standard of excellence required, and in such repair as will in my judgment enable it to run (with proper usage) within a variation not to EXCEED THIRTY seconds per week*

Inspector.

Rejected and reason why
No of Movement *Accepted*
Maker and Grade
No of Case and Description

The round trip tickets are also duplicate tickets and the conductor sells and takes up only red tickets on northbound cars and blue tickets on sounthbound cars, thus the southbound round trip ticket is sold on the northbound car and is printed in blue, and the northbound round trip ticket is sold on southbound cars and is printed in red.

Personnel.

The officers of the company are: G. E. Lamb, president; F. W. Ellis, 1st vice-president; G. W. Bawden, 2d vice-president; J. D. Lamb, treasurer; R. B. McCoy, secretary; P. P. Crafts, general manager; J. A. McCampbell, master mechanic.

The contractors and engineers for the entire equipment of the road and power plant are Pepper & Register, Philadelphia. The superintendent of construction for the contractors is Mr. W. P. Boright.

Mr. Crafts, the general manager of the company, has had a long experience in interurban electric railway work. He was for six years manager of the Brockton & Plymouth Street Railway Co., and other properties and for a considerable portion of this time was connected with Stone & Webster, of Boston. Later he was for two years manager of the Saginaw Valley Traction Co., resigning to become manager of the Iowa & Illinois Railway Co.

Mr. Crafts has done a great deal of valuable work for the new road in systematizing the work of all of the departments, and the various forms which have been described and which cannot fail to be of the greatest value in showing all of the operating conditions and costs are due to him.

New England Street Railway Club.

The fifth annual meeting and banquet of the New England Street Railway Club was held at Hotel Brunswick, Boston, Mass., on the afternoon and evening of January 26th. The following officers were elected: President, Edward E. Potter, general superintendent Union Street Railway Co., New Bedford, Mass. Vice-presidents for the States: Paul Winsor, assistant to president Boston Elevated Railway Co.; Norman McD. Crawford, manager Hartford Street Railway Co.; L. N. Wheelock, manager Claremont Railway & Lighting Co.; A. J. Crosby, superintendent Springfield Electric Railway Co.; J. E. Thielsen, superintendent Providence & Danielson Railway Co.; George E. Macomber, general manager Augusta, Winthrop & Gardiner Railway Co. Secretary, John J. Lane, editor Street Railway Bulletin, Boston. Treasurer N. L. Wood, with C. N. Wood Electric Co., Boston. Executive Committee: J. H. Neal, Boston; H. E. Farrington, Chelsea, Mass.; W. D. Wright, Providence, R. I.; E. A. Sturgis, Worcester, Mass.; C. E. Sprague, Boston; John C. Bradley, Worcester, Mass.; F. A. Barbey, Boston. Finance Committee: E. E. Potter, New Bedford; James F. Wattles, Boston; M. C. Brush, Newtonville, Mass.

E. E. POTTER.

The banquet was held in the dining room of Hotel Brunswick, music being furnished by the First Regiment orchestra. In the unavoidable absence of the newly elected president, the club was called to order by Vice-President Winsor, who introduced as toastmaster of the evening Mr. Dan Prendergast, of the Boston Elevated Railway Co. Speeches were then made by Mr. George W. Bishop, member of the Massachusetts board of railroad commissioners; Prof. George F. Swain, of the Boston Transit Commission; Mr. Howard F. Grant, general manager Seattle Electric Co., Seattle, Wash.; Mr. F. T. Smith, Vermont board of railroad commissioners; Mr. E. P. Shaw, president Massachusetts Street Railway Association; Mr. B. F. Cladbourne, Maine board of railroad commissioners; and Mr. A. C. Whittemore, New Hampshire board of railroad commissioners. The club now has a membership of 576, of which 60 have entered during the past year.

Slag for Ballast.

Slag from the blast furnaces of the Thomas Furnace Co. is now used in ballasting a part of the interurban tracks of the Milwaukee Electric Railway & Light Co. It is interesting to note the manner in which this blast furnace refuse is now rendered fit for ballast, because formerly it was necessary that the large pieces of this material be crushed by mechanical power in a way similar to that now used in the crushing of rock ballast. A pit or cistern 30 ft. deep and 20 ft. in diameter has been dug about 50 ft. from the skimming trap near the mouth of the furnace. The hot slag is led in a stream so that it falls over the edge of the pit. As the hot material falls it encounters a stream of cold water from a 4-in. nozzle under a head of about 60 ft. The mingling of the two streams, one of hot slag and one of cold water chills the slag so that when it reaches the bottom of the cistern the material has an entirely distintegrated form. The individual pieces of slag are now about a size which would pass through a ½-in. screen and can be readily handled in a drop bucket from an overhead crane and thus easily loaded on the ballast cars. This material has all the characteristics of the ordinary slag ballast except the size of the individual pieces of the material.

Development of Automatic Couplers for Electric Cars.

BY W. T. VAN DORN

I have been requested many times to give my experience on the coupling question, and while to cover my entire experience would take a great deal of space, I shall try to give the leading points of interest in the following brief statement.

It is well known by all that the coupling question is a perplexing one. From an official report just received from the United States Patent Office it appears that up to the present time approximately 3,695 automatic couplings have been patented; of these devices not over a dozen ever made any money.

It will take some explanation to tell what it has taken to bring an automatic coupling to the present perfection of the Van Dorn couplings, that will couple automatically within 1-32 of an inch, and under no conditions can be disengaged in train service. It has taken years of study and thousands of dollars to reach this result. I was mechanically inclined from my youth, and learned a trade. I commenced my car-building experience in 1867. I went to Omaha in 1868, and was in the car department with the Union Pacific when the company was building overland to the Pacific Coast. I was sent out to the front with the construction gangs, and stayed there until the road was completed to meet the Central Pacific, 75 miles west of Ogden in Utah, where the golden spike was driven May 10, 1869. The experience that I had while in that capacity was a great help to me in later years, but after the completion of the road I remained with the same company in the car department for some five years, and during that time I had work in building all kinds of cars from a hand car to the heaviest freight and passenger cars, and had a long experience in truck building, and also with the freight couplings that were in use in those days.

I had not given the coupling question much consideration until the early part of the 80's, when steam roads first commenced their inquiry for automatic couplings. I took out a patent on a style that I considered adapted for this class of service, and exhibited some of the couplers when the roads were making preliminary examinations for couplings, and I had samples at all their experimental tests. The greatest test ever given was at Buffalo, N. Y., about the middle of the 80's. The railway companies issued a circular inviting all who had automatic couplings to equip at their own expense two cars and deliver them at Buffalo for a test, and promised a thorough and impartial test.

There were 140 different styles brought to Buffalo for this purpose, and they were all given a severe test. Each style of coupler was given two tests, one on straight track and one on the shortest curve.

The test was as follows: The cars were brought together at a slow speed, three miles an hour, and as a rule they would all make this coupling. The next time they were brought together quickly, and hit hard, and in the concussion or rebound a great many couplers would fail, especially those that were of the gravity lock, trunion, or any style of drop lock pattern, unless they had three or four inches play. The third time the cars came together still more quickly, and as soon as the couplings came together the engine was reversed and started in the opposite direction; there were very few that made this coupling.

When the test was over there were only 17 out of the 140 that made all the couplings, and my coupling was one of the 17.

When the tests were over there were a great many styles that seemed to have great merit. As the railroad companies generally were so interested in adopting an automatic coupling, many leading officials of the different roads were present to witness the tests, from presidents down; but no two could agree on the merits of any one style tested. The different companies did agree that they would pick out what they considered the best and equip a large number of trains for further trial, and two or three of the roads that were represented were so sure that some of the couplings tested had great merit that they would take no chances in adopting them as a standard. They did so and equipped thousands of cars before they found out their mistake. While some of the other companies co-operated with the different coupling firms and equipped a good many thousand cars with the different styles, and spent all the way from $10,000 up (I am told some spent as much as $100,000, after the [illegible] all dropped except those [illegible] the M. C. B. type.

There were two or three [illegible] test, but no decision [illegible] the brake test at Burlington [illegible] coupling test. At Burlington it was thoroughly demonstrated that to use air brakes on [illegible] be a tighter coupling than the old pin and link, and all the trains at this test that had not the M. C. B. type of coupling were wedged up between the buffers with wooden blocks.

The style of coupling that I had at the Buffalo test was not the same as we use now, but [illegible] tight lock. A tight lock in those days was considered out of the question, though I never agreed with others on this point. I always considered a tight lock preferable as I had seen so many breakages and disengagements in train service that were caused by excess of slack. I kept a close watch on all the styles of couplings that were put into service after the Buffalo test to learn the results, and when there were so many failures I followed them up to learn what caused them to fail. I found that the mechanism was not correct, and while the couplings would give good service when they were new, when they began to wear they would disengage. The majority of them had entirely too many parts; there was none tested but what had three parts to one of mine.

When I came into the field to build couplings for street and elevated roads, I knew that their requirements would be a tight lock, and I knew from experience that to make a tight lock all the parts would have to be on what I style a "fixed fact," and that is the line on which our style of couplings are now built. I had from the outset for street and elevated service the correct principle, but I had not at the start the correct mechanical construction. And with all my former knowledge it took me six or seven years with couplings in actual service to develop all the weak points and to correct the mistakes. I had, comparatively speaking, to build a new design and all the couplings that we build at present are styled our 1902 pattern.

One of the greatest problems was when the elevated roads changed from steam to electricity. I soon learned that a coupling that would stand up under the steam locomotive service would not stand with the electric motor system, and I also learned that a coupling that would stand under the older electric motor system would not stand under the multiple unit system. Then when the elevated roads changed from the older electric motor system to the multiple unit system there were things developed that deceived the majority of experts as they were under the impression that the multiple unit system would develop only a slight drawbar pull, as the trains would run for long distances with pins pulled and not be disengaged. I never thought this to be the case, and I never built any style of coupling or draft rigging lighter for the multiple unit system than I did for the older motor system. It has been proved after a few years of test that it takes about 50 per cent additional strength in a coupling for the multiple unit system than for the older system.

I have brought the efficiency of the draft rigging up to the standard of the coupling, and I have given this question as much study as I did the coupling question. Anyone who is familiar with this style of work knows that to make a perfect train service we must have a perfect draft rigging, and our draft riggings are now so perfect and built on such simple and strong lines that it is very essential for the draft rigging and the coupling to go together.

Railroad men often make serious mistakes in ordering equipment without first advising with the manufacturer as to the conditions under which the equipment is to work. In the case of our company we greatly prefer to have our customers' engineers confer with us, giving us the length of car, weight of car, number of cars in a train, the curvatures, etc., before placing the order for couplings, as we would then know what to recommend, and the roads would be sure to have couplings capable of withstanding the conditions of their service. We now have 21 different patterns, and this was brought about by the different conditions on different roads, and the different capacities required. We keep in advance of the requirements as we have couplings now made of which the capacity is double that needed for any requirements that we have as yet been called upon to meet.

Northwestern Electrical Association.

The thirteenth annual convention of the Northwestern Electrical Association was held in Milwaukee, at the Hotel Pfister, January 18th, 19th and 20th, about 100 delegates registering.

The meeting was opened with an able address by the president T. F. Grover, of Fond du Lac, Wis. The report of the secretary-treasurer, Thomas R. Mercein, of Milwaukee, showed the association to be in a healthy and growing condition. The secretary stated that the Legislative Committees in Indiana, Illinois and Iowa had forwarded reports of progress but no reports had come from Wisconsin or Michigan and that the Minnesota Legislature had not convened since the last meeting of the association. The committee on advertising reported that it was meeting with success in its efforts to standardize the publicity literature used by the central station companies of the Northwest. With the report of the membership committee, the names of a large number of new members were proposed and voted into the association. A greeting was presented from the Milwaukee Citizens Business League inviting the convention to Milwaukee for the next annual meeting. The rest of the first day of the convention was spent in listening to the reading of the following papers:

"The Successful Joint Utilization of Several Small Water Powers by the Janesville Electric Co.," by W. B. Jackson, of Madison, Wis., consulting and constructing engineer for the Janesville Electric Co.

"Direct Current Versus Alternating Current Distribution," by O. M. Rau, chief electrician of the Milwaukee Electric Railway & Light Co.

"The Rating of Arc Lamps," by Prof. George D. Shepardson of the University of Minnesota.

"Distribution and Dollars," by C. H. Williams, superintendent of the Madison Gas & Electric Light Co.

Then followed a lecture on "Efficient Salesmanship" by the Milwaukee manager of the Sheldon School of Scientific Salesmanship. In the evening the delegates attended a theater party.

The morning of the second day was occupied in listening to a paper on "Series Alternating Arc Lamps," by E. P. Warner, of Chicago; an executive session and the annual election of officers. The following is a list of the officers of the Northwestern Electrical Association for the year 1905:

President, C. H. Williams, Madison, Wis.

First Vice-President, R. N. Kimball, Kenosha, Wis.

Second Vice-President, H. Almert, Oak Park, Ill.

Secretary-Treasurer, Thomas R. Mercein, Milwaukee, Wis.

Directors, P. H. Korst, Janesville, Wis., Ernest Gonzenbach, Sheboygan, Wis., and H. S. Gille, St. Paul, Minn.

The afternoon was devoted to the reading and discussion of professional papers.

First was "High Tension Practice," by W. T. Goddard. Accompanying this paper were stereopticon views showing the methods used by the Locke Insulator Co. in the manufacture of insulators for high tension work. There were also shown views illustrating the different types of pole line construction both in the United States and abroad. In connection with pole top construction and the choice of pins and insulators Mr. Goddard stated that many engineers seem to feel that the continuity of high tension service is better insured by the use of wood rather than iron pins, but, on the contrary, he favored the use of hollow steel or iron pins in preference to those of wood, explaining that the added factor of safety due to the difference in the strengths of the two materials would more than offset any insulating qualities which the wood might have.

Next came a paper on "Single Phase Railways and Their Possibilities," by Clarence Renshaw, of the Westinghouse Electric & Manufacturing Co. During the reading of the paper [The substance of this paper was published in the "Review" for Dec. 20, 1904, page 958—Ed.] views were shown illustrating the single phase railway motor, its separate parts and its use on cars. In the discussion of his paper Mr. Renshaw explained in detail and showed views of the catenary form of trolley construction. The following question was asked regarding the safety to passengers when operating a single phase system with a difference of potential of 3,000 volts between the trolley and the track rail: In case the track should be covered with dirt so that the wheels were insulated from the rail would there not be a great chance for a passenger being injured in boarding or leaving the car due to the difference in potential between the ground and the frame works of the car? Mr. Renshaw stated that this condition could hardly occur in city or interurban work because the 3,000 volts pressure would pierce any ordinary amount of dirt or ice which might hold the wheels off of the rails, thus equalizing the potential and removing any cause for danger.

Mr. Norman McCarty, of Indianapolis, Ind., next read a paper "The American Diesel Engine." This was in substance the paper read at St. Louis by Col. E. D. Meier and which was published in the "Daily Review" Oct. 14, 1904, page 702. Mr. McCarty added some interesting statements regarding the cost of power when using crude oil in the Diesel engine, stating that:

C. H. WILLIAMS.

"An installation of 50 engines, aggregating 6,000 b. h. p., and representing 25 separate and distinct plants, in service from six months to five years, has so demonstrated the fuel economy that the American Diesel Engine Co. offers the following formula to any user of power, by which he may determine for himself the exact cost of fuel from his operating conditions, under the supervision of his own attendants and for any length of time he may desire, the result of which it is ready to guarantee, assuming that the plant has averaged one-half load for the time under consideration:

"For electrical transmission, $365\ A\ B \div 8 =$ cost of fuel per year;

"For mechanical transmission, $365\ A\ B \div 10.75 =$ cost of fuel per year;

"In which A is number of kilowatt hours, or brake horse power hours per day, and B is cost of oil fuel in cents per gallon.

"For example, assuming that an electrical installation delivers 1,000 kw. hours per day, with oil fuel at 3 cents per gallon, we have

$(1{,}000 \times 365 \times \$.03) \div 8 = \$1{,}368.75$ as total cost of fuel per year of 365 days.

"But as the Diesel plant requires no boilers and eliminates the extra expenses of the fire room it should be credited with this necessary charge against a steam plant, so that assuming the charge for water, labor and depreciation of boilers for a steam plant of this size at $2.50 per day, or $912.50 per year, the cost of fuel for the Diesel would be only $1,368.75—$912.50, or $456.25 per year in excess of fire room charges (exclusive of coal used) necessary for steam, and the total coal bills for a steam plant must be kept within this amount if it would meet the operating expenses of a Diesel plant. But an average steam plant delivering 365,000 kw. h. per year would probably require under actual operating conditions 1,100 tons of coal at, say, $3.00 per ton, or $3,300, and assuming the labor and supplies in the engine room of each plant as equal, the Diesel would make a saving of $2,843.75 per year, or at least 30 per cent of the cost of installation."

As explained in the discussion which followed, the essential features which distinguished the Diesel engine from all other prime movers are:

"1. As all oil fuels have practically the same calorific value, the cheapest is equal to the highest priced for the purpose intended.

"2. The fuel consumption being controlled automatically by the governor, the consumption on variable load approaches very much nearer the theoretical requirements than when dependent on manual control, as in a steam plant.

"3. The medium for compression being pure air and non-explosive, no back-firing is possible.

"4. The ignition being caused by the heat of compressed air, no ignitors are necessary, and no mixtures or explosions tolerated.

"5. The ignition and combustion is gradual and continuous, with a surplus amount of air to maintain complete combustion. Consequently no carbon is deposited and no fouling of valves or cylinders possible."

The Diesel engine, Mr. McCarty stated, costs about $65 per b. h. p. placed, and weighs about 400 lb. per b. h. p. The engines are built in sizes up to 1,000 h. p. and are guaranteed to regulate within

the standard limits for parallel regulation of alternating current generators.

An interesting paper entitled "Motor Adaptability" was next read by Mr. J. W. Schuster of the University of Wisconsin.

A vote of thanks was given the retiring officer, after which the convention adjourned until the following morning when a few remaining business details were completed.

The evening of the 10th was enjoyably spent at a banquet, followed by a vaudeville entertainment.

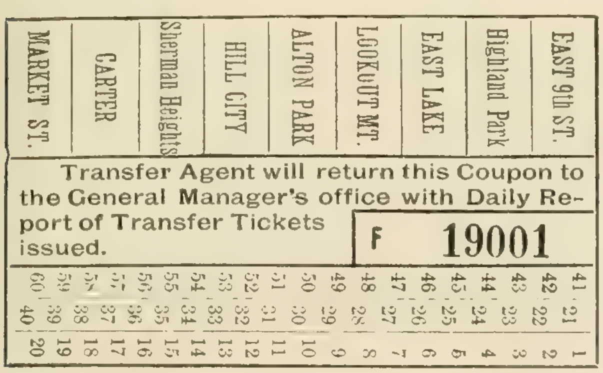
A large and instructive exhibit of railway and lighting supplies was a pleasing feature of the convention. This exhibit, together with the reception rooms provided by the supplymen for their friends, filled the entire parlor floor of the Hotel Pfister.

One of the interesting features of the meeting of this association was the exhibit made by the National Electric Co. Milwaukee being the home of the company, it made special arrangements for the reception and entertainment of its friends attending the convention and exhibited at the Hotel Pfister, the headquarters of the association, some of its specialties. Some bromide enlargements hung on the walls gave an excellent idea of some of the larger electrical machinery made by the firm; the Lundell universal motor, of which the special feature of construction is a magnetic circuit entirely composed of laminations, was exhibited and a nicely printed bulletin giving a detailed description of this new motor was brought out especially for this convention; a publication entitled the "National Electrical Catechism" was presented to each visitor and as a souvenir of the convention a very handsome watch fob was given away, bearing as a charm a bas-relief representation of the company's trade mark. Invitations, which included tickets over the Milwaukee street railway system, were given to the members of the association to visit the works of the National Electric Co. In addition to the manufacture of electrical machinery, the recent order for 700 Christensen air brakes for the Cleveland Electric Railway Co. was being filled and their manufacture seen at the works.

Chattanooga Electric Ry.

The Chattanooga Electric Railway Co. is operating 38 miles of track serving a total population of about 80,000 persons; within the corporate limits of Chattanooga is a population of about 30,000. The company has 16 miles of track. There are operated two lines of 6 miles in length and four which are 3, 3½, 4 and 5¼ miles long, respectively. For all of the lines excepting about 2 miles the franchises are perpetual.

The company has an extraordinarily large number of grade crossings with steam railroads, and the total number of grade crossings



including a few with the Rapid Transit Co. is 98. There is now under construction a viaduct over the tracks of the Nashville, Chattanooga & St. Louis Ry., which will eliminate a most dangerous crossing on the line to the company's pleasure resort, Olympia Park. The cost of this improvement is $58,000, which is distributed as follows: Chattanooga Electric Railway Co., $17,000; County of Hamilton, $17,000; Cincinnati, New Orleans & Texas Pacific Ry. (three tracks), $17,000; Nashville, Chattanooga & St. Louis Ry. (one track), $7,000. The construction is being done by the county according to plans approved by the railways interested.

Other viaducts or subways are contemplated, and when these are completed the cost and danger of operating will be greatly reduced.

Two important [illegible] plated by the company [illegible] of these extensions involves building five miles of track to reach Chickamauga Park [illegible] one mile will be within the park limits, the War Department granting [illegible] track and will [illegible] the top of Lookout Mountain.

The Lookout Mountain [illegible] of track, all of which will be on grades of from 3 to 4 per cent. This line will follow the route of the Chattanooga & Lookout Mountain R. R., which [illegible] rails and ties of the old steam track were removed some years ago and the Chattanooga Electric Railway Co. will rebuild this for operation by trolley.

The company operates regularly about 35 cars and has an ideal transfer arrangement. A transfer station is maintained near the central point of Chattanooga, into which all cars operated run. A passenger paying his fare on any car is entitled to enter the transfer station with the car and being inside the station may remain as long as he chooses and then leave by any other car. Waiting rooms are maintained here and also a ticket office. Persons other than passengers on incoming cars pay fare before entering the station. As a car leaves, the transfer agent counts the number of passengers on board and rings up the proper number of fares on the register and then punches on a duplicate ticket the route and number of passengers entered up on the car; one section of this ticket is delivered to the conductor as his voucher for the fares appearing on his register when leaving the station and the other section is turned into the general manager's office with the daily reports of the transfer agent. No transfers are issued at any other point on the line, thus protecting the company against abuse of the transfer privilege while passengers receive every facility that can be asked within reason.

The company has no power house of its own, but buys current from the Chattanooga Electric Co. The officers of the company are: President and treasurer, J. H. Warner; secretary, T. P. Wells; superintendent, J. W. McFarland.

Electric Omnibus Line in Italy.

"We have many times reported in these columns the interesting experiments made by different constructors to develop a practical system of electric traction on ordinary roads; and at the beginning of the year we described in all its particulars the Canton system which gave so much promise.

"We learn that the Societa Italiana per Industrie Electriche (the Italian Company for Electric Industries) of Spezia, which holds the concession for the electric omnibus service without rails from Spezia to Portovenere, has decided to adopt on this line the jointed trolley system of the firm of C. Frigerio & Co., of Milan (which has just assumed the task of making practical application of the Canton system), and has closed a contract with the Society for the construction of a suitable plant. The service will be begun with three coaches of an absolutely new type worked out by the Frigerio firm, and of the capacity of 16 persons each.

"The construction of the double line about 16 km. long has been intrusted to the Societa Italiana per Trazione Elettrica Ing. Meriggi Diaz & Co. of Milan, specialists in this kind of work. They have in fact worked out a new type of suspension with quadruple insulation between the two lines, which will certainly give the best results.

"The insulation adopted, which being used on a coast line, must be of a special composition, is that of the Ohio Brass Co., of Mansfield, O., a name on which the greatest reliance may be placed.

"We shall follow with interest all the details of the construction and operation of this plant, whether as regards the coach and the special system for taking the current, or as regards the line; and we shall not fail to keep our readers informed in regard to it.

"Meanwhile we observe with pleasure that the first important installation of this kind has been intrusted to two Italian firms, and hence we judge that we shall be able to secure from the results of this great and complex experiment of traction without rails, models for future plants of this kind which in Italy are destined to solve a very important problem."—L'Elettricita, Milan, Italy.

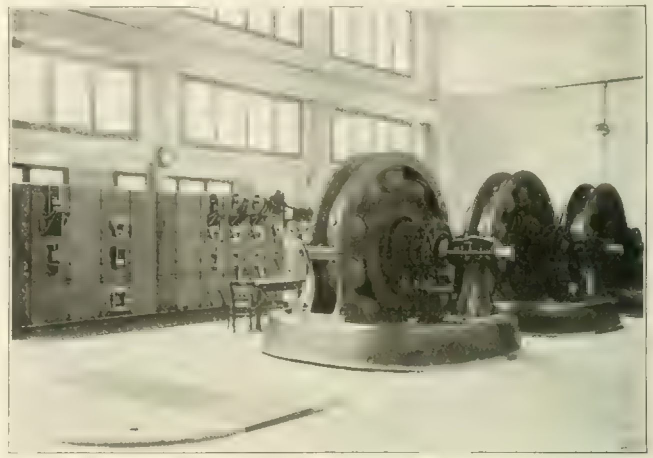
Paris Metropolitan Railway Co.

BY M. [illegible] OF PARIS

The utility of the Paris Metropolitan railway, a service already indispensable to the majority of the Parisian travelling public, has been greatly enhanced by the opening of line No. 3, extending from Courcelles (Avenue de Villiers) in the northwest to Père Lachaise in the eastern part of the city and serving the principal boulevards. The line has a length of nearly five miles and increases the total length of the Metropolitan lines in service to 20 miles. The newly opened line presents several points of interest, in addition to its being the line on which the traffic is expected to be the heaviest of the three now in service. The actual length of the line is 7,485 meters (4.87 miles) making, with the terminal loops, a total of 8,932 meters. Of this length, some 1,845 meters, or a fifth of the total, consists of gradients, the steepest of which is 4 per cent maximum. The curves, except at terminal loops, are never less than 75 meters radius.

The line, entirely underground, includes 15 stopping places, in addition to the two termini at Courcelles and Place Gambetta and the average distance between stations is 466 meters. The service of trains, with a capacity of 800 passengers and a maximum weight of 160 tons, has necessitated more powerful equipments than those in use on the first two lines. The heavy traffic expected on this line has caused the adoption of the train control system, the trains comprising five cars, the first, third and fifth being motor cars. Two types of equipments are at present in service on this line, one the well-known Sprague-Thomson-Houston type with "bridge" control and the other being the Westinghouse pneumatic control known as the turret system.

The Thomson-Houston equipments, some ninety in all, have been supplied by the French Thomson-Houston Co. The motors are of French construction and are known as the TH-10, rated at 175 h. p. Two motors per car are used. The gear ratio is 2.44. Chances of fire are thus reduced to a minimum, although the body of the car remains of pitch-pine, no attempt having been made to supply fire-proof cars, the company apparently relying upon the above mentioned dispositions to safeguard the passengers. The motor cars are placed one at each end of the train and one in the middle and it is stated that this plan has offered the most advantages in making up and running the trains, the starting and acceleration motion being smoother than with two motor cars coupled at the head of the trains.



ROTARIES AND SWITCHBOARD, BARBES SUB STATION.

The cars with which these motor equipments are used are 14.5 meters long and weigh 25 tons empty; they have seats for 46 passengers and standing space for 30 more. These cars are the first cars of the Metropolitan to be mounted on double trucks, and also the first to be equipped with train control. These two features are stated to be giving perfect satisfaction to the company.

CARS 42 FT. 8 IN. LONG, EQUIPPED WITH WESTINGHOUSE PNEUMATIC CONTROL

The whole of the train control apparatus, excepting the motors and collecting device, is arranged inside a cab at one end of the car. This cab is built entirely of incombustible material, and is insulated from the rest of the car. In it are installed contactors, reversers, rheostats, air compressor and switching and controlling apparatus. The wiring is bare, as far as possible, otherwise is encased in asbestos and enclosed in iron tubing. The collectors and shoe fuses, couplers and leads are the only electrical material, besides, of course, the motors, located outside the motorman's cab.

The Westinghouse equipments comprise 200-h. p. motors, and the turret controller is mounted in an insulated cab, similar to those of the Thomson-Houston type of equipments. Some ninety of these equipments have been furnished and most of them are already in service on the new line. The feature of this type of control, as is well known, is the suppression of the 500-volt train cable, the control circuit being operated in conjunction with com-

pressed air by means of a 15-volt battery. The trains comprise five cars, two or three being motor cars. The length of these motor cars is 13 meters and they have capacity for 74 passengers of whom about 45 would stand.

The maximum length of trains is 72 meters, the station-platforms being only 75 meters long. At rush hours a 3-minute headway will be given to the trains, when the service is well in hand; at other times, as for instance early morning and late evening, a 5 to 8-minute service is maintained.

MAP OF METROPOLITAN RAILWAY OF PARIS.

From the accompanying map it will be seen that the lines now open form a divided irregular ellipse, the division being made by line No. 3. Line No. 1 extends from Vincennes to Porte Maillot, and line No. 2, following the northern outer boulevards, makes junction at the Place de la Nation and at the Etoile. Line No. 3 originates in a loop at Courcelles, beneath the Parc Monceau, making there a junction with line No. 2, and proceeds to the Gare St. Lazare and the Opera, and follows at a short distance the central boulevards as far as the Place de la République, whence it proceeds to Père Lachaise Cemetery, passing below line No. 2 with which it again makes junction. Place Gambetta is reached a short time after leaving Père Lachaise Cemetery.

The line is one of the most important of the network of the

PASSENGER BRIDGE OVER SEINE RIVER.

Paris Metropolitan and has enormously increased the receipts of the system. Line No. 3, in fact, ranks next in importance to line No. 4, now constructing, running north and south through the city, serving the Halles, or central markets, a very busy quarter.

The system of the Metropolitan is thus designed:

Section I—1. Porte Maillot—Vincennes (open since 1902).
2. Circle—North part (opened in 1902).
2. [illegible]
3. [illegible]

Section II—4. [illegible]
5. [illegible] menced).
6. [illegible]

Other Lines—7. Palais Royal—Place Danube.
8. Auteuil—Opera.

Only the northern portion of line No. 2 is in service. The southern portion is practically completed, consisting mostly of overhead construction. To make a junction with the northern part, two bridges over the Seine, one at Passy, the other at Bercy, are under construction and will be ready during the first half of 1905. The service over the whole of the circular line No. 2 can then be immediately commenced. This line forms a sort of inner circle around Paris. The outer circle may be called the present steam line of the Petite Ceinture, running close to the walls, which line will probably be electrified at a future date and its system included in that of the Metropolitan. At present the inefficiency of its service is proverbial.

In addition to the cars of a length of 14 meters and 13 meters, as above outlined, there have recently been placed in service on line No. 1 (Vincennes-Porte Maillot) a number of shorter cars (10 meters) mounted on double trucks. Line No. 1 was constructed under the first regulations affecting the Metropolitan system, which included a stipulation that the cars of other railway companies were not to be permitted to run on the Metropolitan, and a narrow gage and small size of tunnel were insisted upon to attain this end. Although the narrow gage was subsequently increased to the present, which is slightly above the standard railway gage, the size of the tunnel was unchanged, and owing to numerous sharp curves on line No. 1, a double truck car of 10 meters is the maximum length allowable thereon.

These cars are equipped with the so-called double-unit equipments of the Thomson-Houston Co., permitting two motor-cars to be coupled at ends, middle or at one end of train. Others have Westinghouse equipments of the type already in service but improved and modified according to the latest practice of that company.

Recent sub-stations opened include Barbes, Etoile and Père Lachaise. All these are similar in equipment, with the usual step-down transformers and rotary converters, the latter of French

TRANSFORMERS AND ROTARIES, BARBES SUB-STATION.

construction and with an output of 750 kw. One or two of the sub-stations are provided with buffer batteries. There are now five sub-stations.

The chief construction features of line No. 3, beyond the No. 2 terminal loops, are the passage beneath the Canal St. Martin and the Opera station. The Canal St. Martin is underground for a portion of its route, where it crosses line No. 3. The subsoil is

aquiferous and the canal has no artificial bottom. Two months only were allowed the contractors for the interruption of traffic on the canal and during this period it was emptied and the ferro-concrete bottom constructed under that part crossing line No. 3, which passes some 14 ft below the bed of the canal

The Opera station also presents considerable interest, as here three lines of the Metropolitan system will cross at levels of 6, 11 and 16 meters respectively below the road level. These are lines Nos. 3, 7 and 8, the two latter forming the lower levels, as yet only on paper. Line No. 3 is the uppermost of the three tunnels and in order to avoid interference with the traffic thereon, when the time comes to place lines Nos. 7 and 8 into service, the whole of the tunnel construction forming the stations has been made. The foundations were made by means of compressed air caissons, three piers being sunk to a level of 18 meters. The masonry work is largely of reinforced concrete, with a steel superstructure supporting the street. The stairway (30 ft. wide) descending to the ticket office is the only exterior sign of the immense work which has been undertaken below, occupying some 18 months to complete.

The cost of line No. 3, construction of tunnels, approaches and stations, but not of the track, equipments and operating mechanism, has been 2,610 francs per lineal meter, this figure including the cost of construction of the Opera and Canal St. Martin sections This line is the cheapest of the three lines in service, the first two costing slightly above this amount per lineal meter and consisting, in part of viaduct, whereas line No. 3 is entirely underground.

Line No. 4 is being pushed energetically and runs from Porte Clignancourt in the North, due South to the Porte d'Orléans. A tunnel, the plans for which have been approved, has just been let to contractors and will allow the passage of the line beneath the Seine. At this point are numerous bridges and an overhead construction for line No. 4 could not be entertained, especially in view of the proximity of the Louvre and other public buildings, the artistic requirements of the city being high.

The remaining lines of the Metropolitan concession are for the most part on paper only. Plans have been approved and portions of lines Nos. 5 and 6 have been given out to the contractors, after the manner in which the first lines were constructed. The work is done, where possible, on the cut and cover system and there is in consequence considerable disturbance to traffic. In parts where the depth or the traffic preclude the use of the cut and cover system, the earth is transported from the tunnels by means of compressed air locomotives.

The whole of the construction work for the Paris Metropolitan railway is carried out under contract for the municipality, which retains the ownership of the tunnels, stations and buildings. A lease of 35 years is granted to the Paris Metropolitan Railway Co., which lays tracks, equips stations, signals, etc., and supplies rolling stock. In practice, a proportion equal to about 30 per cent of gross receipts is paid to the municipality by the operating company, serving as payment for the capital expended on the construction of the system.

Power is supplied to the Metropolitan railway from various sources: (1) from Bercy power station, owned by the railway company, containing two 1,500-kw. direct current units, three 1,500-kw., 5,000-volts, 25 cycles, three-phase units, and a 1,560 ampere-hour battery. (2) From power stations situated outside the city and owned by private companies, one being situated at Asnières, another at Moulineaux; a third is being constructed at St. Ouen, and is interesting from the fact that it will contain, when completed, some 35,000 kw. of turbine driven machinery, of which about 18,000 kw. is now being installed, consisting of three Brown-Boveri-Parsons turbo-alternator groups, 5,500 volts, 25 cycles, three-phase, another group of 3,000 kw. and necessary turbo and engine driven motor-generator groups. Twenty Babcock & Wilcox boilers are installed for this machinery.

The two Metropolitan lines in service, of a total length of 15 miles, carried during the first nine months of 1904 a total of 91,-400,000 passengers. The opening of line No. 3 has made a large difference to the receipts and passengers carried and the figures for the last 10 days of 1904 are as follows: Total passengers, 4,920,-000; receipts, 853,000 francs.

Total passengers carried during 1904 amount to 117,550,500; receipts, 20,348,950 francs; as against 100,107,619 passengers carried in 1903 with 17,290,850 francs receipts.

The Cleveland, Wooster, Mt. Vernon & Columbus Railway Co.

The Cleveland, Wooster, Mt. Vernon & Columbus Railway Co. has recently been incorporated under the laws of the state of Ohio for the purpose of constructing, maintaining and operating an electric railway system between the cities of Cleveland and Columbus, O. The charter granted to this company covers the handling of passengers, freight, express and mail traffic; the furnishing of light, heat and power and the operation of a telephone and telegraph line. It is the intention of the promoters of this line to at first construct a standard gage electric railway from Wooster to Columbus, with a branch to Mansfield, O.; the line from Wooster to Columbus, approximating 105 miles, and the branch to Mansfield, 12 miles. Starting from a connection with the Cleveland & Southwestern Traction Co. at Wooster, the proposed line will traverse the counties of Wayne, Holmes, Ashland, Richland, Knox, Licking and Franklin, touching in their order the cities and villages of Millbrook, Shreve, Custaloga, Big Prairie, Lakeville, Loudonville, Perrysville, Newville, Butler, Ankenytown, Fredericktown, Mt. Vernon, Hunts, Utica, Homer, Johnstown and Columbus. At Newville the line branches off to Mansfield, touching Douglass and Washington. The population of the cities and towns that will be touched by this line is approximately 190,000. The road will be constructed with a view to high speed service, of standard gage, with heavy steel rails, steel bridges and well ballasted. There will be no grade crossings with other railroads and, for the greater portion, the line will be on private right of way. The general offices of the company are at Mt. Vernon, O., and the officers of the company are: President, F. W. Jones; first vice-president, J. J. Vail; second vice-president, E. F. Shelley; general counsel, J. B. Graham; secretary, J. A. Tilton.

York County Railways Beneficial Association.

The permanent organization of the York County Railways Beneficial Association has recently been perfected and application for a charter has been made to the secretary of state. The association was founded by the employes of the York Street Railway Co. and the York County Traction Co., of York, Pa. The objects of the association are to increase the spirit of fraternalism among the employes of the different electric railways in York County and to create a fund to provide for members of the organization in time of sickness or death. The sick benefit will be $5.00 per week, while the death benefits are, in case of the death of a member, $100 payable to the wife or mother, and in the event of the death of a wife or mother of one of the members, $50 payable to the member himself. Upon joining the association members will not immediately become entitled to benefits but will be required to wait a certain period, and if a member leaves the employ of the company he will be entitled to benefits so long as he continues to pay dues and assessments. The amount of initiation fee, dues and assessments has not yet been determined but it is the intention of the organization to discontinue assessments as soon as the funds of the association will permit. The officers of the association are: President, William Shaeffer; vice-president, J. H. Mellinger; treasurer, Ellis W. Lewis; recording secretary, R. S. J. Sitler; financial secretary, S. H. Ludwig; trustees, Milo Glassick, Lee Seachrist and Howard Freed.

Improvements at Birmingham.

The Birmingham Railway, Light & Power Co. is planning a large amount of rebuilding and new work for the coming season. The improvements will include coal handling apparatus, coal storage bins and mechanical stokers at the power house; extension of gas mains in all directions, a viaduct over the railroad tracks in Bessemer, a terminal in Bessemer with a freight house, waiting station and electric light offices; the relaying of the South Bessemer line between Powderly and Bessemer with 70-lb. rails, and the addition of 10 new motor cars, several new trail cars, a new freight motor car, new freight box cars and a general overhauling of the electric light distribution circuits and the replacing of many of them with heavier copper. Mr. T. A. Emery, of Birmingham, is general manager, and Ford, Bacon & Davis are engineers.

The Indianapolis & Cincinnati Traction Co.

Description of the First Single-Phase Electric Railway Built for Commercial Operation.

A very few years ago the proposal to operate an electric railway 120 miles in length from a single power house without the use of rotary converter sub-stations would have been pronounced commercially impossible, yet at the very beginning of the present year we find such a line approaching completion and a considerable portion of it in operation. This has been made possible by the development of a single-phase alternating-current railway motor.

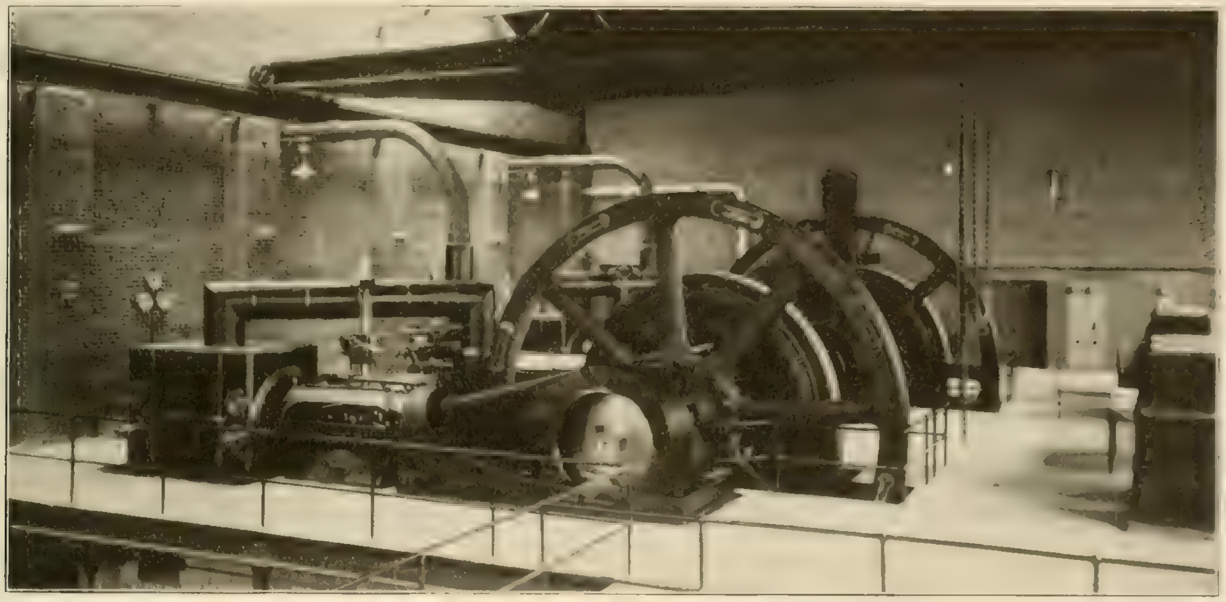
The single-phase traction system is an American one, the application of alternating current to railway work in Europe having involved polyphase induction motors, and in the "Review" for August, 1903, we had the pleasure of describing the Westinghouse single-phase railway motor. This motor was recognized as possessing many points of theoretical advantage for railway work and its test in practical operation has been awaited with keen interest.

The first single-phase electric railway to be built as a commercial undertaking is that of the Indianapolis & Cincinnati Traction Co., of which Mr. Charles L. Henry is president and general manager.

Starting from Indianapolis, the road will pass through the towns of Irvington, Julietta, New Palestine, Reedville, Fountaintown, Morristown, Gwynnville, Arlington, Rushville, Glenwood, Connersville, Dunlapsville, Oxford, Hamilton and Cincinnati. It has already been constructed as far as Rushville, Ind., and, in the course of the present year, will be extended to Connersville. It is the intention of the company to push through to Cincinnati at the earliest possible date. At the present time about 20 miles of road are in operation, and the new system has been shown to be a complete success and to thoroughly justify Mr. Henry and his consulting engineers, Sargent & Lundy, in adopting the alternating current for this important operation.

The central station from which this railway will be operated is located at Rushville, adjacent to the tracks of the Cincinnati, Hamilton & Dayton Railway Co., and distant about 41 miles from Indianapolis. The building is a fire-proof structure of brick, concrete and steel, with well-lighted interior, and skillfully arranged for future enlargement as the operations of the company are extended. The present equipment includes three 350-h. p. Babcock & Wilcox boilers, which are at present fired by natural gas. Provision is made, however, for the burning of coal if at any time the supply of gas becomes insufficient, and arrangements have been made for the future installation of [illegible] machinery, with overhead bunkers which will feed directly to the boiler grates. The [illegible] building. The rest is divided into two parts, the larger room being known as the main engine room, while the [illegible] portion of the building is set apart as a high-tension chamber.

The generating equipment consists of two 500-kw., 2,300-volt Westinghouse alternators of the revolving field type, wound for 3-phase, 25-cycle current, and direct connected to cross compound corliss engines, built by the Fulton Iron Works, of St. Louis. The operating speed is 94 r. p. m. The engines are of the double-cylinder vertical type. Both engines and generators are designed for an overload capacity of 50 per cent. Each engine is equipped with an independent jet condenser made by the Dean Bros. Steam Pump Works, of Indianapolis. Water [illegible] by a large mill-race through an underground tunnel running under the basement floor.



INTERIOR MAIN POWER HOUSE, RUSHVILLE, IND.

The 2,300-volt, 3-phase, 25-cycle current from the generators is led direct to two pairs of 250-kw. air-blast transformers, which are connected according to the Scott 3-phase 2-phase system. The secondary windings are arranged for 2-phase operation at 33,000 volts, at which potential the current is delivered to the transmission lines. A pair of motor-driven Sturtevant fans provide the air necessary to ventilate these transformers.

The generators are separately excited by direct current at 125 volts. Duplicate exciter generators have been installed, one of which is direct connected to a Westinghouse steam engine, the other to a Westinghouse type C induction motor.

The switchboard controlling panels are located in the main engine room, but the switches, transformers and other similar apparatus have been installed either in the basement or in the high-tension chamber. The main bus bars are in the basement and are supported upon a masonry structure of most approved design and construction. Live bars are separated by barriers of "Alberine" stone.

The power house was built according to plans and specifications of the consulting engineers, Sargent & Lundy, Chicago, and all of the equipment was purchased under their specifications and installed under their supervision. The electrical apparatus was all furnished by Westinghouse Electric & Manufacturing Co.

A pair of 300-kw. transformers of the Westinghouse oil-insulated self-cooling type located in the power house reduces the 33,000-volt current from the main transformers to a potential of 550 volts, and feeds that portion of the trolley line which is located within the limits of the city of Rushville.

Other portions of the trolley are fed at a potential of 3,300 volts, obtained from the 33,000-volt transmission lines through reducing transformers which are installed in transformer stations conveniently located along the road at intervals of from 10 to 12 miles. At this time three of these transformer stations have been constructed, one near Indianapolis, another at Reedville and a third at Gwynnville. The buildings are very small and compact, measuring but 21 ft. by 23 ft., but their construction is thoroughly substantial and is fire-proof throughout. The walls are of brick laid in cement mortar and mounted upon foundations of concrete; the floors are of concrete laid upon steel beams. The doors and windows are protected by steel shutters. The equipment of each of the transformer stations so far installed consists of two 300-kw. oil-insulated step-down transformers of the Westinghouse self-cooling type, 33,000 to 3,300 volts, together with disconnecting switches and suitable lightning-protecting apparatus, including low-equivalent lightning arresters and static interrupters. Provision has been made in each station for a third similar unit when required. The transformer stations contain no automatic switches of any type,

OVERHEAD CONSTRUCTION.

but are controlled altogether from the main central station. They therefore require no attendance and need be inspected only occasionally when in operation.

The transformer stations were planned by Sargent & Lundy, and erected under their supervision, the electrical equipment being furnished by Westinghouse Electric & Manufacturing Co. The disconnecting switches in each station were made from designs specially prepared for this service by Sargent & Lundy.

As has been stated, the main section of the trolley will be fed at a potential of 3,300 volts, while in the city of Rushville 550 volts alternating current will be used. As, however, within the city of Indianapolis the cars must operate over the already existing lines, which are equipped for direct current at 550 volts, provision had to be made for operation with both direct and alternating current and at a trolley potential of both 550 and 3,300 volts. This single-phase system, the first to be put in commercial operation, therefore serves to exemplify the adaptability of the new type of motor for operation upon both direct and alternating-current circuits and to illustrate the flexibility of the system in regard to voltage.

In the drawings for the power-house wiring there is shown a 2-phase 4-wire circuit, in addition to the single-phase circuits which connect the power house with the transformer stations. This power circuit illustrates an arrangement whereby it is proposed in the future to operate the electric railway now running between Indianapolis and Shelbyville from the Rushville station. The Indianapolis and Shelbyville line is owned by the Indianapolis & Cincinnati Traction Co. and is at present operated from its own power house through rotary converter sub-stations and direct-current railway motors.

At this time the Indianapolis & Cincinnati Traction Co. is giving an hourly service between Rushville and the neighboring towns towards Indianapolis, and the work is being completed rapidly with a view to running through cars into the larger city. There are at present 10 cars which were built by the St. Louis Car Co. The cars are 55 ft. over all, and divided into three compartments; one arranged to carry baggage, the center compartment as a smoker, and a main compartment with a seating capacity for 38 people. The cars are handsomely finished in mahogany, with plate glass windows and art glass in the ventilators. The trucks are of the M. C. B. type, made by the Baldwin Locomotive Works, and have steel-tired wheels 36 in. in diameter and 6-in. axles with 5×9-in. journals. The electrical equipment consists of four 75-h. p. single-phase alternating current Westinghouse railway motors of the commutator, series wound type, mounted two to the truck. The equipment includes the Westinghouse unit switch system of multiple control, so that the cars may be operated either singly or in trains.

TRANSFORMER STATION AT REEDVILLE, IND.

As these cars are to be operated by both direct and alternating current, the rheostatic system of control was adopted. The motors are geared for a maximum speed of 45 miles per hour and are arranged for a schedule speed of 30 miles per hour, which has been adopted for local service. Stops will be made at all of the cities and towns and at the principal crossings of the country. To properly take care of the through service, additional "limited" cars will be run at an early date. These "limited" cars will be equipped with four 150-h. p. motors and will be arranged for a schedule speed of from 50 to 60 miles per hour, as, under the provisions of the various franchises under which the company operates, they will not have to make stops in the country or in the smaller towns and will be required to make only one stop at each of the larger intervening cities. It is expected that when the road is completed from Indianapolis to Cincinnati these "limited" cars will make the through trip from the center of one city to the center of the other in three hours' time.

The road has been built with a view to handling heavy freight, even to the extent of handling long trains, and it is confidently expected that the use of a high voltage on the trolley wire and the sliding contact bow trolley will make such a service possible without experiencing the difficulties which have heretofore been encountered when a heavy freight service has been attempted with direct-current operation.

Each car is equipped with two trolleys—one of the bow type designed for high potential service; the other, a modified form of the union standard trolley, intended for use on the direct-current

line in Indianapolis and the low voltage alternating current line in Rushville.

The roadway is believed to be equal to that of any one in the country. The track is graded in accordance with the best practice, cuts and fills having been made wherever necessary to avoid excessive or frequent grades. For a distance of nearly 50 miles from Indianapolis there is no grade in the line to exceed 1½ per cent, and, while from that point on toward Cincinnati the country is less level and in some cases straight lines have been preferred even at the expense of slightly increased grade, it is confidently expected that, with the true alignment secured and the low grades encountered, greater speed can be maintained with comfort and safety to passengers than on any steam road now operating in that vicinity. So far as has been yet determined, the heaviest grade will be 4 per cent.

105 FT. BRIDGE OVER BIG SUGAR CREEK, NEAR NEW PALESTINE, IND.

The roadbed is graded 28 ft. wide on top for a double track, with slopes on fills and in cuts of 1½ to 1, and upon a grade line that puts the track in most instances above the level of adjacent lands, so as to avoid trouble on account of snow. In the construction of the roadway, bridges, etc., provision has been made in every case for double track, though but one track has been laid at the present time. The bridges across all streams are constructed in the most approved manner, either with concrete steel arches or with steel girders and stone abutments. The upper structures have been built of the very best steel construction by the Indiana Bridge Co., of Muncie, Ind., and are made of sufficient strength to carry trains of cars having a gross weight of 100 tons per car. Though all abutments have been built for double track, the superstructure at the present time is arranged for one track only. It will be noted that provision has been made for the heaviest demand in respect to size of cars and length of trains likely to be experienced in the near future.

Wherever possible the track has been laid upon the company's private right of way. Where the land is level and there are no considerable fills or cuts, a right of way four rods wide has been secured, but wherever peculiarities of construction made it desirable, a wider right of way has been obtained. In all of the smaller towns the private right of way has been continued through, and the road has been constructed upon streets or highways only in cities of such size as to make it necessary. Wherever possible, curves have been avoided and such an alignment has been secured between cities and towns as will permit of very rapid running with entire safety to passengers and equipment. In most instances the right of way has been protected by a woven wire fence erected under an agreement with the land owner whereby he maintains the fence and keeps all gates closed. Wherever such agreements have not been secured the right of way has been fenced with barbed wire. In most cases the company has also been granted the right to cut and keep out any timber on adjacent lands which might interfere with its wires and fences or with the operation of the road.

The track is laid with 70-lb. T-rail in 60-ft. lengths, connected with Weber rail joints and Ohio Brass No. 0000 10-in. copper bonds, with ⅞-in. terminals under the plates so as not to be exposed. Cross bonds are put in every half-mile and long bonds under all [illegible] been furnished by the [illegible] cago, the construction throughout following the highest standards. [illegible] of open switches. [illegible] though a few [illegible] bridge ties are of long leaf [illegible] used throughout the whole line, and is generally laid 8 in. under the ties and level with the top of the rail. In the streets of Rushville an 18-in. layer of broken stone has been placed under the ties.

The high-tension transmission lines are composed of No. 4 bare copper wire. A single-phase circuit leads to each transformer station. The high-tension wires are supported on large porcelain insulators, held by iron pins to strongly constructed cross-arms, mounted upon a separate line of poles which are set near the edge of the right of way.

Along the private right of way the trolley wire is suspended from poles set in the center of the grade 100 ft. apart, with a bracket made of angle iron looped at the end so as to carry a large flat insulator from the top of which is run a 7-16-in. steel stranded cable or messenger wire. The trolley is formed of No. 000 copper wire and is carried 8 in. under the messenger cable, to which it is attached every 10 ft. with specially made steel clamps. This form of construction is known as the catenary suspension. The steel messenger cable is drawn tight. The insulators are large and strong, and even if one is broken the steel cable would remain suspended from the top of the bracket. As the trolley is attached to the steel cable every 10 ft., breaks will seldom occur, and, even if one should take place, not more than 10 ft. of trolley wire would be loose. The catenary construction provides a practically level trolley, with no sudden bends at the insulators, such as is often found with the ordinary suspension. This point is of particular advantage in high-speed service. The trolley wire is suspended 18 ft. above the track.

Where the tracks are in the streets, the poles are set on the sides of the streets and the trolley suspended from span wires. Otherwise, the construction is the same as along the private right of way.

The overhead material for the entire line construction was supplied by the Westinghouse company according to designs and specifications of Sargent & Lundy.

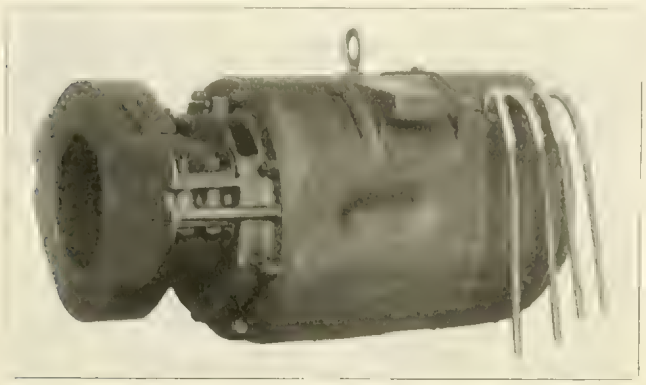
The entire system is provided with two metallic circuit telephone lines, one of which is reserved exclusively for the train dispatcher;

OVERHEAD CROSSING NEAR [illegible], IND.

the other line is intended for general company business. Each car carries a telephone, so that communication can be had with the train dispatcher at intervals of 2,000 ft. Telephone wires are carried on porcelain insulators on cross-arms near the tops of the trolley poles. The wires are transposed every 500 ft. in order to avoid disturbance by the current in the transmission lines.

The poles are all of selected white cedar; those for the center trolley construction are 40 ft. long with 7-in. tops, and the side poles for the high-tension lines are 35 ft. long with 7-in. tops. All poles are set 6 ft. in the ground and are carefully tamped; 30-ft. poles are used for the streets in the cities where there are no feed

wires and the poles are used only to support the span wires, while on the other side, where the high-tension lines run, the poles vary in height from 40 ft. to 60 ft. so as to carry the transmission lines above the shade trees. All the side poles along the streets are neatly shaved and painted and are set in concrete. The 60-ft. poles are of Idaho cedar, and are smooth and straight as if turned in a lathe. The entire pole line was constructed under the direction of Mr. A. A. Anderson, general superintendent of the Indianapolis & Cincinnati Traction Co., and under the immediate supervision of Mr. Oscar D. Emery. The work is of a most excellent character and attracts the attention of the most casual observer.



WESTINGHOUSE 75 H. P. ALTERNATING-CURRENT, SINGLE-PHASE, SERIES-WOUND RAILWAY MOTOR

The Indianapolis & Cincinnati Traction Co. was organized Feb 4. 1903, under the laws of Indiana. It is managed by a board of seven directors, consisting of Charles L. Henry, Indianapolis, president and general manager; Ephraim Marsh, Greenfield, Ind., vice-president; Wm. L. Taylor, Indianapolis, secretary; Endorus M. Johnson, Indianapolis, treasurer; James W. Fesler, Indianapolis; Theodore F. Rose, Muncie, Ind.; Wm. M. Frazee, Rushville, Ind.

The general office of the company is at Rushville. It is a three-story frame building with a slate roof and was constructed from a residence which was purchased in the first instance to enable the company to make an easy curve around the corner. . The building

ARMATURE OF MOTOR.

is now equipped with fire-proof vaults, heated with steam, and lighted from the company's own power station and is arranged with ample accommodation for the general officers of the company. Waiting rooms and baggage rooms are also provided. The executive officers of the company are located in the Traction & Terminal Building at Indianapolis.

Under the provisions of the franchises of the Indianapolis Traction & Terminal Co. interurban lines are allowed to enter the city over the tracks of the city company by such roads as the city designates, upon payment to the city company of an agreed or ascertained compensation. The Traction & Terminal company has made a uniform agreement with interurban roads for entrance into the city over its tracks whereby the interurban road pays 4 cents for each passenger carried while on the city lines. This agreement entitles the interurban line to all of the privileges of the Terminal Station, where all the interurban roads of Indianapolis enter.

The Indianapolis & Cincinnati Traction Co. has franchises of a most favorable character in all of the cities and towns through which the line passes. They uniformly run for a period of 50 years and contain no objectionable features regarding the pavement of streets, the erection of iron poles or the payment of a franchise tax to the state or town. The franchises in the cities of Rushville and Connersville permit the company to run "limited" cars, making only one stop in each city. In all of the smaller towns the franchises specially provide that "limited" cars need not stop at all. The franchises also provide for the carrying of freight, express and mail matter under reasonable regulations of the various cities and towns. All private rights of way and franchises outside of cities and towns run in perpetuity.

The most interesting feature of the new installation, made possible by the use of the alternating-current system throughout, is the absence of the rotary transformer sub-station and the consequent small amount of feeder copper required. The No. 0000 copper trolley wire is supplemented by no feeder and the only lines required are the No. 4 high potential transmission lines which connect the main power house to the transformer stations. The system therefore makes possible a great saving in copper and does away entirely with the expense usually incident to the operation of sub-stations and which may be regarded on an average as amounting to the wages of three men, aggregating not less than $6.00 per day for each sub-station. The adoption of the alternating-current system makes possible for the three transformer stations already installed between Indianapolis and Rushville a saving in wages amounting to $6,570 per annum. It is estimated that for the 10 stations which will be installed between Indianapolis and Cincinnati a total annual saving of $22,000 is thus made posible in wages alone. In addition to this there will be a large sum of money saved in the maintenance and repair of machinery.

President Henry, whose foresight and courage made possible the trial of the alternating-current railway motor in so large an operation, is one of the pioneers in the development of modern electric traction. In 1897 he built the first interurban line in Indiana, and under his management the Union Traction Co. in 1900 united a system of lines extending from Indianapolis via Anderson to Muncie, from Anderson via Alexandria to Marion, and from Alexandria to Elwood, with about 100 miles of line.

Manganese Steel.

Editor "Review":

I noticed that in the January number of the "Review" you report the December meeting of the New England Street Railway Club and the paper which I read at that meeting. While I appreciate the quite full report, there is one quotation of what I said which is incorrect, and as it is somewhat important, I would be obliged to you if you would correct it in your next issue.

At the beginning of page 55 you make me say that as the original patent of Mr. Hadfield on the alloy containing a certain percentage of manganese had expired and the production of the alloy was therefore public property, "a number of different manufacturers were using it with success." This is not correct, or at least it might be misleading. What I did say was that Mr. Hadfield's original patent covering an alloy with a certain percentage of manganese had expired a couple of years ago and the production of an alloy of this description was public property, of which a number of manufacturers in various lines in which manganese steel had been eminently successful had taken advantage, but that Mr. Hadfield's invention was not alone the alloy, but the proper development of its properties by treatment, which treatment is still protected by subsequent patents, and which patents, as stated previously in the paper, were controlled in the United States by the Taylor Iron & Steel Co., of High Bridge, N. J.

Yours truly,

V. Angerer, Vice-Pres.,

Philadelphia, Jan. 24, 1905. Wm. Wharton, Jr., & Co., Inc.

A suburb of Revere Beach, Mass., is known as Streetcarville. This name originated from the large number of residences consisting of old horse cars, which a local transportation company sold at $10 each, and which are arranged in regular street formation.

Meeting of A. S. R. A. Executive Committee.

On February 3d and 4th, the executive committee of the American Street Railway Association held a meeting at the Holland House, New York City, at which were also present representatives of the Accountants', the Mechanical and Electrical, the Claim Agents and the Manufacturers' associations. The principal purpose of this meeting was to consider plans for the re-organization and possible amalgamation of the various street railway associations with the American Street Railway Association. Mr. W. Caryl Ely, president of the American Street Railway Association, briefly summed up the action taken at St. Louis, which was in favor of a re-organization of the American Street Railway Association, and emphasized the need of careful consideration before any definite action be taken. Mr. Ely stated that his mind was open as to what should be done, and that he believed that the best result would be obtained by submitting the question to a sub-committee representing all the associations. As a basis to work upon he highly approved the plan suggested by Mr. Richard McCulloch of St. Louis, which is given herewith.

MR. McCULLOCH'S PROPOSED PLAN.

Before street railways attained their present importance, the president, manager, superintendent or operating head of the railway dircted its every detail and was interested in every part of the work, from the care of horses and the construction of track to the accounting and financial problems. At that time he took part in the discussions at the general meetings of the American Street Railway Association because he felt familiar with all the questions there presented.

With the growth in size, importance and wealth of street railways, however, these conditions have changed, the different departments now being under the direction of specialists. The superintendent of transportation is no longer interested in accounting propositions, and the master mechanic does not care to sit through a discussion on transfers. This is shown by the fact that for several years there has been a poor attendance, a general listlessness, inattention and lack of discussion at the general meetings of the main association, while quite the reverse has been the case at the meetings of the accountants and mechanics.

To prevent the breaking up of the association by the further secession of organizations of specialists, and to enable the association to perform the good of which it is capable, the following plan of organization and meeting is proposed:

I. The annual conventions shall combine general meetings of the American Street Railway Association together with meetings of certain sections to which the consideration and discussion of papers and technical questions shall be allotted. The following sections are suggested.

A. FINANCE, POLICY, ORGANIZATION, LEGISLATION.

It is presumed that the presidents, managers, directors, etc., would attend the meetings of this section, and if deemed advisable its meetings could be held in executive session.

B. TRANSPORTATION.

This section is for superintendents, and such questions as transfers, time-tables, inspection, etc., would naturally come before it.

C. ACCOUNTING.

This section would perform the work now done by the Accountants' Association.

D. ROLLING STOCK AND CAR EQUIPMENT.

This section would consider questions relating to the construction and maintenance of cars, trucks, motors, etc., which are now taken up by the Mechanical and Electrical Association.

E. POWER PLANT AND POWER DISTRIBUTION.

Matters regarding the construction and maintenance of power plants, high-tension distribution, low-tension feeders, overhead construction, together with the consideration of new systems for the supply of power, would come before this section.

F. BUILDINGS AND ROADWAY.

This section would discuss building and track problems.

G. CLAIMS AND DAMAGES.

In the meetings of this section, those interested with the settlement of damage claims could get together and compare notes.

II. The necessary changes in the constitution and by-laws of the association shall be made that the officers of the association shall consist of a president, vice-president, permanent secretary and treasurer. The permanent secretary shall be the executive officer, statistician, keeper of records, etc., performing similar duties to the secretaries of the various engineering societies.

The executive committee shall consist of the president, vice-president and treasurer of the general organization, together with the presidents of the different sections. This executive committee shall perform the work of the present executive committee and shall have the power to increase or diminish the number and scope of the various sections as it may deem advisable.

III. Simultaneous meetings of the various sections may be held at the annual conventions, but meetings of related sections should be so arranged that a delegate who is interested in questions coming before more than one section may have the opportunity of attending the meetings of several sections. For instance, the manager who would attend the meetings of Section A should have his choice of the other sections. The meetings of the superintendents and roadmasters should be held at different times so that one delegate may attend both sections. The same arrangement should be made for the master mechanics and the power plant men, and for the accountants and claim agents.

A printed program of the meetings of the various sections, together with the papers and topics to be brought up at each meeting, should be distributed in advance of the annual convention, and this program should be strictly followed, so that a delegate may come to the convention knowing what questions he wishes to discuss and how to dispose of his time to the best advantage. There is no reason why the meetings of the sections should not begin at 9 a. m and continue, with a recess for lunch, until 5 p. m., and if the business cannot be completed during the day sessions there is no reason why a certain section may not hold a night session.

There will be ample time for a delegate to examine the exhibits when his particular section is not in session, or the executive committee may assign a day for this purpose.

In order to illustrate the application of the scheme thus outlined, the following program for the year 1905 is mapped out, the dates being chosen at random:

ANNUAL CONVENTION, A. S. R. A., 1905.

Tuesday, Sept. 26, 1905.

9 a. m. to 12 m. General Meeting of the Association.
- Call to Order.
- Address of Welcome.
- President's Address.
- Abstract of reports of Secretary, Treasurer and Executive Commitee.
- Reports of Committees.
- General Business of the Association.
- Appointment of Nominating Committees.

2 p. m. to 5 p. m.
- Meeting of Section B (Transportation).
- " " " C (Accounting).
- " " " D (Rolling Stock).

Wednesday, Sept. 27, 1905.

9 a. m. to 12 m.
- Meeting of Section F (Roadway).
- " " " C (Accounting).
- " " " E (Power Plants).

2 p. m. to 5 p. m.
- Meeting of Section B (Transportation).
- " " " G (Claims).
- " " " D (Rolling Stock).

Thursday, Sept. 28, 1905.

9 a. m. to 12 m.
- Meeting of Section A (Finance, Legislation, etc.).

2 p. m. to 5 p. m.
- General Meeting of the Association.
- Unfinished Business.
- Report of Nominating Committee.
- Election of Officers.
- Adjournment.

The following is a resumé of the allotment of time:

Section A—Finance, Legislation, Organization, etc.	3	hours
" B—Transportation	6	"
" C—Accounting	6	"
" D—Rolling Stock and Car Equipment	6	"
" E—Power Plant and Power Distribution	3	"
" F—Buildings and Roadway	3	"
" G—Claims and Damages	3	"
Total time spent in meetings of sections	30	hours
Time allotted for general meetings of association	6	"

This division of work will give 30 hours of section work during a three days' session of the convention, and allowing one hour and thirty minutes for the discussion of each topic or paper. There is time for the discussion of 20 subjects, which about quadruples the capacity of the present organization. It is unnecessary to dwell on the fact that the topics would be discussed by men who are interested in the questions and that, as the meetings would be smaller, discussion is apt to be freer. The above outline is merely given as an illustration of what might be done under this scheme and without any intention to limit the sections to the time allotted to them, or to establish any arbitrary limit to the number and scope of the sections. This should be established by the executive committee of the association from time to time.

Precedents for this method of disposing of the business of large conventions exist among the educational associations, notably the American Association for the Advancement of Science, which has for a number of years conducted very successful meetings on this basis.

Mr. McCulloch made some further explanations of the plans suggested by him, dwelling upon the fact that the general scheme was one which had been found to work well in connection with the American Association for the Advancement of Science, many of the members of which were interested in the work of more than one of the sections of the association.

Mr. W. G. Ross, president of the Street Railway Accountants' Association, expressed approval of a great many of the features of the plans suggested by Mr. McCulloch, but said he was opposed to having his association placed as a part or section of the parent association; he wished to retain the name and identity of that association, which had been in existence since 1897 and had got into close touch with steam railroad commissioners of the country. Mr. Ross did not believe that the work of the secretary's office of a combined association could be done in a satisfactory manner by a general secretary, as there was in connection with the work of the Accountants' association alone enough work to keep one man busy. Mr Ross also touched upon the desirability of having the matter of individual membership in the various associations considered.

Mr. C. F. Baker, president of the American Railway Mechanical and Electrical Association, expressed ideas similar to those of Mr. Ross. The Mechanical and Electrical association is an association of engineers and independent in a way of the American Street Railway Association. It needed financial assistance, however, to make it the benefit it should be to its members and the railway companies they represent. Its secretary should be a technical man familiar with the line of work undertaken by the association. As the president holds office for only a year, whereas the secretary is habitually re-elected, it is the secretary who should be the active executive officer of the association.

Mr. H. H. Adams spoke along the same lines as Mr. Baker.

Mr. W. H. Dibbs, president of the Claim Agents' Association, stated the progress it had made since the St. Louis meeting and explained the manner in which his association had already proved of great assistance to its members by aiding in exposing fake accident workers.

Mr. D. M. Brady, chairman of the Manufacturers' Association, spoke at some length as to the attitude of that body, which was anxious to co-operate in every way with the American Street Railway Association. Mr. Wm. Wharton, Jr., also addressed the meeting as a representative of the Manufacturers' Association.

Mr. H. H. Vreeland criticised the American Street Railway Association for its backwardness in still adhering to horse car methods in conducting its business while the business of the members was conducted along modern lines with advances commensurate with the change of conditions. Mr. Vreeland referred to the various associations in the steam railroad field, particularly the American Railway Association and the Master Car Builders' Association. He also calls attention to the need of an association bureau charged with the collection of general information and its distribution to those in need of it.

All the speakers expressed approval of the principal features of Mr. McCulloch's suggested plans and approved of the suggestion to submit the matter to a sub-committee. On motion a sub-committee to consist of four members of the American Street Railway Association and one from each of the other associations, with President Ely as chairman ex-officio, was appointed. This committee comprises:

American Street Railway Association—W. Carly Ely, chairman ex-officio; Richard McCulloch, C. G. Goodrich, E. C. Foster and W. E. Harrington.

Street Railway Accountants' Association of America—W. G. Ross; Frank R. Henry, alternate.

American Railway Mechanical and Electrical Association—H. H. Adams; E. W. Olds, alternate.

American Association of Street Railway Claim Agents—W. A. Dibbs; W. H. Renaud, Jr., alternate.

American Street Railway Manufacturers Association—W. H. Heulings, Jr.; Wm. Wharton, Jr., alternate.

The association decided to hold the 1905 convention at Philadelphia during the week beginning Monday, September 25th. Headquarters will be at the Bellevue-Stratford Hotel.

Handling Express by Electric Suburban Railways.

BY F. A. EVANS, MANAGER QUEBEC RAILWAY, LIGHT & POWER CO.

The writer submitted a paper to the Canadian Electrical Association in 1902 upon "Electrical Suburban Railways," in which he took the ground that steam railroads will, in the near future, handle their suburban and short distance interurban passenger traffic and mail, express, baggage and light local freight by electric motive power. In this paper the writer submitted statements showing the results from passenger traffic, of carrying out this theory upon the existing steam railway running between Quebec, Ste. Anne and St. Joachim, a distance of 25½ miles. These results showed that during the year 1889-1890, the first year's operation, 95,563 passengers were carried and in 1899-1900, 261,175 passengers were carried; this under the old regime of steam railroading. The next year, 1900-1901, under the electric motive system, 537,933 passengers were carried and last year, 1903-1904, 877,310 passengers were carried, of which number 155,980 passengers were carried by steam trains. (By way of explanation, it is necessary to mention that the same number of steam trains, arriving and departing at the same hour, are being operated now as in 1899-1900.) And the passenger receipts, which averaged $38,246.47 a year during the 11 years of steam operation, last year amounted to $96,943.47; from this it will be noted that the average fare per passenger has decreased from 18.17 cents to 11.05 cents, showing that the more frequent service permits of and encourages the residents along the railway to visit from village to village, which under the old system was not so frequent and at the time, as there has been no apparent increase in population, accounts for the large increase in travel.

In 1900, the writer issued instructions to all agents to make a report of all parcels, hand valises, baskets, canes, umbrellas, etc., which were handled by them, to be taken charge of and for which no charge was being made; in other words, the agents were taking charge of these parcels merely as an act of courtesy and without responsibility. The results showed that large numbers of parcels were being left, and an inspection of the reports showed that these parcels at the Quebec office principally consisted of groceries, meat, laundry, etc., whereas at the wayside stations, they consisted of vegetables, cut and uncut flowers, fowls, laundry, etc. Consequently, in the spring of 1901, parcel offices were opened at each station and agents were instructed not to accept the care of any packages without making a charge of 5 cents for each article for the first 24 hours, and a similar charge for each additional day,

*Read before the Canadian Street Railway Association, December, 1904.

and a supply of parcel checks was at the same time issued. The movement created considerable opposition from the regular passengers who, by reason of their having had a privilege for over 11 years, now claimed it as a right; as a consequence, receipts which were anticipated from agents' reports to amount to several

THIS WAY BILL TO BE MADE IN DUPLICATE AND ONE COPY TO BE SENT TO AUDIT OFFICE

QUEBEC RAILWAY, LIGHT AND POWER CO. No. 2001
(MONTMORENCY DIVISION.)

CONDUCTOR'S WAY-BILL OF FREIGHT FORWARDED

Initials of Car

No. of Car

Shipper	Consignee and Destination	No. Packages	Description of Articles	Weight	Rate	Net Freight	Advanced	Total Collect

FORM B 31—ORIGINAL IS 10 X 3½ IN.

hundred dollars a year did not amount to $100, and a careful watch at the different stations revealed the fact that residents would bring a parcel to the station, wait the arrival of some friend and then request their friend who was traveling to take charge of it and bring it either to or from town. Grocers in town would be telephoned to from say Mrs. B. to meet a certain train and hand her parcel to Mr. H. who would take charge of it. Mrs. B. some

EXPRESS FREIGHT RECEIPT.

QUEBEC RAILWAY, LIGHT & POWER CO.
(MONTMORENCY DIVISION.)

This Railway will not be responsible for any goods mis-sent unless they are consigned to some Station on the Railway, such Station being plainly stated.

Date 190

RECEIVED from

the undermentioned Property, in apparent good order, addressed to

to be sent by the said Railway, subject to the terms and conditions as stated above and upon the other side.

FORM B 32—ORIGINAL IS 8¼ X 5½ IN. REGULATIONS AND TARIFF ARE PRINTED ON THE BACK.

times and generally meeting Mr. H. at destination to take the parcel from him. This condition naturally led to the establishment of an express, baggage, and light local freight department, thus attempting (perhaps earlier than anticipated) the last theorem laid down in the paper read to the Canadian Electrical Association, previously referred to (the carriage of the mails having been previously arranged for).

Under steam railway rules, as is generally known, freight charges are arrived at according to [illegible] Canadian Freight Association, the different railways of course having their own rates but abiding by the [illegible]. Rule 30 provides for such articles as the Quebec Railway, Light & Power Co. is now carrying under the [illegible] local freight department, as follows: Small consignments of one class, or including articles of several classes, will be charged at actual weight, according to the classification of each article, but no single shipment will be taken for less than 100 lb. 1st class, exclusive of cartage. The minimum charge is 35 cents, with an additional charge of 10 cents for each cartage performed by the railway company's cartage agents. Thus it will be seen that the

M

To the QUEBEC RAILWAY, LIGHT & POWER COMPANY, Dr.

For Transportation of *Our Charges*

From *Advanced*

Shipped by *Total $*

Weight *lbs.* *Received payment for the Company*

FORM B 34—ORIGINAL IS 8½ X 3½ IN.

company was unable under this tariff to convey any parcel, no matter how small, for a less charge than 35 cents—in many cases more than the value of the package of rhubarb or other vegetables that were being sent to town. It was therefore necessary to make not only new rates suitable to the special requirements of the district, but also to make new rules and regulations regarding this class of traffic; these rules and regulations came into effect Dec. 1, 1902, the tariff being as follows:

Any station to any station, for all parcels, small boxes, etc.; From 0 to 10 lb., 5 cents; over 10 lb. to 20 lb., 10 cents; over 20 lb. to 30 lb., 15 cents; over 30 lb. to 50 lb., 20 cents; over 50 lb. and not over 100 lb., 25 cents.

Form B 33

NOTE.—Agent will be particular to note the authority by which any deviation is made from Tariff Rates: otherwise the proper rate will be substituted, and the Agent held responsible for the deficiency.

QUEBEC RAILWAY, LIGHT & POWER CO. No. EX. 6301
(MONTMORENCY DIVISION)

190

EXPRESS WAY-BILL OF FREIGHT FORWARDED from

Train No.

SHIPPER	CONSIGNEE	No. Packages	DESCRIPTION OF ARTICLES	Weight	Paid	Advanced Charges	Our Charges	To Collect	SIGNATURE FOR GOODS

FORM B 33—ORIGINAL IS 10¾ IN. WIDE.

The rules governing [illegible] as follows:

Express Freight.—All goods weighing less than 100 lb. offered for shipment, will be carried on any regular passenger or electric train, with all despatch possible.

Each parcel, box, etc., must be properly packed and addressed in full before a receipt (Form B 32) is given to the sender. Fresh fish, fresh meat and any other perishable articles must be prepaid. Any dangerous articles will not be accepted except on special orders from the superintendent.

Agents will use Form B 33 when way-billing, which must be made in duplicate, one copy of the way-bill to be given to the driver of the electric train or the baggageman of the steam train, and the goods must be forwarded by the first train due after the goods have been accepted for shipment; the other copy of the way-bill will be kept by the agent and accounted for in the same manner as regular freight.

Agents receiving express freight will issue Form B 34 and notify consignee as quickly as possible, and when goods are delivered a receipt must be taken on Form B 33, opposite article for which receipt is required. Way-bills received will be accounted for in the same manner as regular freight.

Conductors of all regular trains may accept goods for shipment at any flag station, using Form B 31 for billing express freight.

Any article weighing over 100 lb. to be carried by the regular freight trains only and under Canadian freight classification rules. These regular freight trains are operated by steam in the usual manner.

Forms B 31, B 32, B 33 and B 34 are shown herewith. Form B 33 is in book form, and is duplicated with carbon paper.

Agents were instructed to despatch all parcels under the foregoing regulations by the first passenger car at any time of the day or night, to give them in charge of the motorman on electric cars and the baggageman on steam trains, and informed that no excuse would be accepted for not despatching by the first train.

The public immediately took advantage of the facilties thus offered and the parcel office, while still open for the accommodation of travelers, is practically not made use of. The receipts from this source of revenue the first year amounted to $300; and last year they practically doubled. And the service is still meeting the appreciation of the public. Passengers in the villages along, the line, instead of purchasing from small stores near their residences, travel to town, purchase goods from different stores, have one parcel made of their purchases and sent to the station, to be forwarded by express to destination, instead of having it deposited in the parcel office and having the trouble to call for it and transport it themselves; and again, from the villages, vegetables of all kinds, cut flowers, etc., are during the summer being daily expressed to town to supply the hotels, boarding houses, etc., in the city.

In conclusion, it is pleasing to be able to state that during the two years in which this business has been in operation, only three complaints of delays have been received, and not one single package has been lost or gone astray.

Of course it will be noted that the conditions mentioned are different from those on most suburban electric railways, by reason of the company having no agents at the different stopping-places; this, however, is a point which in the writer's opinion, can in most cases be overcome by the managers of the different roads interested. It seldom happens that there is not some responsible man or woman residing close to the stopping place or flag station, in which case arrangements could most probably be made whereby these persons would be willing to take charge of the packages for a small consideration or commission.

The Union Terminal Railroad Co., Cincinnati.

The first authorized statement of the plans for a new union passenger station and a subway across the center of the city of Cincinnati has been announced by the Union Terminal Railroad Co., which has been in existence nearly a year. The new union depot is to be situated between Court St. and the canal and extending from Walnut St. to Elm St. The plans of the company include the construction of a passenger station; the building will be eight stories high, 214 ft. wide and 500 ft. long. Under the surface of the street passenger and freight tracks will be run; there will be six tracks running east and west, each of which will be approached from the main waiting rooms by means of a separate stairway. The center of the building will be a hollow square, with a 60-ft. dome surmounting the subway. Three main entrances are provided for and two driveways, while the baggage, freight and mail rooms will extend along the canal end of the building. Room is to be provided for street cars and express companies and also arrangements made so that the interurban lines which are near the site can run into the building. The plans for this depot have been made by D. H. Burnham & Co., architects, of Chicago.

The Passenger Terminal Construction Co. will be incorporated for carrying out the plans as already proposed by the Terminal company. Mr. George R. Scrugham, who recently retired as president and general manager of the Interurban Railway & Terminal Co., of Cleveland, O., which operates over 100 miles of interurban electric railways, will be president and general manager of the construction company and will personally have charge of the construction work, which it is stated will cost $10,000,000.

Appleyard Situation in Ohio.

Arthur E. Appleyard & Co. have agreed to a reorganization of the Ohio electric railway companies known as the Appleyard system. The plan calls for the formation of three companies with stock aggregating $8,500,000 which shall issue bonds to the same amount. This agreement must be signed by 55 per cent of the creditors before it becomes operative. The combined capitals of these companies amount to $9,350,000 and they have issued bonds amounting to $5,215,000.

The plan provides that the Ceneral Market Street Railway Co., of Columbus, which operates 16 miles of track, shall be reorganized as one company; that the Dayton, Lebanon & Cincinnati Railway Co., which operates 35 miles of electric and steam road between Dayton and Lebanon, shall be reorganized as a separate company, and that the Dayton, Springfield & Urbana Electric Railway Co., the Columbus, London & Springfield Railway Co., the Urbana, Bellefontaine & Northern Railway Co., the Columbus, Grove City & Southwestern Railway Co., and the Springfield & Western Railway Co. shall constitute the third company, which shall be known as the Ohio Union Railway Co.

A Peculiar Accident.

The evidence in a suit for damages brought by the owners of the schooner Frank W. Benedict against the Portsmouth, Dover & York Street Railway Co., of Portsmouth, N. H., shows a rather peculiar accident. On Sept. 10, 1903, the Benedict tied up at Cutts' wharf, Kittery Point, with a cargo of coal consigned to the Portsmouth, Kittery & York Street Railway Co., predecessor to the present company. According to the plaintiff's claim, the consignee failed to provide a safe berth for the schconer, as on September 16th the vessel came in contact with the feed wire and her starboard side was badly burned. A further claim is made that the wire with which the schooner came in contact was not properly insulated. The defendant company claims contributory negligence on the part of the captain of the vessel. A portion of the Benedict's cargo was discharged and to conveniently remove the rest the schooner was hauled forward, which brought it dangerously near the company's feed wires and the martingale of the steamer was hauled up to clear them. This was done when the tide was high and the captain was notified that the martingale should be hauled up still more, so that the schooner might drop away from the wharf. The company claims that the warning was disregarded and that the schooner fouled the feed wire as a result.

The second number of the Interurban Monthly, published at Champaign, Ill., in the interests of the Illinois Traction System, has made its appearance. In this number are included the time tables of the Illinois Traction System and the steam railroad connections at the various cities on the Illinois Traction line, and a reprint of the article on the McKinley Syndicate properties of Central Illinois, which appeared in the "Street Railway Review."

New York & Stamford Railway Co.

BY PUTNAM A. BATES.

Traversing much the same route that was followed by the old mail and road coaches of a century or more ago, the New York & Stamford railway forms a connecting link between the suburban branches of the Metropolitan Street Railway Co., of New York City, and the Stamford Street Railway Co., which in turn makes direct connection with the street railway lines running into the city of New Haven, Conn.

The Stamford Street Railway Co. being owned and controlled by the New York, New Haven & Hartford Railroad Co. is not a part of the New York & Stamford Railway Co's. system as might be supposed from the names of the two companies. (Note by author: Since the foregoing was written announcement has been made that on Jan. 1, 1905, this entire electric railway system was purchased by the Consolidated Railway Co. at an amount reported to be about $1,500,000. The Consolidated Railway Co. is controlled by the New York, New Haven & Hartford Railroad Co.)

The latter company is an entirely independent corporation and is the result of a combination of old Port Chester Street Railroad Co., the Larchmont Horse Railway Co. and the Greenwich Tramway Co.

The system is a single track having an extreme length of about 20 miles extending from Larchmont on the west to Stamford on the east and passing through the townships of Mamaroneck, Harrison, and Rye, and the villages of Larchmont, Mamaroneck, Harrison, Rye and Port Chester, all in the county of Westchester, N. Y. In Connecticut it traverses the township of Greenwich in the county of Fairfield and connects the villages of East Port Chester, Greenwich, Cos Cob, Riverside and Sound Beach.

Touching as it does the old Post Road, over which our forefathers had to make the three or four days' journey by horse when they wished to go from New York to Boston, this electric road marks the result of a most interesting evolution of transportation by means of public conveyances from the early coaching days to the present period of rapid transit by means of electric power.

As this road runs through a section of the country which not only abounds in picturesque scenery, but also in landmarks and reminiscences of considerable historic interest, it perhaps may not be inappropriate to make mention of a few of these points before passing to a general description of the road itself, its equipment and the service which it renders the people at large in the community through which it passes.

The lands about Larchmont were originally in the possession of Peter Jay Munroe, who is credited with having planted the rows of fine old elm trees along the Boston Post Road as it passes through the village of Larchmont. From Munroe's descendants the property passed into the hands of E. K. Collins, the once well known manager of the American Line of steamships to Europe. Early in 1872 this tract of land was purchased by a few individuals who desired to build for themselves attractive country homes in what they considered a most desirable location and to control sufficient property to forever insure the permanency of their plans against intrusion. These men organized themselves into what is known as the Larchmont Manor Co., which platted the land for a suburban place of residence by laying it out into regular-sized lots and by imposing certain restrictions in every deed of conveyance.

Towards the end of 1872, the plans of the Larchmont Manor Co had so far matured as to suggest the construction of a line of horse railroad from the New Haven railroad station to the sound, a distance of about one mile.

A small wooden railroad station had been built in 1853 on the east side of the railroad bridge, by an association of gentlemen calling themselves the Chatsworth Land Co. This little building standing in the unrelieved loneliness of the Chatsworth woods, excited the derision of passengers on the New Haven railroad trains for many years, because lack of patronage prevented the railroad company from establishing a regular stopping place. The Larchmont Manor Co., being possessed of this station building, made it the terminus of its horse car line.

FIG. 1.—POWER STATION, CAR HOUSES AND OFFICES, PORT CHESTER

In constructing this horse car line, which was the beginning from which the present New York & Stamford Railway Co's. system started, it was necessary, from reasons of economy, to lay the rails upon the ground, in truly prairie fashion. The equipment of the road consisted merely of car No. 1 and one pair of horses. This original car is in existence today, and is kept in the company's car barn as a relic.

Sarting with this very modest beginning it was not long before new franchises were obtained and this horse railroad was extended through the village of Larchmont and the towns of Mamaroneck and Harrison.

In the first week in July, 1898, the Port Chester Street Railway Co. started operating. This road was from the first equipped electrically, and the power plant which was installed for the operation of this road, although enlarged to meet the increased demand upon it, today supplies the power for the entire system, a combination of the three separate roads.

At the commencement the equipment consisted of but three cars and the line was limited to the village of Port Chester only. Later a branch was installed on Westchester Ave., then an extension was

[illegible] Rye Village [illegible] Harrison to connect with the Larchmont Horse railway.

The company's line is double tracked from the power house at Port Chester to Rye Beach, and also for about half of its length in the village of Larchmont. There are other sections of double track in other parts of the line, but these cover short distances only, and are used merely for switching purposes.

Some portions of the line have been constructed on private property in order to secure suitable right of way, in which instances the company controls these rights of way. At the terminus of the road at Rye Beach the company owns sufficient ground to provide a terminal loop and storage tracks.

FIG. [illegible]—EXTERIOR LARCHMONT CAR HOUSE

Adjoining this property the company has leased a piece of ground for a term of years and has erected a terminal station; in addition to these improvements for the Rye Beach business it has leased a large grove and after thoroughly draining it has erected a dancing pavilion, band stand and other buildings for amusement purposes. This grove is free to the patrons of the line and during the summer season extra service is put on this branch road to accommodate the heavy travel and special trolley parties

The management of the company has been very conservative and its method of dealing with accidents and other items of a similar nature has always been extremely liberal.

The Greenwich Tramway Co., although a part of the New York & Stamford Railway Co's. system, is a separate company organized under an old charter. The former, however, is operated by the latter and the same interests are identified with both. The road of this company lies wholly in the state of Connecticut and extends from the bridge over Byram River to the Boston Post Road at the western end of the city of Stamford.

FIG. [illegible]—[illegible] CAR HOUSE BUILT IN 18[illegible].

In August, 1901, the consolidation of the interests of the two roads was effected and in that same month the new company commenced to operate a portion of the Greenwich Tramway line from Byram River to Byram Shore Road in East Port Chester, Conn., a distance of about one mile, this being the only portion of the Greenwich Tramway construction which had received the approval of the Connecticut authorities at that time. In September this line was extended through the village of Greenwich to the Soldiers' Monument on Putnam Ave. and down the famous "Put's Hill" to Cos Cob. [It should be noted that the car line does not actually follow the direction of the trail taken by General Putnam when he escaped from the English officers down the sheer hillside.] Extensions were then added to Miamus and Sound Beach and finally to Stamford.

This then makes a through line from Larchmont to Stamford of about 20 miles, the running time being about one hour and thirty minutes. The entire amount of trackage covered by this system, including the main line, branches, double tracked portion and switch sidings, is about 30 miles.

It is an interesting fact that a traveler on this road in glancing out of the car windows will occasionally see along the route some of the old mile posts from which distances were reckoned a century ago.

The track equipment throughout is of standard gage, the rails being in some places 70-lb. T sections, and in others 101-lb. girders. The latter construction is used in the towns where brick pavement has been used.

The total rolling stock at the present time consists of 10 open 17-bench double truck cars, equipped with air brakes and seating 102 persons; 20 open single truck cars; 12 closed single truck cars; 1 parlor car; 1 wrecker car; 1 construction car; 1 sprinkling car; 3 snow plows, and 3 gravel cars. In addition to these cars the company is operating and has charge of 10 open and 7 closed single truck cars of the Greenwich Tramway Co.

The power station is at Port Chester. The equipment comprises two Rice & Sargent engines rated at 700 h. p., each direct connected to a G. E. 800-kw. generator, one Buckeye engine of 700 h. p. direct connected to a 425-kw. G. E. generator and one Green engine of 350 rated h. p. direct connected to a 225-kw. G. E. generator.

FIG. 4.—DOUBLE REVERSE CURVE.

These generating units supply direct current to the line at the power station switchboard at a potential of 550 volts. In addition to these machines there is also a 75-kw. alternator belt driven by an Armington & Sims engine; this is used for lighting an amusement park at Rye Beach.

The boiler plant, which is in practically a separate building from the engine and dynamo room, is equipped with a battery of nine water tube boilers of 145 h. p. each, made by the Pacific Iron Works of Bridgeport, Conn.

Adjacent to the power station at Port Chester, are located two car barns, an office building and a repair shop. This last is immediately back of the office building which is shown on the extreme right of the illustrations.

All of these buildings are heated by exhaust steam from the engines.

By means of a siding connecting with the tracks of the New Haven railroad, all coal and heavy freight may be brought directly to the power station building.

In Larchmont the company also has a car barn measuring 50 x 150 ft.

All of the company's buildings are of recent construction. When designed great care was taken to provide structures that would not only be substantial and adequate for their present needs, but also for reasonable increases in the future.

The oldest building now in existence is that shown in Fig. 3, which is the first car barn built by the new company in 1899. This engraving shows the substantial construction which was adopted from the first.

As in the history of most roads, there were many difficulties which this company had to surmount in the laying out and the work of constructing its lines, but those who were instrumental in putting the project through feel well repaid for their labors as the road today forms a connecting link between two very important railway systems and traverses a country which has proved sufficiently desirable to attract the most active attention of two 20 million dollar corporations, each of which has been organized for the express purpose of building a four-track system from the Connecticut line to a suitable point at which connection can be made with the surface traction and rapid transit systems in New York City. No matter what may be the outcome of the development of these two tremendous enterprises this road, which has already passed through its development period and is now on a substantial financial and operating basis, is bound to be benefited.

To put this road through was not an easy undertaking, as it was necessary to bring the interests of those owning each of the three companies, which the consolidation includes, into the new company in such a manner that all should feel satisfied and interested in the future interest of the enterprise.

The country through which the road runs being more or less open in character the engineering difficulties encountered in constructing the line were not exceptional. In some places, however, the matter of obtaining clear right of way made it necessary to employ measures which would not ordinarily have been followed. Fig. 4 shows a double reverse curve which was introduced to connect the line on one street with that on another, the former running at right angles to the latter, over an L-shaped piece of property which had to be purchased by the company as it was impossible to obtain the necessary privilege to extend the tracks until they meet at their natural intersection.

Pacific Coast Water Powers for Operation of Railroads.

"The use of Pacific Coast Water Powers in the Electrical Operation of Railroads" was the title of an interesting paper read before the Pacific Coast Railway Club, on January 21st, in San Francisco. The paper was presented by Mr. Robert McF. Doble, consulting engineer of the Abner Doble Co., of San Francisco. Mr. Doble discussed the relative advantages and disadvantages of steam and electrically hauled traffic. In speaking of the power required for the electrification of several of the California roads particular reference was made to the conditions on the Pacific Coast where available water powers are distributed at frequent intervals all the way from southern California to British Columbia. But a very few of these magnificent power development opportunities are now utilized. In speaking of electric traction in California particular reference was made to the Los Angeles & Redondo Railway, Pacific Electric Railway of Los Angeles, and the North Shore and the Key route systems of San Francisco. The North Shore railroad is of special interest by reason of its being the first and only third rail line in California and because of its being operated from the Alto sub-station which is the terminus of one of the longest transmission lines in the country. The Alto station is 180 miles from the hydro-electric plant at Colgate, and 250 miles from the new De Sabla power house. [illegible] made to the new De Sabla power house, of the California G[illegible] Electric Corporation, where is now operating an 8,000-h. p. tangential water wheel, the largest single water wheel ever constructed. This station regularly supplies power to San Francisco and other points over 300 miles distant.

Annual Report of the Ottawa Electric Railway Co.

The annual report of the Ottawa Electric Railway Co., of Ottawa, Canada, for the fiscal year ended Dec. 31, 1904, and submitted at the 11th annual meeting, held Jan. 30, 1905, has been published in pamphlet form. The gross receipts for the year were $384,939.64; net earnings, $139,097.70. During the past year $54,926.54 was expended for betterments, which included the work of replacing old 40-lb. and 52-lb. rails with new 80-lb. rails and the double-tracking of Elgin and Archibald Sts. from Sparks St. to the Swing Bridge, and Dalhousie and St. Patrick Sts. from Rideau to King St. A 1,300-h. p. motor generator set was installed in a new power house built by the company. Last winter the company experienced the worst snow storms since the opening of its line and the cost of snow clearing amounted to $20,186 for the year. Forty-two acres were added to the company's park at Brittannia-on-the-Bay and the auditorium moved from Victoria Park to Brittannia-on-the-Bay. Twelve new open cars have been ordered and will be ready and fully equipped for the opening of the summer season's business which has been largely increased during the past season. The report also includes a statistical statement for the years 1892 to 1904 and a comparison of the year 1894 with 1904 will be interesting.

	1894.	1904.
Gross receipts	$129,484.02	$384,939.64
Total expenses	83,324.64	275,840.98
Net profit	46,159.38	109,098.66
Passengers carried	2,797,281	8,717,205

The officers of the company are: President, T. Ahearn; vice-president, Peter Whelen; secretary-treasurer, James D. Fraser; auditor, R. Quain. The board of directors included the president and vice-president and Warren Y. Soper, George P. Brophy, Hon. George A. Cox and Thomas Workman.

Pratt & Lambert Convention.

The managers, superintendents and salesmen of Pratt & Lambert have lately held an interesting convention of four days length at their Buffalo plant, about thirty-five representatives being present.

The firm of Pratt & Lambert began making varnish in a very modest way as early as 1846, and has grown steadily and healthily until now the capitalization of their combined manufacturing plants is in the neighborhood of $6,000,000. This firm, whose business is the manufacture of oils, varnishes and paints, is now operating three complete factories in this country, located in Chicago, Buffalo and Long Island City, N. Y. Pratt & Lambert have branch sales houses at St. Louis, San Francisco and New York City. With these combined plants they are the largest makers of varnish in the world. The main office of the company is at the Buffalo factory. Associated with Pratt & Lambert is the firm of Robert Ingham Clark & Co., Ltd., which operates varnish factories in London, Hamburg and Paris, where are manufactured the well-known high-grade "Britannia" railway varnishes.

Purdue University, Lafayette, Ind., has been presented by the American Locomotive Co. with a pair of full-size model locomotive cylinders, sectioned to show the piston valve construction. This model formed part of the company's exhibit at the World's Fair, St. Louis.

A very attractive calendar is that issued by the Ft. Wayne, Van Wert & Lima Traction Co., on which is mounted a photograph, 4 x 5½ in., showing the first electric car from Van Wert to Lima, over the elevated crossing of Pennsylvania R. R., Dec. 31, 1904.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address. "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York 39 Cortlandt Street. Cleveland 302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV FEBRUARY 15, 1905 No. 2

CONTENTS OF THIS NUMBER.

INCREASING RATES OF FARE.

A great many electric interurban railways made the mistake of fixing the fares at too low a figure, and while probably most of them who have made this mistake realize that they are suffering from it, but few have had the courage to increase the rate to a figure more in keeping with the expense of operating and the value of the service given the patrons. The Indiana Union Traction Co. about a year ago increased its rate from 1 cent per mile to the one at present in force, which is 1½ cents per mile. The result of operation shows no considerable loss in traffic, and, as there has been an increase in gross receipts, the change is considered to have been in every way a satisfactory one. The Southwest Missouri Electric Railway Co. has had a most varied experience with regard to rates. On this line the original rates were fixed on the basis of from 1 to 1½ cents per mile and were in force for about five years up until June, 1898, when to meet competition a rate of 10 cents between Carthage and Galena, a distance of 28 miles, including a free hack ride at each end of the line, was made and continued for about seven months. In January, 1899, a readjustment of fares was made upon a basis of ¾ cent to 1 cent per mile. Feb. 1, 1905, the company returned to the original tariff. It is of course too early to say whether this company will find it difficult to educate its patrons to pay the higher rates, but as the company's position in the matter is that it cannot be expected to furnish transportation at a loss, a perfectly just one, it will only be a question of time until the situation is accepted by all interested.

TELL THE PUBLIC WHAT YOU HAVE.

One of the weak points in the operation of electric railways has been the indifference displayed in regard to informing patrons as to possible connections at junctions with other lines. Some companies have published time tables for distribution on the cars, but a number of even the largest systems of these have contented themselves with occasionally announcing that cars run at intervals of an hour or two hours, as the case may be. Quite recently several roads have undertaken to disseminate more widely information as to what they have to offer to the public. One of the latest publicity enterprises of this nature has been undertaken by the Illinois Traction System. The company publishes a 32-page pamphlet, known as the "Interurban Monthly," with complete time tables, information concerning the connections made at various points with steam railroads, and at the same time gives considerable reading matter that should be of interest to the average patron. It is considered that this publication will prove itself of some value as an advertising medium and secure enough business of this nature to make it self-supporting.

There are comparatively few companies that are large enough to undertake the regular publication of other than a mere folder on their own account, and for these a middle course is furnished by joint time tables, such as those which it is proposed to publish for the Indiana lines. The scheme proposed by Mr. Richey, which is referred to in the report of the Indiana meeting for February, is one that offers considerable advantages, as the railway companies secure the desired publicity for their time tables, and at the same time the trouble and expense of managing the publication are undertaken by an outside party who makes that his business.

REORGANIZATION OF THE ASSOCIATION.

The opinions expressed at the recent meeting of the executive committee of the American Street Railway Association indicate that all concerned are agreed as to the need for a reorganization of the association. Such differences as exist are as to the extent to which the other national electric railway associations should be reorganized in order to best serve the interests of the companies they represent. Existing conditions were admirably stated by President Ely in his summary of the action taken by the associations at the St. Louis conventions, by Mr. Richard McCulloch in connection with the proposed plan of reorganization submitted by him, and in a very epigrammatic manner by Mr. Vreeland when he said that the electric railway men had been keen and progressive in meeting changed conditions affecting their business in every respect except one—they had departed from horse-car methods in everything except the conduct of their national association.

Twenty years ago the American Street Railway Association was in effect a club of horse railway owners, which held annual meet-

ings; today it is but little more than a club of electric railway presidents and managers. At the annual conventions the social features have year by year encroached upon the others until the meetings became mere junkets for delegates of the members—very enjoyable affairs doubtless, but hardly, from a business point of view, justifying the dues and expense accounts.

The conditions are not the same with the other and younger associations, each of which was organized to fill a recognized want, and each of which (even the Claim Agents' association organized only last year) has a very flattering record of good work accomplished.

The present status of the several associations is about as follows: A. S. R. A.—ample income, unsatisfactory work; Accountants'—income and record both satisfactory; Mechanical and Electrical—record good, income insufficient; Claim Agents'—income not assured, and as yet but little opportunity to make a record.

It is essential that each of these associations have adequate financial support from the railway companies, and as it is the presidents and managers of the companies—that is the delegates to the A. S. R. A.—who hold the purse strings, the A. S. R. A. may be subjected to the temptation to reorganize too radically for the best interests of all concerned. Perhaps it is not putting the matter too strongly to say that the A. S. R. A. owes it to its members to demonstrate that it is capable of conducting its affairs in an acceptable manner before it insists upon a merger of the other associations with itself.

The chief executives of the railways—the men who ought to be and doubtless always will be, the delegates to the conventions of the A. S. R. A.—are not the proper ones to represent their companies in the other associations for two reasons: First, they do not have the intimate knowledge of the details affecting the departments that is necessary to useful active membership in the departmental associations; second, by their presence they restrain their subordinates who do have the desired knowledge, as no wise master mechanic or auditor will undertake to expose the ignorance of his general manager, or debate matters of opinion with him in public. Any plan in which these facts are not given due weight is foredoomed to failure.

Mr. McCulloch's proposed plan is evidently the result of careful consideration on his part and appeals to all who read it as a most admirable basis from which to start.

To us the problems to be met in readjusting the relations between the various associations appear to fall under the following heads: Financial, Structural and Administrative.

The financial burdens must be borne nearly altogether by the companies, and should be apportioned to the variable resources of the members—as on a mileage, car, car-mileage or gross-earning basis. Revenue thus raised should be appropriated among the various associations in accordance with their needs. The Canadian Street Railway Association authorizes assessments on the basis of gross earnings; the Master Car Builders' Association assesses the railroads according to the number of cars owned, not exceeding $8 per 1,000 cars per annum.

In the scheme of the association or associations provision should be made for representative membership and for individual membership, so that a man need not be forced out of an association because he changes his occupation and works for a car builder instead of a railway. Each departmental association should have great independence and freedom of action in order to give to active members the spur of ambition for advancement, and to increase the influence of each departmental association. It is doubtful whether the Accountants' association would have established the existing relations between it and the Railroad Commissioners had it been only a section or committee of the A. S. R. A.

Among the best known of the steam railway associations there is no relation of dependence; thus the American Railway Association exercises no authority over the Master Car Builders' Association, though many of the investigations and recommendations of the latter have been made at the request of the former.

In the administration of each of the several associations the secretary will be the important official and the working head, and this is practically equivalent to saying that each association must have its own secretary as it cannot reasonably be expected to find one man who combines in himself an engineer for the engineering branches, an accountant for the Accountants', a lawyer for the Claim Agents', etc., and the executive ability needed to pilot the aggregation. Such sub-division of secretarial duties is not inconsistent with the greatest degree of harmony essential to satisfactory work; if in the opinion of the A. S. R. A. any given question should be considered by one of the departmental associations that question will already have come up between the managers and the department heads in so many companies that the departmental association will be quite as desirous as the other of discussing it.

As a keynote for the sub-committee now having the question of reorganization in hand, we would suggest the climax of Webster, "Liberty *and* Union"—or the motto of Illinois, "State Sovereignty —National Union."

GEORGE R. METCALFE.

With this issue Mr. George R. Metcalfe resigns as electrical editor of the "Street Railway Review," to become editor of the Technical World and the text book department of the American School of Correspondence at the Armour Institute of Technology.

Mr. Metcalfe is a native of Brooklyn, N. Y., and was educated at the Polytechnic Institute of Brooklyn, and the Stevens Institute of Technology, from which he was graduated in 1886 with the degree of mechanical engineer. After leaving college he had a wide experience in the practice of his profession, which proved particularly valuable when he took up editorial work, towards which he always had a strong inclination. Immediately on leaving college he was engaged with the National Meter Co., of Brooklyn, in the shops and drafting room; after this he was employed successively with the Edison United Manufacturing Co., installing isolated electric lighting plants; with the Daft Electric Co., in the engineering department, where considerable time was spent in experimenting with the first electric locomotive built for the Ninth Ave. elevated line in New York; and with the Sprague Electric Railway & Motor Co., for which he had charge of construction work on a number of electric railways in different parts of the country. He was with the Edison company for some time after the Sprague company was absorbed by it, and afterwards was in the engineering office of Mr. C. O. Mailloux.

Mr. Metcalfe's first connection with journalism was as associate editor of "Electricity"; he very soon was appointed editor of that publication, which he conducted for four years, resigning to engage in technical writing for the International Encyclopedia. Mr. Metcalfe came to Chicago in 1899 as electrical editor of the "Street Railway Review." In leaving to take up his new work Mr. Mecalfe carries with him the best wishes of the "Review," and all who have been associated with him on its staff.

THE LATEST EXPERIMENT IN LOW FARES.

For several years the street railway interests of Cleveland have had to contend with a persistent agitation on the part of the public, the city council and especially the mayor of Cleveland, in favor of a reduction in car fares. Unsuccessful attempts were made to organize rival companies which should compete with the Cleveland Electric Ry., charging only 3 cents. Some of the proposed plans were pronounced illegal by the courts, and no real progress has been made towards the settlement of the controversy that could be considered advantageous for any of those concerned. The Cleveland Electric Ry. has at all times been willing to make all concessions to the public that it could in justice to its stockholders, but until very recently the attitude of the public authorities was so unreasonable that no substantial progress could be made. On December 29th last, the mayor suggested that a practical test be made to determine whether a 3-cent fare would yield reasonable returns to the street railway company and serve the people of Cleveland in a satisfactory manner. The mayor suggested specifically a trial of 3-cent fare lines with cars running from the public square through the most densely populated portion of the city. The directors of the Cleveland Electric Railway Co. met on the following day and agreed to make a test of such 3-cent lines, provided the city council would authorize and request it.

In a letter accepting the suggestion of the mayor, the company stated the results of its experiment in 1903, which showed the fallacy of the increased traffic argument usually advanced to justify lower fares. The company had for eight months, beginning July 4, 1903, sold tickets at the rate of six for 25 cents and gave a practically universal transfer. The result of this experiment showed a

loss of about $220,000 in gross earnings, the reduction in fares amounting to about nine per cent, taking into consideration the increased number of tickets sold at the reduced rate, and the stimulation of fare-paying traffic was but slightly over one per cent.

The lines of the Cleveland Electric Railway Co. serve a territory extending about 6½ miles east from the public square, 7 miles west and 4 miles south. For the 3-cent lines the territory was limited to the area bounded by a north and south line two miles east of the public square and by an east and west line two miles south of the square. The western limit was three miles from the square. Within this area there were 17 three-cent lines, 10 served the territory south of the lake and north of the river and within the two-mile limit to the east, a triangle through which the several lines spread out like the sticks of a fan, with the junction at the public square. Each of these ten lines was from two to three miles in length. In the southern and southwestern parts of the city there were seven three-cent lines, six being about two miles in length and one about three miles. The aim of the company was to ascertain what the effect would be upon the gross earnings of the reduction in fare to three cents per ride for the distance of two miles from the business center of the city, without regard to operating expenses, and to this end the company furnished the very best service it could.

The 3-cent experiment was started January 23d and met with surprisingly little encouragement on the part of the public. On only two lines was the travel on the low-fare cars anywhere near the average on the regular-fare cars. Throughout the day the low-fare cars were astonishingly free from passengers, and, even during the rush hours of the morning and afternoon, the highest average on any of the 3-cent lines, excepting the two first mentioned, was less than 30 passengers per car per trip.

This experiment was discontinued and February 6th the company made a rate of 4 cents for a continuous ride without transfer, the rate for passengers desiring transfers being the regular 5-cent fare. The 4-cent experiment was discontinued February 12th.

These experiments of the Cleveland Electric Railway Co. have been made in absolute good faith and without regard to the financial cost to the company during their continuance. The schedules were arranged between the officers of the company and the mayor of Cleveland, and were presumably satisfactory to the latter. The results, we believe, may be taken to demonstrate two points; the first, that a 3-cent or 4-cent fare is not sufficient to pay the company, and, second, that the zone system is not adapted to the wants of American cities.

DEVELOPMENT IN ELECTRIC TRACTION.

Some very interesting statements and descriptions of the recent advances in electric traction were given by Mr. W. B. Potter, in a paper read by him at the January meeting of the New York Railroad Club. He first reviewed the subject of the electrical equipment of existing railways and stated that the reasons for not so equipping many steam operated lines are becoming less and less important each year by reason of the progress of invention, and also by the changes which are now taking place in traffic conditions, and he further stated that, taking into consideration the many different electrical schemes now developed, and being developed, there are probably few steam railroads but what will find the electrical equipment of part and in some cases of the whole of their lines a profitable undertaking.

The justification of such equipment is determined by financial considerations, rather than technical difficulties, and the several points to be considered are the amount of capital invested in steam railroad rolling stock, the expense of electrical equipment, the fact that it involves a greater capital outlay than operation with steam locomotives, and that it is cheaper to operate and maintain the electric road and therefore it will earn a greater percentage of interest on the invested capital.

The ultimate profits to be derived from any new traction scheme are more or less an unknown quantity and depend greatly upon the resulting effect on traffic. The past has shown that the amount of this traffic has increased in proportion to the facilities given the public. That electric roads have the faculty for building up new traffic has also been shown and proven. For these reasons, when considering the transformation of a steam sytem as a whole, a margin on account of the extra traffic which the increased facilities are practically sure to induce may be safely added. Electric service handles either long or short trains with the interval as needed, while with steam locomotives it is a common practice to handle only long trains at less frequent intervals. Mr. Potter emphasized these latter facts on account of their showing in a forcible manner that in many instances where the present traffic is of a concentrated nature and therefore seemingly best handled in long trains this same traffic would naturally change from the concentrated to the distributed form were an electric system installed.

Mr. Potter discussed the advantages and disadvantages of single-phase traction and the relative costs for alternating current and direct current distribution systems. He pointed out that the apparent resistance for 25-cycle alternating current, as compared with direct current, is about 50 per cent in the trolley wire and between six and seven times greater in the rail return, the latter increase in apparent resistance being due to the fact that the rails are of steel. When these are combined the apparent resistance for the trolley wire and track taken together, will be, roughly, from one-half to twice that for direct current. Hence, an alternating current at 1,000 volts is about equivalent to 600 volts direct current. So far as affecting the amount of trolley copper, this necessitates, if advantage is to be realized over the direct current system, the use of 3,000 volts, or perhaps 5,000 volts for heavier service. Regarding the design of the motors for alternating and direct current systems, Mr. Potter said that, on account of the alternating current motor having a somewhat higher armature speed with a slightly less air gap, its maintenance cost will in all probability be greater than that of an equivalent direct current motor, but there is no question as to the successful operation of alternating current apparatus and the advisability of its use when such an installation will prove financially advantageous.

The relative energy consumption of steam and electrically handled traffic was next considered, together with the costs of power, wages and maintenance. These figures were analyzed and used to illustrate the fact that careful calculations should be made on each individual road considering a change in motive power, because the results would vary with every new set of conditions. The point at issue is whether the traffic is, or is likely to be, of such a character that the saving in operation or increased receipts will show a proper rate upon required capital. In further emphasis of the fact that every case demands an intimate study of itself, the relative costs for hauling freight with the electric and with steam locomotives were analyzed.

The development of electric locomotives for freight and passenger use and the principles of their construction were discussed. The general design of the locomotives recently designed and built by the General Electric Co. and the American Locomotive Co. for the New York Central railroad, together with its details of construction was explained.

The best form of working conductor depends greatly upon local conditions. If the overhead trolley be used, the catenary method of suspension is recommended by Mr. Potter. This method has many characteristics which recommend it highly for single-phase traction where high voltages are used. Among its advantages are the added conductivity of the messenger or catenary cable, the frequency with which the trolley wire may be supported with little added expense, the doing away with many poles, and that a larger trolley wire giving a greater contact area may be used.

The initial expense of electric equipment due to the cost of power station and distribution circuits has deterred many steam railroads from equipping their branch lines in sparsely populated districts. Such districts could be well served in an economical manner by means of a self-propelled car, independent of any feeder system.

In closing his interesting paper Mr. Potter described a car of this type, with which the General Electric Co. is now experimenting. This car consists of the usual form of car body and trucks, and has two motors controlled in the usual manner. Current for these motors is obtained from a 600-volt generator driven by a gasoline engine, this unit being mounted over the motor truck. The car complete will weigh approximately 55 tons. The engine will have a full load output of 200 brake h. p. and will run at 600 r. p. m. The control for the motors will be provided with a series-parallel switch, but no starting resistance, in the usual sense, will be required, as the speed of the motors will be regulated by controlling the field voltage of the generator, the field excitation current being obtained from an exciter mounted on the frame of the main generator, and

the field current being handled through the field [illegible] the controller. The water-cooling system for the engine will be carried through the ordinary heater pipes inside the car in the winter and through radiators on top of the car in the summer. Such an equipment will provide for an acceleration sufficient to maintain a schedule speed of 20 to 25 m. p. h. where stops are three to four miles apart, and the car can easily be maintained at a running speed of 40 m. p. h. No data are available upon which to accurately base the operating cost of such an equipment, but this cost will be somewhere between 15 to 20 cents per car mile, depending a great deal upon the daily mileage made by the car crew, because their wages amount to a considerable portion of the total expense. No mention was made of the probable cost of maintenance and liability for interruptions in service with such a self-propelled unit.

Cleveland Low-Fare Experiment.

Feb. 15, 1905, the Cleveland Electric Ry. made public the results of the two low-fare experiments in a letter to the city council, making the following statements:

"The results of the tests which have been made lead to the conclusion that fare as low as 3 cents is only financially possible within a zone considerably inside of the city limits. We realize that the so-called 3-cent-zone test was not satisfactory to the public nor to the company, and was not a conclusive test of 3-cent fare. The results obtained were sufficient, however, to indicate that if 3-cent fare were made applicable to the entire city, the reduction in the earnings of the company would be so large as to be disastrous."

"The average gross earnings of the company for the 17 week days preceding the 3-cent-zone test were $13,311 per day.

"The average gross earnings of the company for the 12 days of the 3-cent zone test were $12,547 per day.

"It will be remembered that the reduced rate of fare was in effect for only 13 hours of each day, during which time the loss over the earnings of the 17 week days preceding was 5.74 per cent, or $764.47 per day. This decrease was shown when the 3-cent fares collected were 18½ per cent only of the fares collected on the entire system. If the low rate of fare had been in effect for the whole 24 hours of each day, the percentage of loss would have been greater.

"The only lines of cars which were operated wholly on a 3-cent basis, with transfer upon a 5-cent cash fare, or an 11-for fifty ticket, were the Willson Ave. and the Fairfield line on the south side, both of which lines show an abnormally large percentage of transfers under ordinary conditions, the percentages being, on the Willson Ave. line 81, and on the Fairfield line 42.

"The percentage of transfers issued on all the lines operated by the company is normally 30, and was during the 4-cent test, when the fare for a ride with a transfer was greater than for a single ride, 23.

"The results obtained on the Willson Ave. line show a loss in revenue of 13.4 per cent. If the same rate of fare had been in effect during the entire day, instead of during 13 hours only, the loss would have been 15.5 per cent.

"The results on the Fairfield line show a loss in earnings of 16.26 per cent, indicating a loss, if the same rates of fare were in effect during the entire day, instead of 13 hours, of 20.78 per cent.

"As stated, these two lines issue and collect an abnormal number of transfers, thus making the average fare collected considerably higher than it would be on the lines of the company as a whole under the rates of fare charged during the test, i. e., 3 cents for a single ride and 5 cents for an 11-for-50 ticket for a ride with a transfer.

"If the results obtained on the Willson Ave. line were applied to the whole system of lines operated by the company for 24 hours daily, and if operated upon the same rates of fare of 3 cents for a single ride and 5 cents or an 11-for-50 ticket for a ride with a transfer, and assuming that 80 per cent of the passengers pay 3-cent fare and 20 per cent pay 4.7 cents for fare and transfer, the percentage of decrease would be 29.05, or a loss of $3,600 per day in gross earnings as compared with the earnings under the present legal rates of fare. This result would be altered if lower fares stimulated traffic. The actual stimulation, however, during the 3-cent zone test was only 1 per cent, and during the 4-cent test 1.38 per cent.

"The 4-cent test was begun on Monday, February 6th, and was discontinued on the following Monday at midnight.

"The [illegible]

"The [illegible] 4-cent test were $11,295 per day.

"The decrease in earnings during the 4-cent test as compared with the earnings [illegible]

"The tests conducted have cost the company in the neighborhood of $25,000 in decreased receipts and increased operating expenses, but it believes that the information gained justifies the cost, and it will be glad if desired, to make further experiments in lower fares which, in the light of the experience already obtained, will produce a reasonable revenue, and will file with the council the information gained."

Mechanical and Electrical Association.

The executive committee of the American Railway Mechanical and Electrical Association met at the Holland House, New York City, on February 3rd. President Baker announced at this meeting that, as a result of preliminary correspondence, the following papers had been assigned for the coming convention:

"Power Transmission," C. H. Hile, superintendent of wires, Boston Elevated Railway Co.

"Maintenance and Inspection of Electrical Equipment," William Pestell, New York.

"Way Department Matters," F. G. Simmons, superintendent of way, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

"Power Stations," Fred Bushnell, chief engineer, Rhode Island Co., Providence, R. I.

Standing committees were appointed to consider a number of subjects, a chairman for each committee being named to serve for three years and with authority to name two other members for each committee, one of whom will serve for two years and the other for one year. The subjects assigned to the committees and their respective chairmen are as follows:

Controlling Apparatus, J. S. Doyle, master mechanic, Interborough Rapid Transit Co., New York City.

Brakes, D. F. Carver, chief engineer, Public Service Corporation of New Jersey, Newark, N. J.

Wheels, John Millar, master mechanic, International Railway Co., Buffalo, N. Y.

Shops, W. D. Wright, superintendent of equipment, Rhode Island Co., Providence, R. I.

Way Matters, F. G. Simmons, superintendent of way, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

Mr. C. C. Lewis advised the association that he would be abroad for the next two or three years, which would make it impossible for him to serve as a member of the executive committee. The chair was authorized to fill the vacancy caused by Mr. Lewis' withdrawal.

The price for extra copies of the second annual report of the association was fixed at $3.00. New members joining the association will be charged $1.00 each for formal annual reports.

Guthrie Electric Railway Co.

Construction work on the line of the Guthrie Electric Railway Co., which is the northern terminus of the Oklahoma Traction Co., an interurban line connecting Oklahoma City and Guthrie, is progressing rapidly. Nearly one-half of the 33 miles of the interurban line is now in operation, and its success from both an operating and financial standpoint is assured, the traffic being far in excess of that anticipated. The line in Guthrie is expected to be completed by May 1st. Two parks are served, one belonging to the city, and the other an amusement park, both of which are expected to develop considerable traffic during the summer season. Brick and concrete work with steel ties for construction within the city limits are being used, the ties being furnished by the Pennsylvania Steel Co. The cars will be furnished by the American Car Co. The Knox Engineering Co., Chicago, is the general contractor for the company, and Mr. Lincoln Nissley is in charge for the Knox company at Guthrie.

Trolley service over the new Williamsburg bridge was started February 10th. The 14th St. cars were the first to cross.

Chicago City Annual Meeting.

The annual meeting of the Chicago City Railway Co. was held February 16th, and a new board of directors chosen in consequence of the recent changes in ownership of stock.

The number of shares voting at the meeting was 164,313 out of a total of 180,000; of the number voting 124,600 represent the Morgan syndicate interest acquired recently.

The new board comprise: A. J. Earling, Robert M. Fair, Edward Morris, J. A. Spoor, Mason B. Starring, P. A. Valentine and Lawrence A. Young. The board has not yet organized, but it is understood that the officers will be: First vice-president, T. E. Mitten; second vice-president, Lawrence A. Young; general manager, M. B. Starring; secretary and auditor, C. N. Duffy; treasurer, T. C. Penington.

No successor to President D. G. Hamilton was elected, and it is understood that Mr. Spoor as chairman of the board of directors

T. E. MITTEN.

will assume the duties of president, insofar as they are not devolved upon Mr. Mitten.

The retirement of Mr. Hamilton after six years as president was marked by a resolution of thanks from the stockholders who took this means of formally recording their appreciation of his services.

The annual report for the year ending Dec. 31, 1904, showed the following:

Income Account.

Earnings.	Dec. 31, 1904.	Dec. 31, 1903.	Increase.
From passengers	$6,609,500	$6,381,245	$228,255
Other sources	59,478	54,319	5,185
Total	$6,668,979	$6,435,565	$233,414
Operating expenses	4,802,120	4,648,341	153,778
Net earnings	$1,866,859	$1,787,224	$79,636
Depreciation	120,000	100,000	20,000
Earnings on stock	$1,746,859	$1,687,224	$59,636
Dividends	1,620,000	1,620,000	Unchanged
Surplus	$126,859	$67,224	$59,636
Capital stock	$18,000,000	$18,000,000	Unchanged

The number of fare passengers carried in 1904 was 132,852,717, an increase of 4,548,272 over 1903; the number of transfer passengers was 77,732,749, an increase of 10,849,403.

The number of car-miles was: Cable, 13,701,643, a decrease of 163,830; electric, 20,319,293, an increase of 1,723,853; horse, 86,257, an increase of 12,047; total, 34,107,103, an increase of 1,572,070.

The ratio of operating expenses to income was .7201; the increase in business over 1903 was 7.88 per cent; the earnings on stock were 9.7 per cent.

The plans contemplated by the company are indicated in the following resolution:

"That it is the sense of the stockholders of the Chicago City Railway Co. that immediate steps should be taken, without regard to future contingencies, to re-establish the company in the confidence of the public, and that, in order to attain this end, the directors of the company be and they are hereby instructed to begin at once a systematic and thorough investigation of the property and the affairs of the company, for the purpose of learning what steps must be taken to enable the company to provide ample and satisfactory accommodations for the public.

"And the directors are further advised to put into effect such measures as will put the physical properties of the company into proper condition, without regard to expense, in order to furnish first class service. Promptness and thoroughness are the prime essentials in the work of rehabilitation and improvement of the company's service, and, therefore, immediate action is desired and expected."

Mr. T. E. Mitten who who will be the first vice-president of the company, has been general manager of the International Railway Co., of Buffalo, since 1901. Before going to Buffalo he had been superintendent of the Milwaukee Electric Railway & Light Co. for six years. Mr. Mitten is a native of England, born in Sussex in 1865, and came to the United States in 1880. His first railroad work was as telegraph operator on the Chicago & Eastern Illinois; after nine years in the operating and claim departments of steam railroads, Mr. Mitten entered the electric railway field, being appointed general superintendent of the Denver, Lakewood & Golden.

Machined Journal Boxes.

One of the points of superiority claimed by the Standard Steel Car Co., of Pittsburg, Pa., for its electric railway trucks is that all of them have machined pedestals and journal boxes, which are considered essential in order to keep the axles parallel and at right angle to the truck sides. The effect of faulty alignment of axles, which is considered for the most part to be due to carelessness in assembling the truck and ill-fitting the journal boxes, is referred to at some length in the article by Mr. W. G. Price, which appears on page 109 of this issue

The Scioto Valley Traction Co. has leased a four-story building in Columbus, O., for general offices.

The Detroit United Ry. is now receiving the first installments of the 50 double-truck cars ordered from the St. Louis Car Co. and the American Car & Foundry Co. for the Woodward and Jefferson Ave. lines.

The Boston Elevated Railway Co. transfer men are wearing a new style hat which attracts much attention. These hats are of pure white with a band of gold encircling them and are distinctly Russian.

Concessions have been granted by the Mexican government for the construction of a system of electric lines which have a proposed length of 200 miles and will connect the cities of Guadalajara and Patzcuaro. This road will traverse one of the richest sections of Mexico.

The Aurora, De Kalb & Rockford Railway Co., which is now ballasting its roadbed, has purchased a gravel bed of such great size and high-class ballasting material that the management is now making arrangements to furnish this gravel to intersecting steam roads and local users along the right of way.

The report is current that plans are under way for giving the interurban railways of Ohio and Indiana the local mail business of the territories which they cover. It is stated that in the near future special mail cars will be placed on some of the more important routes and the experiment given a thorough trial by the government.

The Curtis steam turbine and the engineers connected with its design and development were awarded high honors by the International Jury of the Louisiana Purchase Exposition. The grand prizes were awarded to Elihu Thomson, C. P. Steinmetz and F. J. Sprague. Gold medals were awarded to C. C. Curtis, W. L. R. Emmett and W. B. Potter.

February Meeting of the Indiana Electric Railway Association.

The regular February meeting of the Indiana Electric Railway Association was held in Anderson, Thursday, Feb. 9, 1905. By courtesy of the Indiana Union Traction Co. a special car was provided to carry those who went by way of Indianapolis. This special left the Traction & Terminal station at Indianapolis at 9:15, with 22 members of the association on board, and reached Anderson at 10:30.

When the Indianapolis delegation reached Anderson, it was joined by a number of gentlemen from Ohio and the northern part of Indiana, there being about 50 members present when the meeting was called to order.

Mr. L. J. Shlesinger's paper on "Interurban Passenger Traffic" was the first business brought before the meeting. This is as follows:

Interurban Passenger Traffic.

BY LOUIS J. SHLESINGER, SUPERINTENDENT MUNCIE, HARTFORD & FT. WAYNE RY.

Although it is comparatively but a few years since interurban railroading first became a practical reality, the industry today is one of the country's leading enterprises. Predictions as to the future, if based merely upon the rate of development of the past, mark a most glorious pathway ahead for the accomplishment of remarkable achievements. The pioneer efforts which have led to our present systems were merely extensions of local street car lines, built to encourage and provide for the suburban development of our larger cities. The next step was a bolder one and embraced the connection of cities and towns lying in close proximity. As the mechanical and electrical obstacles were encountered and overcome by the engineers, lines of greater length were projected and built. New methods of transmission were introduced and experimental work was undertaken along larger and broader lines, until today we have our modern roads. There is still ample opportunity for the development of constructive and operating features, but a few years will undoubtedly witness the elimination or modification of the weak points of our electric systems. It is a conservative prediction to prophesy that in the near future our individual lines will lose their identity and become merged into systems forming trunk lines of inter-state importance.

The state of Indiana has been one of the foremost in the development of the modern interurban road. In 1893 the first three miles of interurban service in the state was inaugurated between Brazil and Harmony. The ensuing year saw an additional 20 miles of interurban in operation. Then came the financial depression following the panic of 1893, and railroad development, as well as all other forms of investment, suffered in consequence. In 1898 construction work was again resumed, and since that time the development has been rapid. Encouragement has been given investors by the attitude of the legislative authorities of the state and considerable outside capital has been attracted. We have today within the limits of the state 23 different companies operating 818 miles of interurban track, all of which has been constructed within the past seven years, with the exception of the 23 miles previously mentioned. This is truly a wonderful growth. For the purpose of obtaining a fair notion of the total results accomplished by Indiana within these past few years, let us imagine that the 818 miles of interurban were placed in one continuous line. We would have a railway track extending from the city of Indianapolis to the city of New York. If a passenger were to undertake this journey, making direct connections upon leaving the lines of each company and taking advantage of the limited service in vogue on a number of the roads, the trip would occupy a period of 38½ hours. This represents an average speed of 21.25 miles per hour, and varies from 8.5 to 27.5 miles per hour on the various roads. Without the limited service mentioned, the time required to make the journey would be 42½ hours. Our traveler, unless supplied with free transportation, would find that $12.75 would be required to pay his fare for the entire distance, an [illegible] traveled [illegible] an expenditure of 2.23 cents per mile.

In preliminary work on interurban enterprises, one of the engineer's chief sources of perplexity is to establish a basis upon which to estimate gross receipts. Each proposition necessarily presents local conditions which must be carefully studied before comparison is made with apparently similar conditions in other localities. A case is presented in another state, where the receipts of a certain road were not up to expectations, because of the fact that one of its principal towns contains the car shops of a trunk line steam road, and consequently the competing electric line was considered with prejudice by a majority of the town's population. Whether prospective earnings are calculated upon the basis of car mileage, track mileage, population, or any other method, it is only by a study of results actually obtained that we may arrive at any sort of rule to apply, in an effort to eliminate as much as possible the element of "guess."

The Muncie, Hartford & Fort Wayne Railway Co. represents a type peculiarly and distinctively interurban. The company has its own track extending from court house to court house of the terminal cities. Outside of towns the road is located entirely on private right of way, three-fourths of the entire mileage lying adjacent to the right of way of the Lake Erie & Western R. R. No city cars are operated, nor are the tracks of any other company used. In the terminal city of Muncie but four minutes' time is required for the run from the courthouse to the corporation limits, so that practically no city service is given. The towns, mileage, rates of fare and population served are shown by the following table:

City or Town.	Miles.	Local Fare.	Population.	Additional rural population [illegible] one mile from track.
Muncie	[illegible]	[illegible]	[illegible]	[illegible]
Royerton	5.2	.10	[illegible]	400
Shideler	2.9	.05	[illegible]	
Eaton	2.5	.05	2,000	400
Hartford City	[illegible]	.15	[illegible]	[illegible]
Montpelier	9.3	.15	[illegible]	[illegible]
Keystone	[illegible]	[illegible]	[illegible]	[illegible]
Poneto	[illegible]	[illegible]	[illegible]	[illegible]
Bluffton	[illegible]	.10	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]

The total population served, 61,500, is approximately one-third the number of people in the city of Indianapolis. The population per mile of track averages 1,470; excluding the principal terminal, Muncie, the average per mile is 705. The average rate of fare charged approximates 1.8 cents per mile. No local or round trip tickets are issued, but 5-cent coupon and commutation books are sold at from 20 to 25 per cent reduction. Reduced rate tickets to the company's park at Eaton are on sale during the summer months. The company has not yet developed the freight business, although packages are handled on all cars; consequently all the succeeding figures given refer to passenger business purely. The use of the Ohmer fare register enables complete traffic statistics to be maintained at a minimum of clerical expense.

The following table shows the number of passengers carried during the year 1904, classified according to fare denominations:

5 cent fares	276,202
10 " "	[illegible]
15 " "	[illegible]
20 " "	[illegible]
25 " "	[illegible]
30 " "	[illegible]
35 " "	[illegible]
40 " "	[illegible]

45 cent fares.	664
50 " "	[illegible]
55 " "	[illegible]
60 " "	230
65 " "	1,013
70 " "	106
75 " "	[illegible]
Tickets	[illegible]
Passes	7,008
Total	[illegible]

It will be noted from this table that over one-fourth the total number of passengers represent 5-cent cash fares. The 15-cent fares are the most profitable, followed closely by the 35-cent fares, while the least remunerative are the 70-cent fares. The average cash fare per passenger is 17 cents, while the average value of tickets used is 15.5 cents. At the rates of fare charged this indicates that the average passenger rides a distance of nearly 10 miles. The average number of passengers carried per day is 2,813, indicating that 4.6 per cent of the total population make a one-way trip each day, or every available person in the territory served rides 17 times per year. Introducing the element of car-mileage it is found that there are 1.8 passengers registered for every car-mile of service. The receipts per car-mile figure 32.05 cents, of which 27.32 cents represents cash fares, 3.23 cents represents ticket sales, .69 cent represents packages, .24 cent represents newspapers carried, .16 cent represents chartered cars, and the balance comprises miscellaneous minor items. On the basis of receipts per mile of track per annum the figures for 1904 show this item to be $4,335.

The table showing the number of passengers representing each denomination of fare indicates general facts in reference to passenger traffic. The following method was adopted for determining more specifically what might be termed the "location" of business: During the last week of January, all conductors were supplied with blank forms, on which they were required to keep a record of the number of passengers boarding and leaving trains at and between towns. At first thought this would seem to be a gigantic task with which to burden a trainman, in addition to his other duties, but it must be remembered that no transfers are in use and that the type of register employed requires duplex tickets to be issued for an average of less than two fares for every one thousand collected. Consequently the results obtained may be considered as fairly accurate, inasmuch as a considerable personal error would have no appreciable bearing on the total amounts. A tabulation of the statistics thus collected shows the following results, which are the total figures for seven consecutive days:

	Passengers On	Passengers Off	Total On and Off	Percentage of Total	Mileage	No. of Rural Passengers On and Off per Mile per Day
Muncie	2,826	2,812	5,638	16.1	.7	
Intermediate distance	354	364	718	2.1	4.5	23
Royerton	392	410	802	2.3	.0	
Intermediate distance	204	225	429	1.2	2.9	21
Shideler	483	438	921	2.6	.0	
Intermediate distance	146	168	314	.9	1.9	24
Eaton	1,399	1,313	2,712	7.8	.9	
Intermediate distance	634	682	1,316	3.8	6.6	28
Hartford	3,905	3,857	7,762	22.2	2.0	
Intermediate distance	681	752	1,433	4.1	7.7	27
Montpelier	2,274	2,285	4,559	13.0	.8	
Intermediate distance	156	187	343	1.0	2.6	19
Keystone	818	806	1,624	4.6	.3	
Intermediate distance	306	358	664	1.9	4.1	23
Poneto	731	713	1,444	4.1	.5	
Intermediate distance	383	428	811	2.3	5.5	21
Bluffton	1,800	1,694	3,494	10.0	.8	
Total	17,492	17,492	34,984	100.0	41.8	

By combining the number of passengers on and off, each town or rural district receives credit for every in-coming and out-going passenger; comparative results are thus obtainable, using as a base the figure representing the total number of passengers on and off. The column of percentages given in the table indicates the relative amount of traffic furnished by each town and by the rural districts lying between adjacent towns. The proportion of business furnished by the towns is shown to be 82.7 per cent of the total, in comparison with 17.3 per cent supplied by the rural districts, a ratio of nearly five to one. Incidentally it might be mentioned that similar statistics were gathered for one week during the month of August, 1903, at which time only that portion of the road between Muncie and Montpelier was in operation; the results showed 88.3 per cent for the towns and 11.7 per cent for the rural districts, a ratio of over seven to one. In the preceding table a column of figures is given showing the mileage in towns and in the intervening country. By using these figures the results in the last column of the table are obtained, the purpose being to show the relative traffic value per mile of track of all the rural territory traversed. The general results of the table indicate that the greatest volume of town and rural traffic is supplied by Hartford City and the adjacent territory; on account of geographical and local conditions, this result is a natural one to expect.

Proceeding further in an effort to determine the relation between gross receipts and population, the following earnings per capita per annum are obtained, the method used being to credit each community with its proportion of the total receipts to which it is entitled, according to the percentage values given in the preceding table.

The results are as follows:

City or Town.	Receipts per Capita per Annum.
Muncie	$ 0.91
Royerton	13.89
Shideler	15.70
Eaton	7.07
Hartford City	5.03
Montpelier	3.93
Keystone	20.84
Poneto	14.86
Bluffton	2.59
Rural Population	6.27

The average receipts per capita per annum show nearly $2.95. Omitting the population of the principal terminal city, which method is sometimes used in calculating per capita earnings where the terminal is a large city, though hardly applicable in the present instance, the per capita value increases to $6.14.

The question of providing the requisite number of stopping stations for any road is one which should be carefully considered as having more or less bearing upon passenger traffic. The tendency has been to establish stations at rather too frequent intervals, with the result possibly of stimulating rural traffic to the detriment of through business, operating schedule, car maintenance, etc. Each problem must be considered according to its own conditions, bearing in mind the endeavor to provide the greatest good for the greatest number. On the road under consideration in this article the established rural stopping stations vary from ½ to 1½ miles apart. There are 47 stations provided in the rural districts and 23 within the corporate limits of the towns; of these 70, 15 may be classed as regular or compulsory (i. e. on account of occurring at railroad crossings or at the principal stations in the towns), and the remaining 55 may be considered as flag stations. While the passenger statistics previously referred to were being collected by the conductors, a record of the number of train stops was taken by the motormen. The result for the week showed an average of 28 stops made per single trip, 12 of these being within the corporate limits of the towns and 16 in the rural districts. Of the 28 stops 15 were compulsory, and the remaining 13 were at flag stations. That is to say, with 55 flag stations along the line an average of 13 are used per single trip.

In conclusion, it should be stated that the Muncie, Hartford & Fort Wayne railway was first opened for traffic between Muncie and Hartford City in February, 1903. The mileage between Hartford City and Montpelier was added the following May. The division between Montpelier and Bluffton was opened in December of the same year with bi-hourly trains, continuing with this inadequate

service until July, 1904, at which time the full hourly schedule was inaugurated. Consequently, although general traffic statistics should preferably be based upon second year results, it will be noted that in the present instance all figures applying to the year 1904 are hardly indicative of the fully developed results which may be expected for the coming year.

In reply to an inquiry as to how the results stated in the paper compared with the estimates of the engineers made before the road was built, Mr. Shlesinger stated that the results achieved exceeded the estimates by from 10 to 15 per cent. Mr. Cravath stated that an analysis of the receipts of 32 Ohio interurban lines showed practically the same results per car-mile and per capita as those given by Mr. Shlesinger.

Mr. Shlesinger, replying to a question regarding competition, stated that the steam railroad competition his company had to meet was not serious and that when opening the road the local tariff had been fixed at two cents per mile. At that time the company had been criticised for making the rate so high, but it had believed it would be easier to lower the rate were it found too high than to raise it were it fixed too low in the first place. The rate of two cents had been found very satisfactory and had not been changed.

Mr. J. W. Chipman introduced the subject of interchangeable mileage or coupon ticket books on which he believed action should be taken by the Indiana association. He expressed the belief that a book of coupon tickets which would be accepted in payment for everything that any of the railway companies had to sell would greatly increase the earnings.

Mr. J. H. Merrill, Lima, ex-secretary of the Ohio Interurban Railway Association, who was present, gave a brief history of the steps leading to the adoption of the interchangeable coupon ticket used by the Ohio roads. A coupon ticket was considered the only practicable form because of the different rates or fare obtaining on the various Ohio lines. These rates vary from 1¼ cents per mile to 2 cents per mile. The interchangeable book containing 240 five-cent coupons, or transportation of the face value of $12, is sold for $10, a reduction of one-sixth. On the Western Ohio the number of coupon books sold in November was 13; in December, 22; and in January, 35. The value of the Western Ohio coupons lifted on foreign roads was $97 in December and $134 in January. The value of foreign coupons lifted on the Western Ohio was $45 in December and $87 in January. Mr. Merrill stated that he could not tell the effect on receipts of the use of the coupon books. He knew, however, that the interchangeable coupon books were not used by the people who had used the company's mileage books. He believed that the principal use of the interchangeable book was by traveling men who used them to save the trouble of keeping track of small car fare items, and that he believed this class of users would use electric lines over which interchangeable books were good, in preference to using the steam railroads. The Ohio coupon book is not good on the Dayton, Springfield & Urbana road and he knew of several instances in which, for this reason, traveling men had stated they used steam railroad mileage in preference to going over the Dayton, Springfield & Urbana.

Mr. Merrill stated that several companies realized that a mistake had been made in limiting the interchangeable coupon book to the use of the individual and that an effort is now being made to remove this limitation and make the book available to all members of the purchaser's family. Such a change would be a financial advantage to his road, as the discount on the coupon book is only 16 2-3 per cent, while on the family mileage books now sold the discount is 25 per cent.

Mr. C. D. Emmons stated that the Ft. Wayne, Van Wert & Lima Traction Co., one of his properties, was using the Ohio interchangeable book under agreement, and suggested that a committee be appointed to consider an interchangeable book for Indiana roads.

The subject of baggage having been introduced, Mr. Merrill stated that there was great variation in practice as regards carrying baggage; the roads in the northern part of Ohio carried baggage free, while those in the southern part of the state made a charge. Among the companies that charged for baggage, some accepted interchangeable ticket coupons at their face value and some only at the actual value, that is, some roads would take five coupons for a 25-cent baggage charge and others would collect six in order to make the net collection 25 cents.

Mr. H. A. Nicholl, of the Cleveland & Southwestern Traction Co., expressed his belief that baggage should be carried free up to 150 lb. His company now carries baggage on about one third of its trains, beside which [illegible] the intention to carry baggage on all cars. The present practice of the Cleveland & Southwestern is to carry 150 lb. of baggage free where the ticket is more than 25 cents, and 15 cents per 100 lb. excess. To different stations where the ticket rates are less than 25 cents, a charge of 15 cents per 100 lb. is made for baggage.

On motion, the chair was directed to appoint a committee of five to consider the question of coupon ticket books and the transportation of baggage and report at the next meeting of the association. There were appointed as this committee, with instructions to select their own chairman, the following: E. C. Folson, Ft. Wayne & Wabash Valley; Charles A. Baldwin, Indiana Union Traction; J. McM. Smith, Indiana Railway Co., South Bend; W. K. McKown, Indiana & Eastern; F. D. Norveil, Indianapolis & Northwestern.

The chair read a communication from Mr. Paul Richey, stating that he proposed to publish an electric railway guide for the state of Indiana, and requesting the co-operation of the association in securing from the members correct time tables and an agreement to distribute in their cars and stations a suitable proportion of these books each month. On motion, the association adopted the proposed publication as its official joint time table and appointed a committee consisting of L. J. Shlesinger, Muncie, Hartford & Ft. Wayne; C. A. Baldwin, Indiana Union Traction, and J. A. Berry, Indiana Northern, to arrange the details and supervise the publication on behalf of the association.

In answer to a question, Mr. Norveil gave a brief account of the excursion business of the Indianapolis & Northwestern, and called attention to a device which that company had found very satisfactory for increasing its Sunday traffic. There being on this line nothing in the way of parks or pleasure resorts, it was found desirable to stimulate the Sunday riding, which it was found in ordinary conditions would be the lightest of any day in the week. Accordingly, a special ticket, good for a round trip from any point on the line to any other point, was sold for $1. This ticket, of course, had no sale where the round trip fare was less than $1. The results have been very satisfactory.

The chair suggested that the members of the association would do well to consider the advisability of adopting a cheap week-end rate, that is, sell round trip tickets good going on Saturday or Sunday and good returning Sunday or Monday. He believed that by this means the week-end business could be distributed over three days, instead of over one or two, with good results for all concerned.

On motion, the executive committee was directed to arrange for the time and place and programs of future meetings.

Mr. A. W. Brady, president of the Indiana Union Traction Co., extended an invitation to all members present to dine with him at the Hotel Doxey. The courtesy was promptly accepted and acknowledged by a vote of thanks. After dinner, a special car was in waitnig and took the party to the main power station of the Indiana Union Traction Co., after inspecting which the Indiana delegates returned to Indianapolis over the Indianapolis Northern Division by way of Alexandria and Tipton.

The Newman Properties Association.

A new association has been formed for the advancement of the interests of the Newman properties, among which are the Birmingham Railway, Light & Power Co., the Nashville Electric Light & Street Railway Co., the Knoxville Traction Co., and the Little Rock Railway & Electric Co. The officers and heads of the departments of these roads met in Nashville, January 23d, 24th and 25th for the purpose of inspecting the Nashville property and exchanging ideas, thus benefiting not only the property under discussion but each member being in this way enabled to gain some new ideas which would be of use to him in the operation of his own property. The next meeting of the association will be at Birmingham, Ala., in April.

The officers chosen for the association were: President, Percy Warner, president of the Nashville Electric Light & Street Railway Co.; vice-president, C. H. Harvey, president and general manager of the Knoxville Traction Co.; secretary, C. O. Simpson, treasurer of the Birmingham Railway, Light & Power Co.

Piping and Power Station Systems.—IV.*

By William L. Morris, M. E.

Piping Systems—Continued.

Fig. 16 shows the meter in use with all boilers using hot water. By opening valve "a" and closing "b," cold water would be fed through the meter to the boiler. The dotted lines indicate the portion of the system out of service, though this portion may be under pressure. The arrangement shown in Fig. 14 would permit the water meter to be placed on the floor next to the pumps, the lines "c," "d" and "e" being the risers from the latter. After the system is determined, the pipe details can be considerably simplified by changing the relative location of lines, etc., and at the same time, maintain the same system. For example, Fig. 17 shows a rearrangement which permits the meter and pump connections to be made compact and accessible from the floor. It may be found that the pumps cannot both be of the same pattern as shown. The distance "f" may require the pumps to be right and left handed with their steam cylinders together, in order to leave room for the required connections. The pumps must not determine the piping, but the piping should determine the minor details, such as those just mentioned.

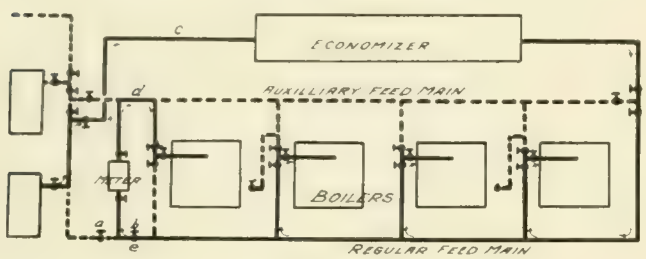


FIG. 16

The early diagrams made for a station should be considered as studies and after the pipe work has been detailed in accordance with these diagrams the best plan would then be to change the direction of the lines on the final diagram so that they will correspond closely with the lines as they are to be built. This will enable the men in the station to read the diagram much more readily and with less liability of making an error in the operation of the valves. The valves should be shown in approximately their correct location. For instance, when Fig. 17 has been laid out in detail these data should be used for correcting the diagram as illustrated in Fig. 14 and the final result be shown as in Fig. 18. At first glance the system shown in Fig. 18 appears to be a different one than that shown in Fig. 14, but in reality it is exactly the same. The object in correcting the final diagram is to avoid this deceptive appearance.

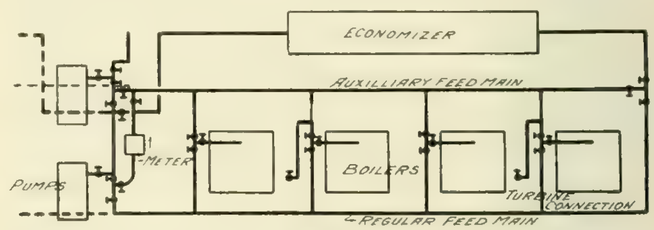


FIG. 18

Fig. 12 shows the general arrangement which will be used in designing the problem plant. There are four groups of economizers shown which will ordinarily be fed from one pump. If the boiler plant were divided into halves and each half provided with its own economizers, then the pumps could be placed at the dividing line between the two halves, and with possibly a few modifications in regard to the valves Fig. 14 could be used. After adding the connection lines between the two halves the arrangement would be as shown by Fig. 18.

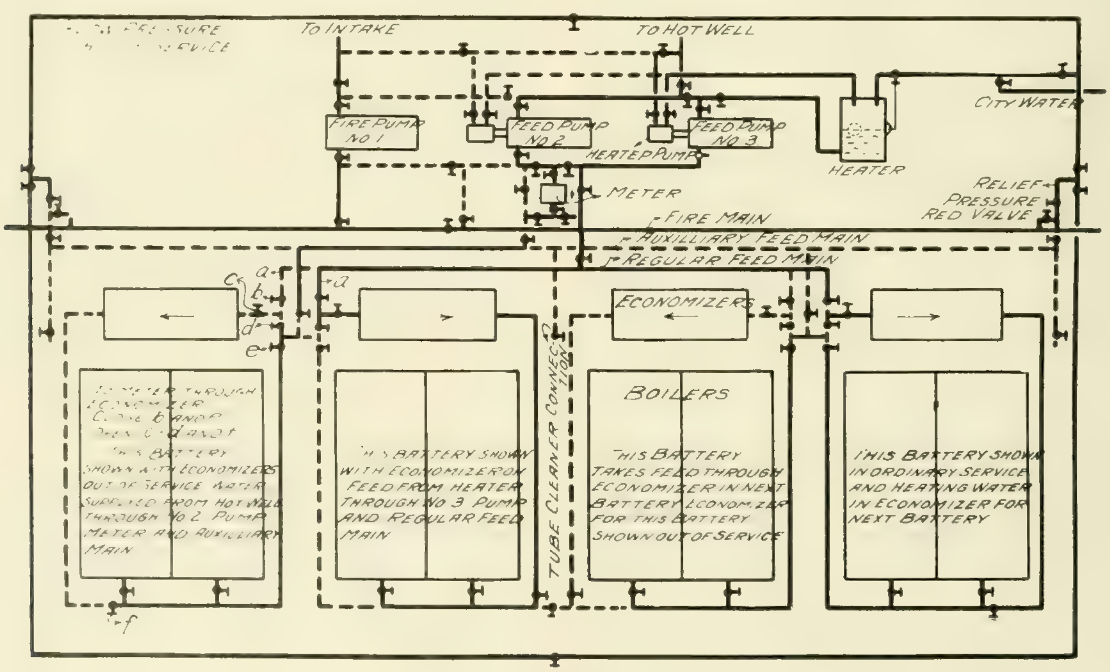


FIG. 19

Having decided upon the general arrangement of the economizers and boilers, the piping should now be laid out in a detailed system. This system should be made as reliable and as flexible as that shown in Fig. 14 and by tracing out Fig. 19 it will be seen that the following conditions are readily secured:

1. Regular operation of No. 1 pump on fire line and house

service; No. 2 pump on auxiliary main for tube cleaning, [illegible] pump on feed mains.

2. The meter can be used with either pump No. 2 or [illegible] with both; the discharge from the meter can be fed to the main auxiliary main or to both at the same time; the meter can deliver through one or more economizers with either heater water or cold water; it can also feed direct to the boilers by passing one or more economizers.

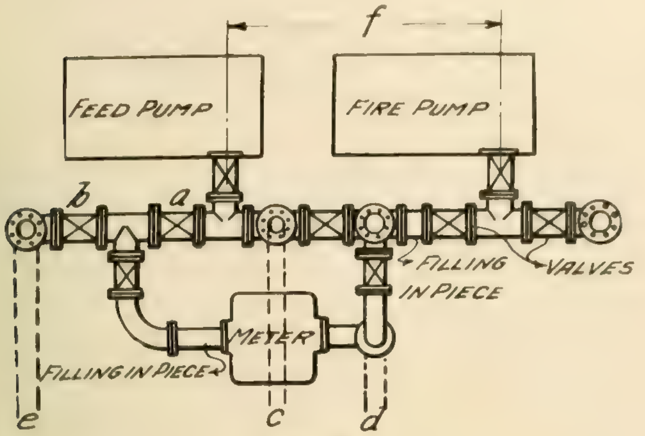


FIG. 17.

3. Any one pump may be shut down without interfering with regular operation; any two pumps may be shut down and still maintain pressure on the feed main and the house service, using cold water or water from the hot well in the economizers.

4. When an economizer is shut off the boilers which regularly feed through it can get feed water from the economizer in the next battery of boilers.

5. The entire feed main may be shut off and water then be fed through the auxiliary main or vice versa.

6. The auxiliary main may feed through the economizer or directly to the boilers.

7. During the winter, warm water may be kept on the fire and house service system by using the hot well as a supply.

This system necessitates the metering of the water used in two of the boilers in each battery. The advantages which might be gained by separately metering the water for each boiler would not justify the addition of the piping connections necessary to accomplish this detail. If it is found necessary to make a separate test on one boiler this can be done when the other boiler is shut down, or if it is necessary to test two boilers which discharge into the same economizer, the meter reading when divided by two would hold, because the [illegible] feed water for the other boiler.

The [illegible] for in Fig. 19. They are as follows:

1. Any part of the [illegible] ing the capacity more than one-fourth, for four units.

2. The hot well water may be fed to the economizers when the heater is off.

3. The [illegible] any other economizers which are in operation.

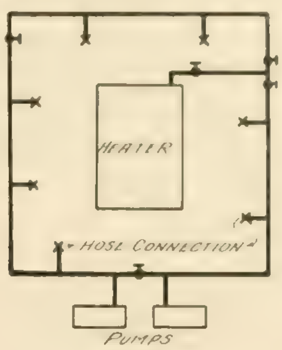


FIG. 21.

4. An abundance of feed reserve is provided for.

There are various other systems of metering which might be employed such as a separate meter for each [illegible] separate meter with a by-pass might be used for each economizer if placed at the points in the feed system marked a. By using four smaller meters they could be operated at nearer their normal capacity than could one of sufficient size to care for the entire plant, thus the readings would be more accurate, but simpler and more accessible details can be obtained by using one large meter at the pumps. This will also allow the meter to be read from the pump room floor. The relative performance of the boiler units can be determined more accurately by using the same meter for measuring all the water. Any difference in the performance which might be shown on two individual boiler meters might be due to one or both of the meters being inaccurate. With but one meter the degree of inaccuracy will show the same for all boilers.

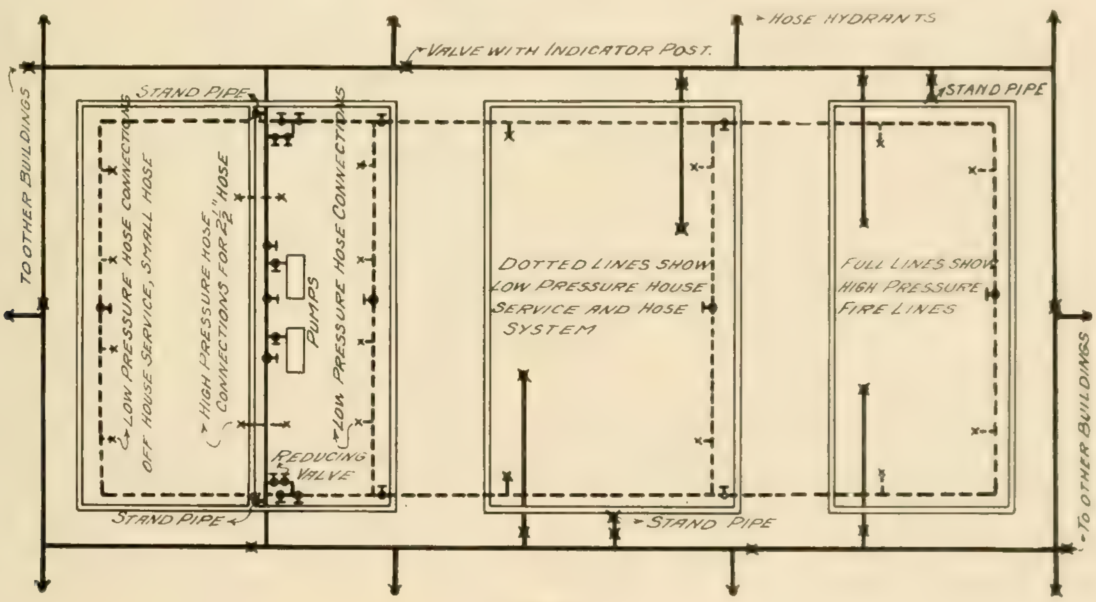


FIG. 20.

City water connections which are taken from a meter in the city water works line, should have a line carried to the house service main and a branch to the heater so that when it is necessary to clean out or shut off the intake there would be another source of water supply for boiler feeding. All these conditions must be provided for because no one can foresee the many difficulties which may come up and it is safe to assume that every line and connection will necessitate shutting down sometime without giving more than a moment's warning.

But a portion of the fire main in the station is shown in Fig. 19. Ordinarily a safe fire and house service can be laid out on the loop system as shown in Fig. 20. Valves should be arranged so that any portion of the loop can be shut off and still have a partial fire protection. The very important connections, such as the water to the heater, should have a valve on either side of them as shown in Fig. 21 and a valve between the two separate sources of supply; then

any section of the line may be shut off and water still delivered to the heater.

The branches to the roof, city line, low pressure service, other buildings and lawn sprinklers should all be provided for. As the points to be brought out in considering these are more in the nature of details than of general system, they will be considered later. Ordinarily the hydrants should be kept away from the outside walls a distance not less than the height of the wall. The fire mains and branches must be laid below frost line, the depth of which can be obtained from a neighboring city water works. Steam pipes which run to the roof and any hose lines inside of the buildings should have an indicator post outside, so that in event of piping becoming broken or bursting from exposure to frost the water can be shut off and the pressure on the fire piping maintained. All house service valves when connected to the fire mains should be readily accessible so that in case of fire they may be closed quickly. Any lawn sprinklers fed from the fire lines should be fully able to stand the fire pressure and should be frost proof.

Before making a final decision on the design of the building or piping it would be well to take up all the details of fire protection with the board of underwriters because some details which an engineer would consider to be of minor importance must be used in order that the underwriters' rules and regulations be obeyed. To secure the lowest insurance rates it will be necessary to install such details as they require, and even though they admit that some of their demands are unreasonable they are without authority to modify them.

The subject of artesian wells is not always a necessary part of power station work but in the case of many factory plants cannot very readily be avoided and will be explained later by means of diagrams.

Let it be assumed that the plant in question is located alongside of a stream of water suitable for boiler feeding. The intakes, discharges and connections to circulating pumps and condensers of such a plant are shown in Fig. 22. As in other lines, the chief requirement in this system is that it be possible to shut off any part of the system and yet allow three-fourths of the plant to be operated. The waterway A is always an intake, the waterway C is always a discharge, the waterway B may be either. Any one of these three waterways may be shut off at any time. Either of the lines from the intake or hot well to the pumps may be shut down and operation continued with the other. Any portion of the discharge main from the circulating pumps may be shut down and the operation of one condenser still permitted. Any one of the three circulating pumps can supply water to either of the condensers. All lines are so connected that repairs can be easily made.

At first thought it would possibly seem that too many valves are used to make this system reliable. On noting the suction and discharge of the circulating pumps it will be seen that there are seven valves on the suction side and seven on the discharge. By disregarding the making of pipe work at all times accessible a shut-off valve would still be required for each machine, each condenser and each source of supply such as intakes B and C, and if the factor of readily made repairs to the lines is also disregarded it will be found that out of a total of 18 valves but 4 can be saved, thus it is seen that with an increase of about 5 per cent in the cost of pipe work the line may be made entirely accessible. The piping cost is ordinarily about 5 to 7 per cent of the total station cost for such a plant as is being outlined, so the difference in the cost of a station having an inaccessible system and one having a readily accessible system would be about one-fourth of one per cent of the total station cost or about 25 cents per kilowatt increased cost for valves, and if 10 cents be allowed for extra labor, fitting, etc., the total added cost would be but 35 cents per kilowatt or one-third of one per cent of the total cost of the station. The cost should not be considered. The only factor should be the time and study necessary to perfect the layout and provide the station with a flexible and reliable system.

In case three waterways are used instead of two, there would be a slight additional expense in the first cost, but the expense of operation would be lessened because one screen house could be shut down and cleaned of any sediment or obstruction while the other two fed the plant, and during the winter months the waterways B and C may be used and the liability for interference from ice be lessened by the warm water discharging close to the intake. During the warmer months of the year waterways A and C could be used since they are placed at a considerable distance from each other.

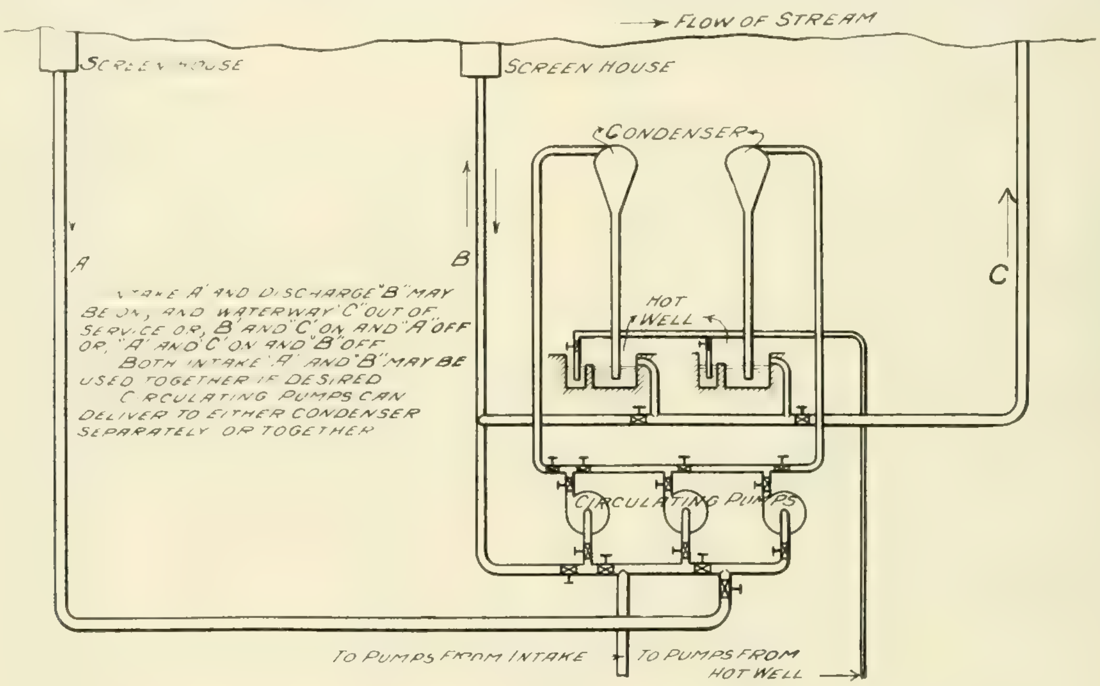


FIG. 22.

(To be continued.)

The annual ball of the International Railway Employes' Association, of Buffalo, N. Y., was held at Convention Hall, Tuesday, January 10th. There were 4,000 present, consisting of trainmen, starters, electricians, car makers and repairers, and their friends. The ball was pronounced a brilliant success financially, as well as socially, and the proceeds will be turned over to the sick and death benefit fund of the Employes' Association.

Through limited service has been established between Dayton, O., and Indianapolis, Ind., via the Dayton & Western Traction Co., the Indianapolis & Eastern Railway Co. and the Richmond Street & Interurban Railway Co. lines. There will be three trains each way daily, known as the Interstate Limited, which will make the run in four hours and fifteen minutes, the distance being 108 miles. Very fine parlor and buffet cars, as well as sleeping cars, have been put in this service and meals may be had enroute a la carte.

Wear of Steel Tired Wheels How to Eliminate Excessive Flange Wear.

BY W. G. PRICE.

The cause of excessive wear of steel tired wheels can probably be attributed to faulty truck construction.

Chilled iron wheels may wear unevenly when not accurately paired, or from a difference in temper, or depth of chill, and the wheel which becomes the smallest in diameter will have the most rapid wear of the flanges. The temper of a pair of steel tires probably does not vary sufficiently to cause uneven wear.

Trucks can be out of true in several ways, and it is very common to find these inaccuracies in motor trucks.

Cast steel side frames vary in length from one pair of pedestals jaws to the other as much as one-half inch, due to a variation in shrinkage and molding. If the mold is rammed very hard, the sand at the pedestals will not give away when the metal cools, and the beam which connects the pedestals will not be allowed to shrink as much as when the mold is less hard. In many cases no attention has been given to pairing frames, or to machine finishing them so as to make them all of the same length, which results in the axles not being parallel. Such a truck tries to run in a curve at all times, and if the car is run continuously in one direction only, the wheel flanges at two diagonally opposite corners of the truck will be worn sharp, while if it be run in both directions, all flanges will wear rapidly. In other types of trucks there is sometimes a variation in lengths of side frames.

Until very recently, at least, nearly all motor truck frames were put together and bolted in position on the axles, instead of being built separately, and they were made approximately square by having the faces of the wheels in line. This was the only way of squaring them, with the wheels and axles in place, as the wheels and journal boxes prevented diagonal measurement. Such trucks were seldom square for several reasons:

First, the planes of the wheel's faces were not at right angles to the axles, except when the wheels were turned true after being pressed on the axle, which was not usually done.

Second, the gage lines of the wheels were not equally distant from the centers of the axles, and this is a very common defect, and also causes bad fitting brake shoes which can be frequently noticed.

Third, the lost motion endwise of the axle, between the journal and the bearing, and between the bearing and the box, permitted the frame to be so placed before bolting together as to be out of square, even when the wheel faces were in line.

Fourth, journal bearings are frequently bored out of center, and as all are likely to be placed in the same holder for boring, where one is found to be out of center, all of that lot will be found to be out of center in the same direction.

Fifth, journal boxes are placed in trucks without machine finishing, and owing to inaccurate molding, one side of the box is thicker than the other side, and owing to the personal equation of the molder, or to some inaccuracy of the pattern, all of the boxes will be thickest on the same side, which locates the axle to one side of the center of the box, and as all of the boxes are approximately alike, all of the axles journals will be out of center on the same side of the box, which would also be the case when the journal bearings are bored out of true. When the truck frame is built perfectly square, this variation in either journal bearings or boxes, while not throwing the axles out of parallel, does throw the wheels out of line. This causes the axles to run in a position not at right angles to the tracks. If such a truck were run in both directions, probably all of the flanges would receive more than a normal amount of wear, while if it were run in one direction only, probably two flanges on one side of the truck would receive the most wear. Many trucks are constructed with from ⅛ to ⅜ in. space between the side of the journal bearing and the inside of the box, and many trucks which have been in service for some time have much play between the boxes and pedestals, which permits the axles to run out of parallel. Trucks should have the journal bearings nicely fitted to the inside of the boxes. The boxes should be rigidly connected together, as is done in the M. C. B. type of truck, and they should be so constructed that no wear of pedestals and journal boxes can take place to cause lost motion. There can be of course many variations of the inaccuracies described, causing different results in wheel wear, but probably in most all cases it is due to inaccurate construction.

Accurate work requires skilled labor, machinery and time, which are expensive. If railroad companies would specify accurate work, to be done under the eye of their own inspectors, there would be a saving of power consumption and wheel wear.

The lack of proper lubrication of center plates, and the permitting of the car bodies to be partially carried on the side bearings, cause much wear of both the tread and flanges of wheels. There should be a clearance of ⅛ in. between each of the car body and truck side bearings, and the truck center plates should have a raised portion around the king pin, of the same height as the outside rim of the plate so as to retain the oil, and there should be an oil hole on each side of the car body center plate so the bearing can be oiled without raising the car body. Grease will not remain in a center plate so as to lubricate the bearing more than a few hours, while a good oil, as long as it remains fluid, will stay in the plate, and give good lubrication for several weeks. In cold weather it is necessary to thin the oil with kerosene. As soon as the oil is cooled sufficiently in winter, to change it to grease, it will immediately be squeezed out, and there will be no lubrication of the bearing. By casting the top plate hollow and then filling the cavity with waste to be saturated with oil, a much better lubrication of the bearing will be secured. Attention to this detail, which in the writer's experience is neglected on most all cars, will prevent much of the wheel wear.

A Talk on Railway Development in Massachusetts.

Mr. Robert H. Derrah, general passenger and advertising agent of the Boston & Northern and Old Colony street railways, lately gave a talk before the Haverhill street railway employes on the development of the Massachusetts street railways. Mr. Derrah's remarks were well chosen for the ears of his listeners and were greatly appreciated. He called attention to the fact, that in such interesting localities as his listeners were employed, it would add greatly to the pleasure of trolley travel and not interfere with their work, if the conductors would call out the points of historical interest as the car passed them. The speaker regarded three men as largely responsible for the Massachusetts street railway development —Henry M. Whitney, who was the pioneer in opening up the suburbs suitable for mechanics' homes; Gen. Wm. A. Bancroft, of the Boston Elevated, and P. F. Sullivan, president of the Boston & Northern.

In his talk Mr. Derrah illustrated the growth of the electric railways from the earliest conception down to the magnificent special cars which are now operated by many roads. He also described the park systems and the many points of historical interest served by the street railways near the Massachusetts coast. The speaker has made a study of giving such little talks and has attracted worthy attention by this means.

Electric State Railway Experiments in Sweden.

FROM U. S CONSUL ROBERT S. S. BERGH, GOTHENBURG, SWEDEN

In the spring the railway board petitioned the government for permission to erect electrical transmitting apparatus on land belonging to the state, between Tomteboda and Vārtan, in order to carry out the experiments in electric railway traction, for which a grant of 500,000 crowns ($134,000) has been made by the Riksdag. At Tomteboda station double wires will be used and at Vārtan the contact system will be employed for transmitting the current from the power station to the electric locomotive or motor car, the rails serving for the return current. For these experiments a high-tension, one-phase, alternating current will be used, the tension and frequency of which will vary according to requirements. This question, so important for the whole country, has for some time been considered by the board of trade, and the board has recommended that the request of the railway board be granted, providing the permission to erect and use the apparatus be limited to a certain period, say five years, and that private rights are protected.

Annual Meeting of the Ohio Interurban Railway Association.

The first annual meeting of the Ohio Interurban Railway Association was held at the Algonquin Hotel, Dayton, O., Jan. 26, 1905.

President Clegg called the meeting to order at 10:50 a. m., and made a brief statement of the work already done by the association and some of the matters then in the hands of committees. After the minutes of the Canton meeting had been read and approved, the reports of various committees were received.

Mr. Clegg as chairman of the Committee on Standard Rules stated that the rules as agreed upon by the committee had been adopted by the Dayton & Troy Electric Railway Co. and copies of that company's rule book were submitted to members as the committee's report.

Mr. E. C. Spring, of the Committee on Baggage, reported that a letter of inquiry had been sent to some 70 roads and read a letter from Mr. Green in which were included his recommendations based on the replies received. These were: 1. To charge 25 cents for each piece of 100 lb. or less, and 25 cents for each 100 lb. additional. 2. Roads to divide baggage receipts in the same manner as receipts from coupon tickets. 3. Card checks in brass holders to be provided. 4. Roads handling baggage must have baggage masters at stations. 5. Companies should combine their stations wherever possible.

Mr. Spring stated that in the northern part of the state the companies appeared to favor carrying baggage free, while in the southern part of the state this could not be done.

In discussion the question of paying for transferring trunks between interurban stations was brought up. Mr. Clegg stated that the Dayton & Troy had made arrangements with the Western Ohio and Ft. Wayne, Van Wert & Lima electric lines and the Clover Leaf whereby through cars would be run from Dayton to Delphos to connect with the Clover Leaf for all points between St. Louis and Toledo. In order to get a contract with the steam road the electric lines had to agree to check 150 lb. of baggage free. The companies pay 5 cents per piece for the necessary transfer from the electric to the steam station at Delphos, this charge being divided among the three companies.

[The "Clover Leaf Special," beginning February 1st, leaves Dayton at 5:18 p. m. and arrives at Delphos at 8:25 p. m.; returning it leaves Delphos at 9:25 p. m. and arrives at Dayton at midnight. The distance is 95 miles.]

Some companies have arrangements for transferring baggage; others have not. Mr. Spring stated that in the case of his line, the Dayton, Covington & Piqua, it would require the major part if not all of the receipts from baggage to pay necessary transfer charges.

Some statistics as to the amount of baggage handled were given: Mr. Spring stated that on his line for every 100 interurban passengers there were 45 trunks handled. Mr. Coen said that on the Lake Shore Electric in 1904 there were carried 2,691,000 passengers, of whom one in each 139 had baggage carried free (up to 150 lb). Mr. J. A. Wilson, of the Cleveland & Southwestern, gave the monthly averages as 780 trunks and 300,000 passengers on that road.

The Lake Shore Electric makes a rate of $1.75 between Cleveland and Toledo; the rate on the Lake Shore & Michigan Southern (mileage at 2 cents) is $2.18, but the steam road sells commutation books to all stations at the rate of one-half of the electric roads' round trip rate. In view of this the electric line considers that it cannot with advantage charge for baggage weighing less than 150 lb. per passenger.

A representative of an association of commercial travelers having some 350 members in Dayton stated that traveling men would use the electric lines to a much greater extent were baggage carried free up to 150 lb. and prompt service given.

Regarding the interline coupon tickets, Mr. Paxton, of the Dayton & Troy, stated that the company had ordered the O. I. R. A. form, but for the Clover Leaf business had added the words "First Class" at the request of that road; also it had ordered a round trip validating form for Clover Leaf business.

Mr. Coen reported that the Lake Shore Electric had the O. I. R. A. form of coupon tickets on sale.

AFTERNOON SESSION.

The convention met at 2:30 p. m. and proceeded to the election of officers, which resulted as follows:

President, E. C. Spring, manager Dayton, Covington & Piqua Traction Co., Dayton.

Vice-President, Warren F. Bicknell, president Lake Shore Electric Ry., Cleveland.

Secretary, F. W. Coen, general passenger agent Lake Shore Electric Ry., Cleveland.

Treasurer, R. E. DeWeese, superintendent Dayton & Northern Traction Co., Dayton.

Executive Committee: F. J. J. Sloat, general manager Cincinnati, Dayton & Toledo Traction Co., Hamilton; F. D. Carpenter, general manager Western Ohio Ry., Cleveland; J. R. Harrigan, general manager Columbus, Buckeye Lake & Newark Traction Co., Newark; W. B. Tarkington, general superintendent Detroit, Monroe & Toledo Short Line Ry., Monroe, Mich.; F. J. Green, general manager Springfield, Troy & Piqua Ry. and Springfield & Xenia Traction Co., Springfield.

Finance Committee: E. C. Spring, J. H. Merrill, A. W. Anderson.

The discussion on "Steam," the subject for the afternoon, was opened by Mr. E. P. Roberts, president of the Roberts & Abbott Co., Cleveland, who presented the following paper:

The Choice of Prime Movers.

BY E. P. ROBERTS, CLEVELAND, O.

Introduction.

The subject for discussion this afternoon is "Steam Power," and as this covers too large a field to receive even general consideration in the time allotted, my talk will be confined to the consideration of reciprocating steam engines and steam turbines with special reference to interurban electric railway conditions, and omitting consideration of the steam generating and vacuum producing mechanisms, even though they are so closely connected with the general proposition that, in practice, they must be considered in their inter-connected relations.

Moreover, as the other speakers for this afternoon represent the manufacturing end, it seemed advisable that I should open the meeting by presenting general features and leave the description of actual mechanisms and the results obtained to the representatives of the manufacturing companies.

When taking up the matter of "Power" it is evidently necessary to consider, first, What is needed; second, What is best for the conditions. Therefore, I will follow this logical order, and although, at the start, the reason for the first may not be apparent, I think it will be before the completion of the presentation of the second.

As this audience is mainly composed of men interested in the operating and financial, rather than the technical end, my talk will not be relative to technical features from the technical standpoint, but from the standpoint of the effect of modifications of such features upon financial results.

POWER FOR INTERURBAN ELECTRIC RAILWAYS.

In Ohio the prime mover is usually a reciprocating steam engine, and, in a few instances, a steam turbine. In some portions of the United States water power is being largely utilized as the prime mover, but there are few, if any, economically desirable properties of such kind available in Ohio. Owing, however, to the recent developments in the line of gas and oil engines, there are situations where these should receive consideration.

In order to decide as to what prime mover is best for a specific case, considering type, number of units and size of each, all the factors affecting the case must be considered; and, generally speaking, in the following order:

1. Predetermination of the operating conditions.
2. Estimate of first cost.

3. Estimate of operating expenses, including financial charge

4. Comparative reliability, depreciation and repair account, and other matters which are largely questions of judgment.

5. Combination of all the foregoing, considered for each type of power plant, and a comparison of the results.

1. Predetermination of Operation Conditions.

This necessitates decision as to location of track, and the curves and grades most economically desirable, and the predetermination includes the following:

A certain location of the road is taken as the standard for comparison, being generally that which will give excellent, though not necessarily the greatest, accessibility on the part of the public, and having such grades and curves as a general knowledge of the proposition indicates would be good practice. The size of cars and number of trains necessary to handle the anticipated passenger travel are decided, and train schedules and train sheets are prepared which show the schedule time between the terminal points, based on a stated average schedule speed in the cities and towns, and a stated average speed whilst the car is in motion in the country, with deduction from the latter on account of country stops, thereby obtaining the schedule speed in the country. The train sheet shows the trains in service at any amount, and the location of such trains. The size of motors necessary to handle a car, or train of the assured weight and speed is then calculated.

A study of the results as thus obtained may indicate that it is preferable to obtain a slightly greater schedule speed between the terminal points, in order that, when operating on hourly headway, the lay-over at the end be not too long. For example, the time of the tentative run may be 2 hours and 10 minutes, which would necessitate a lay-over of 20 minutes when cars are operated on hourly headway (starting from one end on the hour, and from the other on the half-hour). This would require five cars in operation, whereas if the cars could make their run in 1 hour and 55 minutes only four cars would be needed. Such reduction in the number of cars would reduce the expense of the train crews 20 per cent, and the greater schedule speed between termini would be attractive to the traveling public.

In order to accomplish such higher schedule speed, one or more of the factors must be changed, with:

1. Higher schedule speed in the cities and towns. This may not be practicable.

2. Higher speed when in motion in the country. This would require larger motors and greater rapidity of acceleration, which would increase the first cost, not only of the rolling stock, but also of the entire power generation and distribution system, and it is the resulting increase in maximum and average power requirements which today especially interests us.

3. Reduction in number of country stops. This may reduce the income, and whether it is advisable depends largely upon the character of the proposition, and also whether, or not, "limited" trains will be operated. Consideration must also be given to the time made by competitors, more especially between distant points.

4. Change of location in the road so as to shorten the distance. This may necessitate giving lessened facilities to some localities, or it may necessitate more expensive construction, or both.

5. Such change of location as will allow higher schedule speed. This may be done by reducing the lengths of the runs on streets, or, if the right of way is by the side of the highway and in front of buildings, changing it so that it is back of the buildings. Sometimes the best location is adjacent to a steam road.

6. Reducing grades and curves.

Consideration of the foregoing factors, individually and collectively, also necessitates consideration of comparative first cost and operating expense, and comparative gross and net income, and the study of all the conditions may result in a decision to operate at a slower schedule speed, and change one or more of the factors in the opposite direction from that required to increase the schedule speed. If "limited" trains are to be operated, these must also be considered.

The foregoing relates to passenger service, but in addition express and baggage service may require consideration, also freight, using this word to mean the same as when applied to steam roads.

A specialist in the predetermination of what is the most desirable construction and equipment for any given proposition may not, and possibly [illegible] fications all these [illegible] to some degree [illegible] frequently [illegible] might be supposed to be able to state "off hand" what would be most desirable for any given proposition.

A striking proof [illegible] obtained by [illegible] by Mr. A. S. Richey, in a paper read before the Indiana Electric Railway Association [See St. Ry. Rev., Jan. 15, 1905.] Jan. 12, 1905, in which he states that the same cars are used on the Indianapolis Northern division of the Indiana Union Traction Co., as on the other divisions, and power is furnished for the entire system from one power house. That the average distance of the sub-stations on the Indianapolis Northern division is 46 miles from the generators, and on the others 15 miles, also that 12 per cent of the power used on the other divisions is delivered directly from the power station without alternating current transformer or transmission losses. Nevertheless, the power for the Indianapolis Northern division, measured at the power house, is only 33 per cent of the total, although it represents 42 per cent of the total car mileage. He also states that the average schedule speed is slightly greater on the Indianapolis Northern division than on the rest; and that the result illustrates "the general effect of a careful consideration of operating features in the engineering design and construction of a road, such as reducing curves and grades to a practical minimum, careful location of sub-stations with respect to their loads, and the economical distribution of copper."

The subject of this talk being "Steam Power", it may seem as though I had wandered far from the path, but all the parts of an electric road are so inter-connected, financially and physically, that decision as to steam power mechanisms can only be made after a study of the entire proposition, and in more or less detail depending upon its special features.

For example, if power is very expensive, measured at the motors on the car, then, from this standpoint, a reduction of grades is economically advisable, and also a reduction in the size, number and speed of cars; whereas, if power is cheap, the reverse is preferable.

All these factors are so inter-connected that, in order to obtain the best plan for the given conditions, a tentative plan must first be prepared which will be in accordance with the engineer's best judgment, based upon a preliminary study of the general and special conditions, and then such plan must be modified, and the effect of such modifications considered from every standpoint—first cost, operating expense, and effect on gross and net income.

It is, therefore, evident that the decision as to the power plant necessitates predetermination, within a reasonably close limit, of the average output which will be required at different hours of the normal operating day, and the maximum which may be required for any considerable period, and also the momentary maximum, the excess being taken care of by the momentum of the fly-wheel.

Also, decision as to similar features on days other than normal, Saturdays, Sundays, holidays and the like.

It may seem that the foregoing is what is frequently termed "not practical," or, looking at it from another standpoint, that it is "impracticable," and for the reason that operating conditions vary so greatly from day to day, that it might be considered impossible to predetermine them with such degree of approximate accuracy as to obtain results of any value. There is not now time for elaborate presentation of proof that careful and skilled predetermination of operating conditions pays, and, in fact, pays better than an equal amount of money expended in any other manner, but I will merely present as an interesting example the comparative results obtained by two power houses, each using the same make of water tube boilers, stokers, and compound condensing engines, and the one obtaining the poorer results, having generators of one of the best makes, and the other having old style (Siemens & Halske), which were probably somewhat less efficient than the other. The generators were direct connected, and both plants furnished direct current, and used the same quality of coal at the same cost per ton.

The plant obtaining the poorer results did not have the conditions predetermined, and in consequence various units were not of the best proportion for their operating conditions, considered as a whole and in relation to each other.

In the other case the character of the output was predetermined and the sizes of units considered with reference to each other, and although the load for this power house was more fluctuating than for the other, nevertheless the coal and the cost per kilowatt-hour output was materially less.

On the other hand there is, of course, a difference between what may be termed calculations for commercial purposes and those made for scientific reasons. The basis of the former is generally only approximate and of the latter is presumably exact, and it is evidently absurd to carry out calculations into fractions of a per cent when the basis is not known within 5 per cent, or, to use a mathematical simile, to "use eight place logarithms on four place data."

Having predetermined the average maximum power required from the engine or engines, when operating on regular schedule, and, for special days, a tentative decision is made as to the number of units and the size of each, based on capacity.

The condition of operation of engines furnishing power to an interurban electric road is, except when storage batteries are used, one of rapid and excessive fluctuations of load, usually ranging from 25 per cent to 125 per cent of the rated capacity of the engine and often from zero to 150 per cent, and sometimes, momentarily, up to 200 per cent.

I present the following as statements of facts:

1. For any engine supplied with steam at a definite pressure and quality, and with a definite vacuum, there is a definite load at which it will operate at its greatest economy.

Increasing the steam pressure, or superheating the steam, or increasing the vacuum, will both increase the maximum obtainable horse power and, generally speaking, and within limitations, the efficiency of the engine as a converter of heat energy into mechanical energy; but, considering the increased energy required by the engine auxiliaries, it will not necessarily increase the heat energy efficiency, considered as a whole, and, even more important, it may even decrease the "dollar efficiency." The latter efficiency includes first cost and operating expense, and it is upon this efficiency, considering the entire road, that either dividends or assessments are declared.

[The speaker then presented a curve showing the variation of coal consumption per kilowatt-hour, with varying load factor. Some of the co-ordinates of this are as follows:

Load, per cent.	Kw. h.	Lb. Coal per Kw. h.
50	42,000	4.7
45	36,000	5.0
39	33,000	5.2
36	30,000	5.5
30	25,000	6.1
25	21,000	6.7
20	17,000	7.4

This curve is based on the daily records obtained during one year. The power house is the Avon Beach power house of the Lake Shore Electric Ry. The results are old and were published several years ago, and I would apalogize for presenting old material if it were not for the fact that I have not results from any plant in which the coal has been weighed daily for such a long period and under such variation of percentage of rated load. It should also be noted that at rated load the test showed 3.2 lb. per kw. h., which, for this station, may be considered as the theoretical limit, and it should also be noted that a change of proportion of the individual mechanisms and of the size of such mechanism relative to each other could have been so made as to have obtained better results at rated load of the generator, but inferior economic results under the average operating conditions.

A schedule which will allow climbing of grades with motors in series is much better for the power house than one which requires "hustle" from start to finish; but of course this is not the only standpoint and there are too many inter-connected factors to now follow up this train of thought.

I desire to call especial attention to two facts readily shown by economy curves of any engines:

1. Comparative water consumption on rating is not the proper basis for decision when operating on variable load.

2. Comparative values obtained by comparing results for i. h. p. are not the same as for b. h. p.

The statement has already been made that engines for interurban electric railways normally operate with loads varying from friction load to 100 per cent overload, but it should also be noted that the average load is generally, and practically always, below rating.

Because of this, it follows that an engine should be so mechanically designed as to safely carry excess loads, and from the steam standpoint, so designed as to give maximum economy at a point below that which is ordinarily considered as its rating. The valve operating mechanism should permit the entrance of steam for as large a percentage of the stroke as practicable, and the steam passages should be of as great section and freedom from bends as practicable in order that steam may flow with the minimum drop in pressure. The cylinder or cylinders should not be any larger than necessary to give the required maximum of sustained power under the assumed conditions of steam pressure and quality, and of vacuum, including allowance for lessened pressure and vacuum when having a sustained load which is in excess of the normal.

Please note that I have here used the term "load in excess of that termed normal"; the common, and more convenient, term is "overload", but the latter term tends to convey the impression that the load is greater than that for which the apparatus is designed, and that load is injurious which, for the case considered, is not only erroneous, but directly contrary to the fact.

What cylinder proportions, for any given case, are most desirable depends upon steam pressure, vacuum, etc., and ratio of average to minimum load, and in a paper presented by me at the New York meeting (December, 1903) of the Engine Builders' Association of the United States I especially referred to the question of ratio of cylinder diameters of compound condensing engines under variable load, and the advisability of reduction of such ratio as the ratio of maximum to average increases.

Evidently, for any given case, it is necessary to ascertain what will be the water consumption of the various engines it is desired to consider, and not only at rated load, but over a large range of load. This information for any given engine must be obtained from the manufacturer, but, unfortunately, sometimes statements made require investigation before being accepted.

Some engine builders know what the engine on which they submit a bid will do at rating and with stated steam pressure, quality of steam, and vacuum. Fewer know the result which will be obtained at fractional loads. The engine builder does not know what will be the degree of variability of the load nor the average load; it is his duty to furnish a certain mechanism to accomplish certain agreed upon results, but whether the operating conditions will allow such results to be obtained in practice he does not, and generally cannot, know. The actual result is often unfair to the builder and uneconomical for the purchaser.

As an example of the unreliability of data in bids, I present the following, which are taken from bids in our office:

Our specifications stated the steam pressure and quality of steam to be delivered at the engine throttle, the vacuum at the engine exhaust, revolutions per minute, desired average indicated horse power, desired lower limit of maximum sustained horse power at stated steam pressure and vacuum (slightly less than specified for the average), and specified a maximum limit for the piston speed and a maximum and minimum ratio of diameters of high to low pressure cylinders. Fifteen manufacturers were invited to tender bids, and there was considerable difference in stroke, cylinder diameters, etc., and a comparison of all brought to the same basis necessitates too complicated calculations and too many considerations to present to a non-technical audience, therefore I have merely chosen data from the bids from four corliss engine builders, of better than the average standing, each of whom happened to choose the same diameter of cylinders and length of stroke, therefore making the steam conditions the same for all except as modified by steam passages, clearance, and control of steam by the valves. The comparison of all the bids showed differences far in excess of those here presented.

BIDDERS' STATEMENT.

Point of maximum cutoff of steam.	Maximum sustained horse power, stated as a percentage of the greatest.
.75	79
75	84
.75	72
60	100

The lowest was approximately the limit stated in our specifications.

There might be a slight difference in the maximum load or power obtainable, but that the engine having a maximum cutoff at .6 would give one-third more maximum power than the one cutting off at .75 is evidently impossible. The importance of maximum obtainable power has already been stated.

We will next consider the difference of efficiency guarantees for these four engines, all on the same basis as to steam and vacuum. The order is changed from that in the previous table.

Engine	Percentage of Rating.		
No.	50	100	150
1	13.75	12.50	13.25
2..	12.75	12.50	13.50
3..	14.00	13.00	14.00
4	15.00	12.75	14.00

If the stated water consumptions are correct, and if, for this comparison, we consider the gross amount to be allowed annually for depreciation and repairs to be the same for all engines, then it is evident that the No. 1 engine is the best if the average load is above rating, and No. 2 if it is below rating.

How much more, based on cost of fuel, can we afford to pay for No. 2 than for No. 4 engine?

If the load be .5 rating for ½ the day, at the rating for ¼ the day and 1.5 rating for ¼ the day, or an average of .88 rating for the whole time (and this is a very high average load for an interurban railway not using storage batteries), and the daily run be 20 hours, and the additional (not pro rata) evaporation be 8 lb. of water per 1 lb. of coal, then the annual saving of No. 2 will be:

Steam per i. h. p. per day—2.25 lb. for 10 hr., plus .25 lb. for 5 hr., plus .50 lb. for 5 hr., a total of 26.25 lb.

If the average output is 1,000 h. p., then the steam saved annually is in round numbers 9,600,000 lb., which with an evaporation of 8 to 1 is equivalent to 1,200,000 lb.

With coal at $2.00 per short ton the saving would be $1,200 per annum, or the interest on $20,000 at 6 per cent; if coal cost $3.00 per ton the saving is $1,800 per annum, or the interest on $30,000.

It is natural to hesitate at paying $20,000 or $30,000 more for one 1,200-h. p. engine than for another; nevertheless, on the guarantees we could afford to do so. If the engine guaranteed as the more economical as to fuel is also better designed and manufactured, there is an additional reason for purchasing that engine even at a greater first cost; but how nearly do the guarantees represent the facts?

The answer can only be a matter for the exercise of judgment, and considering the technical features, standing of the bidder, and proved results.

The foregoing shows the results which may be obtained by the investigation of only one feature, and also the importance of making comparisons on the basis of operating conditions, which latter, if not existing, must be predetermined.

The average load above considered is a high percentage of the rating, and if in order to make the comparison over a greater range we consider that No. 2 engine at .3 load would take 14 lb. and No. 4 17 lb., and that the load is .3 rating for ¼ of the day, .5 rating for ½ of the day, full rating for ⅛ of the day and 1.5 rating for ⅛ of the day (a day being 20 hours as before).

The daily difference in steam per i. h. p. will be, computed as before: 5×3 plus 10×2.25 plus $2.5 \times .25$ plus $2.5 \times .5$, which gives a total of 39.4 lb.

This is 50 per cent more than the previous result, making a capital saving for $2.00 coal of $30,000 and for $3.00 coal of $45,000.

Probably there would be not less than two engines and for the greater portion of the time only one would be in operation, if the average time of operation of two engines be simultaneously only one-fifth that of one engine (one engine 16 hr., two engines 4 hr.), load conditions for each engine be considered as unchanged, then the total additional amount which we could afford to pay for the two more economical engines would be six-fifths of that for one, or with $2.00 coal, $36,000, and with $3.00 coal, $54,000.

If the comparisons were made at rated load, then the annual saving would be approximately one-fifth of that of the first assumption, and the difference in value being only $4,000 for $2.00 coal and $6,000 for $3.00 coal.

The foregoing [illegible] comparative values must include the cost of coal; this fact is not always appreciated.

The same general considerations apply to the question of the comparative advisability of installing steam engines or steam turbines, as have been considered in connection with various engines, and there are some additional considerations, such as comparative space, cost of foundations, etc.

The writer would state, at the outset, that he believes as good coal economy can be obtained by using the highest grade of reciprocating engines, properly proportioned to the work, as can now be obtained by the use of turbines, and that, to a considerable degree, the better results reported where turbines have been installed are because the turbine plants have been of a higher grade than the engine plants with which they have been compared. Turbine plants generally have superheated steam, frequently at a higher pressure than the average reciprocating engine, and also with higher vacuum, and they do obtain better efficiency from the standpoint of water per kilowatt-hour than the majority of the engine plants in interurban power houses. But it does not necessarily follow that reciprocating engine plants could not have been so designed as to have obtained equally high efficiency, nor does it follow that the plant which is most efficient from the standpoint of fuel is most economical, everything considered. I believe in the steam turbines, but do not consider that they have the field to themselves, but rather that each case must be considered on its own merits.

Many comparisons which have been published are misleading because of misleading statements. For example, some comparisons are made on the basis of rated load, which has been shown to be inaccurate when operating under variable load; others are based on pounds of steam per kilowatt-hour taken by the turbine, or the engine, and without making allowance for the additional heat energy required to obtain the higher vacuum for the turbine. In this connection it should be noted that the efficiency of the turbine is materially increased by an increased vacuum, whereas this is much less the case for an engine built on commercial lines. For the turbine it is wise to obtain high vacuum, but the cost must not be overlooked.

Also, the steam for the turbine is usually superheated, and, if the comparison is based on difference in pounds of steam, it is evident that consideration should be given to the additional heat units in the steam, and the cost of supplying such additional heat energy. When considering fuel economy the basis of comparison is the per cent of heat energy transformed into mechanical energy delivered by the mechanism, including the amount of energy required for the auxiliaries.

On this basis a recent comparison, which I made, between the guarantee of a turbine manufacturer and those of an exceptionally high grade engine, showed such an exceedingly slight difference as to be practically negligible, and a comparatively small difference in operating conditions would throw the balance one way or the other, as would also a slight difference between guaranteed and obtained results. The difference, as tabulated, was slightly in favor of the turbine, with temperature of condensing water at 60 degrees, and with 26-in. vacuum for the engine, and 28-in. for the turbine, and with barometer at 30 in., but if the condensing water were at a higher, though probable summer temperature, it would not be found economically desirable to endeavor to obtain at such time such high vacuum, and therefore during such time as this condition might exist the result would be in favor of the engine. Assuming other conditions of operation there would be a greater difference, and in favor of one or the other, depending upon the assumptions.

Therefore, for this case decision must be based on other grounds than comparative fuel economy.

A comparison would include at least the following:

A. First cost, including engine, turbine, generators for each of same, foundations, buildings, traveling crane, sometimes ground, piping, condensing system, superheaters.

B. Operating expenses, including fuel, oil, labor, repairs and depreciation.

C. Reliability.

All of A and fuel and oil under B can be predetermined with sufficient accuracy for a decision. The other items under B and C are, for the present at least, largely questions for the exercise of judgment.

Following Mr. Robert's address, Mr. Hans Holzwarth, the inventor of the Hamilton-Holzwarth steam turbine, addressed the association, describing the construction and operation of the line of turbines for electric railway work which the Hooven, Owens, Rentschler Co. is now manufacturing. Mr. Holzwarth had a large number of blue prints showing elevations and sectional views of the assembled apparatus and drawings to a larger scale showing the more important details, and covered the subject very thoroughly, his address being much appreciated.

Mr. C. H. Weeks, of the Buckeye Engine Co., Salem, O., next followed with a short talk on power house management. The point which Mr. Weeks most emphasized was that there should be lots of brains in the power house. Companies install the most expensive and complicated machinery and yet too often entrust it to the care of incompetent persons, overlooking the fact that an ignorant or careless fireman or engineer will greatly increase the cost of operation and may easily do a vast amount of damage to the equipment.

ANNUAL DINNER.

The annual dinner was held in the evening, 192 guests sitting down at the tastefully decorated tables. The guest of honor was Gov. Myron T. Herrick. Mr. H. B. Clegg served as toastmaster and made the first address of the evening, that introducing the president-elect, Mr. E. C. Spring. Mr. Spring made his inaugural address, emphasizing in it the extent of the electric railway interests in Ohio and the usefulness of the association in protecting these interests. In conclusion Mr. Spring, on behalf of the association, presented to Mr. Clegg a silver loving cup as a testimonial of appreciation of his success in administering the affairs of the association during the past year.

Governor Herrick followed Mr. Spring, the principal points of his address relating to electric railway legislation. Governor Herrick stated that while he did not approve of an after-dinner speaker reading from manuscript, yet he felt that his position made it important that he be not misquoted on matters relating to recommended legislation and begged permission to read a statement of his views on this subject. Governor Herrick's remarks as regards legislation were as follows:

"Interurban electric railways are getting closer and closer every day to the status, the business, and the characteristics of commercial steam railways. In a number of recent cases the courts of Ohio have found it difficult to distinguish between these two classes of common carriers. In the early days of horse cars, and even later, when electricity as a motive power was first introduced, street railroads were looked upon as conveniences for the cities alone. They were purely municipal institutions and no one thought of carrying their work beyond the public streets. But within recent years the business of street railroads has been revolutionized. The urban has become the interurban. So far as the business of these companies is concerned, municipal boundary lines have become obliterated. There is scarcely a street railroad line in Ohio that does not run into two or more municipalities; and if today we should seriously consider municipal ownership, the first question that would be asked with respect to nine out of ten of the street railroads of Ohio would be, Which municipality shall own them? So fast indeed has this business grown, and so active has been the genius and enterprise of those engaged in it, that the very growth it has enjoyed has perhaps settled, for the present at least, the question of retarding it by public appropriation; for the number of cities and villages now reached by the interurban roads is so great that municipal ownership would only serve the purpose of destroying the continuity of the lines.

"But the progress of this business has gone even further. It has not only obliterated the boundaries of municipal corporations, but it has crossed with its network of tracks throughout the country the lines of counties and states. The interurban railway has become the short haul carrier for the people.

"Manifestly, therefore, we have lived past the day when these companies may be regarded as purely local conveniences and controlled solely by local authorities. The legislature of Ohio in recent years has been recognizing with increasing assurance and conviction the ultimate sameness of all railroad companies, whether operated by steam or electricity, whether operating upon the highways or upon the private rights of way, and whether called by one name or another. The general assembly of 1902 granted to interurban companies the power of eminent domain outside of municipalities. The general assembly of 1904 granted to street and interurban railways, under certain conditions, the power of eminent domain within municipalities; and the same legislature last winter provided for the taxation of the property of interurban electric railway companies by a method identical with that in force with respect to steam railroad companies. Thus the two kinds of railways are coming closer and closer to mean one and the same thing. Peering into the future it does not require mental field glasses to see the day when in fact as well as in law there will be but one kind of railroad in this country, and when electricity, which is now coming more and more into use in the subways and by the steam roads upon the urban streets, will be the only motive power for all.

"Now, what does all this mean? Certainly I am not one of those who believe in taking away from the municipalities of the state the inherent right of home rule; and certainly I would not advocate any plan that would destroy the principal of local government in so far as it is necessary to protect local interests. But in so far as interurban railways have ceased to be the concern of a single city or a single locality, and have come to be the concern of the state at large, I believe the business in which they are engaged ought to be regulated and controlled by the state. As interstate commerce is the concern of the nation at large, so intra-state commerce is the concern of the state at large; and any agency which thus unites, by bands of steel, the interests of urban and rural communities, and conducts a passenger, freight, express and mail traffic between different sections of the state, should be directed and controlled by some authority which would see that equal justice is done between all patrons of the lines, whether they live in the city or the country. Nothing has seemed to me more obstructive of general progress than the spectacle of an interurban railway line being, on the one hand, retarded in its work by the caprice or cupidity of local authorities, or, on the other, practicing discrimination in favor of the people of one community against those of another. I am not willing to take from the people of our municipalities the control of their streets or deprive them of the just return which should be made by those who use the streets for any public service business. But with respect to interurban railway lines, which run through a number of municipalities as well as counties, I believe that, for the protection of the people and for their safety and convenience, as well as for the protection of investors in these enterprises, some just and equitable method should be devised for their control which will avoid the confusion that conflicting interests always entail."

In arranging for the banquet, the entertainment committee of the association had the able assistance of a committee of the supplymen, of whom Mr. John F. Ohmer was chairman, and to him was in a large measure due the perfection of the arrangements.

The supplymen maintained headquarters on the parlor floor at the Algonquin Hotel. Among those having literature for distribution or models on exhibition were the Ludlow Supply Co., of Cleveland, which besides having its own specialties is now agent for the Peter Smith Heater Co. of Detroit, and the Kalamazoo Railway Supply Co.; the W. R. Garton Co., which has recently taken agencies for the Lima Insulator Co. and the Lord Electric Co. railway bonds; the Dittrick-Jordan Electric Co. and the Bloomer Bureau. Representing other railway manufacturers and supply houses were E. B. Grimes, Ohmer Fare Register Co.; Ambrose Petry and Frank Denning, Ambrose Petry Co.; Edwin Van Winkle, Post-Glover Electric Co.; R. R. Braggins, H. W. Johns-Manville Co.; H. E. Beach, Sterling-Meaker Co.; R. R. Fast, Trolley Supply Co.; George T. Lewis, Viscosity Oil Co.; F. M. Nicholl, Taylor Electric Truck Co.; D. J. Evans, Continuous Rail Joint Co.; H. E. Blemker, Cincinnati Metal Co.; H. W. Cushman, H. W. Cushman Co.; L. O. Duclos, Massachusetts Chemical Co.; F. W. Hitchings, Consumers' Rubber Co.; C. Wright, Standard Brake Shoe Co.; R. W. Palmer, General Electric Co.; A. G. Olberding, Columbia Foundry Co.; F. N. Bliss, Buckeye Electrical Co.; J. E. Gimperling, jr., W. B. Schaife & Sons Co.; M. Bleullen, Columbia Foundry Co.; R. D. Jeffers, Kanawka Fuel Co.; Will I. Ohmer, Recording & Computing Scale Co.; J. A. Hanna, the J. A. Hanna Co.; Judson Pratt, Valvoline Oil Co.

The menus for the dinner were handsomely printed and bound in silk ribbon, and were presented with the compliments of the Auditing-Ticket & Record Co., of Dayton.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since [illegible] have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible]; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to [illegible]. Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50, single volume, $2.00.]

MAY ENFORCE MECHANIC'S LIEN AGAINST BUILDING CONVEYED FOR RAILROAD PURPOSES. PRODUCTION AND CONTROL OF ELECTRIC POWER FOR USE UPON TROLLEY SYSTEM A "MANUFACTURING PURPOSE."

Bates Machine Co. vs. Trenton & New Brunswick Railroad Co. (N. J.), 58 Atl. Rep. 935. Sep. 30, 1904.

The right to lien a building for materials furnished under the mechanic's lien act of New Jersey, the court of errors and appeals of New Jersey holds, is not rendered unenforceable by the conveyance of the property to a corporation for railroad purposes.

The production and control of electric power by mechanical means and its adaptation for use upon a trolley system is a "manufacturing purpose," within the meaning of the mechanic's lien law.

RIGHT TO MAKE RULES AGAINST OCCUPATION OF DANGEROUS POSITIONS BY PASSENGERS—CARE REQUIRED WHEN OCCUPATION OF SUCH POSITION IS ALLOWED.

Augusta Railway & Electric Co. vs. Smith (Ga.), 48 S. E. Rep. 681. Oct. 15, 1904.

A railway company, the supreme court of Georgia holds, has the right to make reasonable rules and regulations prohibiting passengers from occupying positions on its cars considered to be dangerous, except at their own risk; but when, notwithstanding such rules, passengers are permitted, and in some instances required, to occupy such positions, the company is still under the duty to exercise extraordinary care and diligence for their safety.

POSSESSION OF GONG A MATTER OF COMMON KNOWLEDGE.

Story vs. St. Louis Transit Co. (Mo. App.), 83 S. W. Rep. 992. Nov. 29, 1904.

Objection to an instruction was made that it submitted to the jury to find whether the motorman negligently failed to give a timely warning of the approach of the car. Counsel made this inquiry, "How should the warning be given?" The answer, the St. Louis court of appeals says, is, "By sounding the gong," which is known by every one at all familiar with street car traffic to be furnished on every car for the express purpose of giving warning when necessary. This is common knowledge, and the jury must be presumed to have been possessed of it.

INJURY TO CONDUCTOR FROM FAILURE TO PROVIDE SUFFICIENT CARS—LIABILITY FOR NEGLIGENCE OF CAR STARTER.

Shaw vs. Manchester Street Railway (N. H.), 58 Atl. Rep. 1073. Oct. 4, 1904.

A street railway company's failure to provide a sufficient number of open cars for the accommodation of its business, the supreme court of New Hampshire holds, will not entitle a conductor to a judgment for damages for injuries, even if it be found that the deficiency was the proximate cause of his injury, where, well knowing of such failure, he voluntarily continued in the service, and thereby assumed the risk of injury from that cause. Furthermore, to render the company liable to the conductor for the negligence of the car starter in sending a defective car over the road behind the car in which the conductor in question was employed, the court holds that it must appear that the car starter was acting in the performance of a non-delegable duty owed by the company to the conductor; or, in other words, that his act was essentially a master's act, as distinguished from a servant's act. [illegible] think it was, when the car starter was not intrusted with the exercise of any discretion relating to the [illegible] maintenance of them in suitable repair, or the determination of the question whether cars were suitable for use.

BOARDING OF MOVING TROLLEY CAR

Murphy vs. North Jersey Street Railway Co. (N. J. Sup.), 58 Atl. Rep. [illegible]. July 6, 1904.

Although it cannot be held, as a matter of law, the supreme court of New Jersey says, that a person who attempts to board a trolley car while it is motion is negligent, yet, when the fact that the car is in motion is the sole producing cause of the injury sued for, the risk of its occurrence is one which the person making the attempt must be held to have assumed.

EMPLOYE A COMPETENT WITNESS.

Feitl vs. Chicago City Railway Co. (Ill.), 71 N. E. Rep. 991. Oct. 24, 1904.

An employe, as for example a motorman, the supreme court of Illinois holds, is not an incompetent witness, under the statute, because he is liable over to the company for any damage he may have caused. Nor does the court consider that he is incompetent as a witness, when the adverse party is suing as administrator, under the provision of Section 2 of the act of 1867 that no party to any civil action, suit, or proceeding, or person directly interested in the event thereof, shall be allowed to testify therein, of his own motion or in his own behalf, when any adverse party sues or defends as the administrator of any deceased person, except in certain specified cases.

OLD ORDINANCE AGAINST SWINGING OR HANGING FROM OUTSIDE OF CARS INAPPLICABLE TO PRESENT CONDITIONS.

Frank Bird Transfer Co. vs. Morrow (Ind. App.), 72 N. E. Rep. 189. Nov. 1, 1904.

A city ordinance adopted at the time when all of the street cars within the limits of the city were propelled by horse power, and making it unlawful for any person within the corporate limits of the city "to swing or hang from the outside of any street car," the appellate court of Indiana, division No. 2, holds, is not applicable to the present condition and manner of operating street cars, as in passing the ordinance the city council did not contemplate the operation of street cars by electricity, nor did it intend that such ordinance should apply to the modern summer car with a running board.

NOT AN ADDITIONAL BURDEN ON STREET.

Budd vs. Camden Horse Railroad Co. (N. J.), 59 Atl. Rep. 229. Nov. 14, 1904.

A double-track street railway was constructed in the northerly half of a road 33 feet in width, pursuant to a city ordinance. The poles carrying electric wires were close to the outer line of the street on which the plaintiff's land abutted, and the ties extended to within two or three feet of that line. No sidewalk had been built. The court of error's and appeals of New Jersey holds that the construction of the railway did not constitute an additional

servitude, and that the abutting owners—owners of the soil of the highway—could not maintain ejectment against the railway company.

WHAT CONSTITUTES DUE CARE IN A PERSON APPROACHING A TRACK—REASONING CANNOT TAKE THE PLACE OF POSSIBLE OBSERVATION.

Goldman vs. Milwaukee Electric Railway & Light Co. (Wis.), 101 N. W. Rep. 384. Nov. 15, 1904.

Due care in approaching a railway track, the supreme court of Wisconsin says, can be satisfied only by the full use of the senses of sight and hearing at the last moment of opportunity before passing the line between safety and peril. The last moment for such observation in this case was just before the plantiff's horse stepped upon the track on which the plaintiff knew a car was approaching, the evidence being undisputed that the movement of the horse was so slow and so without momentum as to approximate the plaintiff almost exactly to the situation of a foot passenger, as to whom the single step onto the track is negligence unless, before taking it, he assures himself, by observation, of its safety, if the view is unobstructed. Reasoning is not due care when opportunity for observation exists. It is only when deprived in some degree of such opportunity that one may, consistently and with due care, rely on his judgment as to chances. Neither can he rely on any assumption that the car is moving at a reasonable, or any other, rate of speed, where he has opportunity to observe the contrary. However, no right of way existed in favor of the plaintiff when, as established by the result, some diminution of the speed of the car was necessary to enable him to pass in safety.

STRIKING BY END OF CAR OF PASSENGER WHO HAS JUST ALIGHTED TO TRANSFER TO ANOTHER CAR.

Walger vs. Jersey City, Hoboken & Paterson Street Railway Co. (N. J. Sup.), 59 Atl. Rep. 14. Nov. 7, 1904.

A passenger disembarked from a car for the purpose of transferring to another car of the company, a ticket enabling him to do so having been furnished him on the car upon which he first took passage. The point from which he alighted was the proper transfer point. After getting off the car, and as he was about to cross over to the other car, or while he was doing so, the car which he had left started to go around what was described as "the loop," and its rear end struck him, knocked him down, and injured him. According to his story, the accident happened immediately after he got off of the car, and before he had taken a single step away from it. In this situation of the case, the supreme court of New Jersey says, it was manifestly proper for the trial judge to refuse to nonsuit. Again, the court says that the man was still a passenger of the company when he was struck. If he was taking the most direct course from the car which he had just left to the car upon which he was about to embark, it was for the jury to say whether he was not entitled to believe that he was safe in doing this, or, at least, that he would not be put in jeopardy by anything done by the company while taking this most direct route. It was also for the jury to say whether the operation of the car, under the conditions disclosed, was not a negligent operation, and the violation of the duty which the company owed to the man as its passenger.

CARE REQUIRED TO AVOID KILLING DOGS.

Moore vs. Charlotte Electric Railway, Light & Power Co. (N. C.), 48 S. E. Rep. 822. Nov. 22, 1904.

Dogs, the supreme court of North Carolina says, are known ordinarily to be able to take care of themselves amidst the dangers incident to their surroundings. Where a horse, or a cow, or a hog, or any of the lower animals would be killed or injured by dangerous agencies, the dog would extricate himself with safety. Besides, the court says that it knows of common knowledge that within that jurisdiction, at least, there is scarcely a household without a dog or dogs, that they are found in every street and public place, no limitation being put upon their free movements, and by the hundreds they daily pass in the cities and towns over the street railway track where and as often as they please. If, therefore, it should be required that motormen in charge of these cars should exercise the same degree of care to avoid running over a dog that the law requires of them to avoid injury to other animals, the public convenience of rapid transit in populous communities would be seriously impaired, and all business interests made to suffer. As the defendant's counsel said in their brief, "The dog would be absolute master of the situation, and would force the electric cars out of business." The rule, the court is satisfied, should be that street railway companies, when their cars are properly equipped, should not be held liable in damages for the killing of a dog by one of the street cars in motion, unless it was done under such circumstances as to justify the conclusion that the killing was done either willfully, wantonly, or recklessly.

CONSTRUCTION OF CONTRACT TO PAY A CERTAIN SUM ON FAILURE TO OPERATE ROAD ONE-HALF OF FRANCHISE PERIOD.

Santa Fe Street Railway Co. vs. Schutz (Tex. Civ. App.), 83 S. W. Rep. 39. Oct. 26, 1904. Rehearing denied Nov. 23, 1904.

The street railway company entered into a contract which stated that, whereas the said Schutz, for the purpose of enhancing the value of his real estate along the line of the railway had expended $1,481.07 for and on account of the railway enterprise, and, moved by the same inducement, promised, on certain conditions, to pay to the company the further sum of $2,000, and had paid the same, the company, in consideration thereof, agreed that during one-half of the period named in its charter (50 years) the street railway should be operated in good faith throughout the entire line, and not abandoned or removed, or any part thereof, and that in the event of a failure to maintain or operate it as aforesaid from any cause, the sum of $3,481.07, with lawful interest from the failure aforesaid, should be paid to said Schutz, who was to have a lien upon all the property owned by the company, and, in the event of his suing to foreclose his lien, should have such reasonable attorney's fees as the court might allow. The court of civil appeals of Texas holds that the agreement on the part of the street railway company to pay Schutz the sum of $3,481.07 in the event of its failure to perform its contract should be construed as one for the payment of liquidated damages, and not as merely a penalty, upon which no recovery could be had, unless actual damages for the breach were alleged and proven. It further holds that the very terms of the contract completely negatived the idea that the company was only obliged to maintain and operate the street railway any 25 years of the 50 years covered by its charter. The maintenance and operation of the line of street railway was, with the exception of certain contingencies to be provided for, to be continuous; and it could not be doubted that it was to continue from the time the contract was executed until one-half of the period (25 years) of the existence of the company's charter should expire.

BOARDING CARS IN BARN.

Gleason vs. Metropolitan Street Railway Co. (N. Y. Sup.), 90 N. Y. Supp. 1025. Dec. 9, 1904.

It appeared in this case that the place where the plaintiff attempted to board a car and was injured was inside of the barn or shed, and not upon the street, and it was claimed by the defendant that passengers were not received at that point, and that the driver of the car had no notice that the plaintiff was attempting to board the car when he started the same. It became a material question, therefore, the first appellate division of the supreme court of New York says, whether passengers were received at this place. If they were, then it would not be disputed but that the defendant owed a duty to the plaintiff to see that he was given a reasonable opportunity to board the car at that place. The plaintiff sought to show it was customary for the defendant to receive passengers at this point. He was asked: "Had you gotten on cars at that place before?" "Do you know what the custom was at that time with regard to passengers boarding cars at that point?" Both questions were objected to and the objections sustained. But the court holds that these questions were proper and competent, and bore upon a material issue in the case. It says that the first question called for a fact as to whether the plaintiff had boarded cars at that place. If he had, then it would have been preliminary to the question as to the length of and number of times and the circumstances which

had attended his taking the car at that place, and therefrom, if it had been made to appear, as it might, that the defendant had received the plaintiff as a passenger at that point and carried him therefrom for any considerable period of time, dependent upon the number of times, it might have such probative force as to authorize a finding that the defendant had knowledge that the plaintiff customarily took the car at that point, and thereby arrive at the conclusion that it owed him the same duty as a passenger boarding the car at that point as it would the reception of passengers at other points. Upon the proof, as it stood, it appeared that one passenger had preceded him into the car, and, if this had been followed by showing a habit of the plaintiff to take the car at this place, it might require a submission of the case to the jury. The custom in this respect could be established by his own evidence, as well as by others. The second question was also competent.

LIABILITY FOR INJURY TO PASSENGER DISCHARGED IN UNSAFE PLACE IN STREET OR ON PRIVATE RIGHT OF WAY—DUTY WHERE PLATFORMS ARE CONSTRUCTED OR ADOPTED—AS TO CONTRIBUTORY NEGLIGENCE ON PART OF PASSENGER—INVITATION TO ALIGHT AUTHORITY TO DO SO.

Topp vs. United Railways & Electric Co. of Baltimore (Md.), 59 Atl. Rep. 52. Nov. 17, 1904.

That a street railway is not liable, as a carrier, to the passenger for the condition of the street upon which he alights, the court of appeals of Maryland says, is undoubtedly correct, as a general proposition, though there are cases where it becomes the duty of the street railway to warn its passengers of the unsafe condition of the street, known to those in charge of its car, but unknown or not plainly discoverable to the passenger, and to assist the passenger in alighting.

In this case, however, at the place where the car stopped and the plaintiff was injured in alighting the railway was not upon a city street, but upon its own private right of way—a fact which, the court says, at once broadly discriminated this case from all those relied upon by the company, and which effectually deprived it of recourse to the exemption from liability above mentioned. Where, as in this case, the street railway owns and controls the place where the accident occurs, and has either constructed or adopted platforms provided for the regular receipt and discharge of passengers, the reason for the rule as to such places ceases, and the rule must cease to operate as such. The court can perceive no reason, upon principle, why, as to the place of this accident, this defendant should not be held to the same liability, as regards a passenger, as a steam railroad. It is firmly established that the relation of passenger does not cease upon the arrival of a train at the passenger's destination, but continues until he is afforded an opportunity safely to alight.

When, therefore, this defendant entered into the occupation of its own right of way, under its own exclusive control, it subjected itself, as respecting the receipt and discharge of passengers upon that right of way, to the duty imposed by the rule stated. It might have required passengers for Chelsea Terrace to get on and off at the intersection of that Terrace with Clifton Ave., thus alighting upon the public street, if unwilling to assume the burden of that rule. If it had undertaken to receive and discharge passengers upon the embankment of its own right of way, where the car in question stopped (which was an unsafe and dangerous place to let passengers off), without any platform or other provision for their safety, it would have neglected the duty imposed by that rule. Having either constructed or adopted certain platforms, it so far complied with that rule, since it could not be material whether the company built or adopted the platforms; and it has been held that the adoption of a platform neither owned nor constructed by the company creates an implied contract that passengers may rely upon its use. The rule imposes the duty not only to provide, but to use, safe means of passage from the car.

If the passenger knew, or should have known in the exercise of ordinary care and prudence, that she was about to alight upon a steep slope, and that her foot, in stepping from the car, could not reach the ground, she would be negligent in taking the risk; but if, after looking as she said she did, she could reasonably believe she would alight upon a safe surface within reach of her foot in stepping down, she would not be negligent. While the conductor was negligent in not stopping at the platform, it would be unfair to him to assume that he knew she could not safely alight on the embankment, and recklessly permitted her to attempt it; and if he, an experienced employe of the railway, presumably familiar with the place, did not perceive danger in such attempt, it would surely not be reasonable to deny to a woman unacquainted with the place the benefit of the same presumption. Moreover, the implied invitation of the conductor to alight at that place could not be overlooked in passing upon the plaintiff's alleged negligence. This was a question of fact to be determined from the conductor's action and conduct, as well as from express words. It has been held in numerous cases that an [illegible] to alight at a place other than the station is held sufficient authority for the passenger to do so.

POWER TO CONDEMN LONGITUDINALLY FOR SECOND TRACK—A STRIP OF [illegible] RAILROAD—WHAT CONSTITUTES A RELOCATION.

Chicago & Milwaukee Electric Railroad Co. vs. Chicago & Northwestern Railway Co. (Ill.), 71 N. E. Rep. 1017. Oct. 24, 1904.

Condemnation of a strip of land for another track parallel to the line of road purchased and being operated by the electric railroad company, the supreme court of Illinois holds, was not in violation of the provisions of the state constitution forbidding any railroad corporation consolidating its stock, property, or franchises, with any other railroad corporation owning a parallel or competing line. The court does not think that the laying of another line of road upon the same right of way, where the company building the new line, already has one line, is to be deemed the construction of a parallel or competing line, within the language of the constitution. It says that the right of way owned by the electric railroad company was 25 feet in width. It had the right, under the statute, to condemn a right of way 100 feet in width. The acquirement of a 25-foot right of way did not exhaust its power, but it possessed the right to condemn additional right of way up to the statutory limit; and the fact that it appeared that upon this additional 25-foot strip of right of way it proposed to construct a line of railroad in accordance with the terms of its charter, it seems to the court, simply meant that the additional track was to be operated in conjunction with the existing track as a double-track railroad, and not as a parallel or competing line, within the meaning of the constitution. The statute contemplates that a railroad company shall have the right to lay as many tracks as it sees fit upon its strip of right of way 100 feet or less in width. As long as its tracks are all laid upon that one right of way, the question of parallel or competing lines does not arise.

It was urged that the company exercised its power to locate the line of road when it purchased a line already located, and that, the power of location having been thus exercised, it was exhausted, and the company was without power to locate a line on the additional 25 feet which it sought to condemn, and, being without power to locate a line there, it was without power to condemn land for a line which it could not locate. But the court says that in each of the cases cited in support of this position it would be found that the court had in contemplation such a change or relocation as would require the use of an entirely different and distinct right of way. Changing the tracks of a railway from one side to another of a right of way strip 100 feet or less in width is not to be regarded as a relocation. To constitute a relocation, it is necessary that the new line should be projected, in whole or in part, over and upon ground not included within the original right of way or its additions; the whole of that right of way and additions not exceeding 100 feet in width.

It was conceded that a railroad company cannot appropriate or condemn a strip off of the right of way of another railroad company longitudinally. But the court is disposed to the view that the authorities announcing the doctrine that one railroad company cannot condemn longitudinally the right of way of another, had reference only to the right of way of the width which the railroad company is authorized by the statute to condemn. A 50-foot strip of land owned by the railway company and adjoining its 99-foot strip, but being no part of it, was not exempt from condemnation on the theory that it was part of the right of way. If it were

within the 99-foot strip, it would be exempt, whether actually needed by the owner for railroad purposes or not, so long as the owner was engaged in the business for which it was chartered. Being outside the 99-foot strip, the question of its exemption depended upon other considerations. It being evident that the railway company owning it did not need it then, and would not need it in the immediate future, while the electric railroad company needed it then for a present public purpose, for which it had the power to acquire a right of way by condemnation, the remote and uncertain needs of the railway company owner must yield to the present and certain right of the electric railroad company.

LIABILITY FOR INJURY TO BOY PERMITTED TO RIDE ON FRONT PLATFORM AND JUMPING, OR REQUIRED TO JUMP, OFF MOVING CAR—"TURNTABLE CASES" NOT APPLICABLE TO CARS—ADMISSIBILITY AND EFFECT OF ORDINANCE PROHIBITING JUMPING OFF MOVING CARS.

Denison & Sherman Railway Co. vs. Carter (Tex.), 82 S. W. Rep. 782. Nov. 7, 1904.

There was some testimony in this case that certain boys got on a car with permission of the motorman, who also acted as conductor, and were permitted to ride a short distance for having turned the trolley pole, when one of them, a boy ten years old, was injured by jumping off of car, by order of the motorman or otherwise. It was contended that negligence of the motorman or driver of the street car in permitting a child to ride upon such car when such permission is granted to subserve the purpose of the driver individually, and not in transacting the business of the owner of the car, does not render such owner liable for the injuries to the child in getting on or off the car. But the supreme court of Texas says that the fallacy of this contention lies in the assumption that, because the servant permitted the boys to ride for an improper reason, in running the car he was not acting for the master. If, in the control and management of the car, he was guilty of negligence which caused the injury to the boy, the company was responsible.

There are authorities, the court goes on to say, which warrant the proposition that there might be actionable negligence in permitting an immature child, incapable of caring for its own safety, to ride in such a position, when it has received an injury proximately resulting from that fact—as when it has fallen from the platform, or has been led by its childish impulses to jump therefrom. It is held that it may be negligence in those managing a car to allow such a child to incur the risks incident to riding in so exposed a position, and also in not exercising a careful watch and restraint over it while so riding. This court makes no question as to the soundness of these doctrines when applied to some states of fact, but it does not see their application here, because, it says, no injury resulted to the boy from riding on the platform. He was hurt in jumping off, and under the facts peculiar to this case its decision turned upon the question as to the negligence or not of the motorman in causing or permitting him to do that. He did not fall from the platform nor jump off because the motorman lost sight of him, but claimed that he was caused to jump by the motorman. His own act in jumping was the proximate cause of his injury, and the question was solely as to the legal responsibility for that act—whether it was his or should be imputed to the company because of negligence on the part of the motorman in causing or permitting it. That was the question that should be submitted with proper instructions to enable the jury to determine it.

Again, the petition claimed that there was negligence in admitting the boy to the car at all. This complaint was apparently based upon the doctrine of the "turntable cases" and others in which liability was fixed upon the owners of dangerous machinery because of enticements or invitations made out to children to expose themselves to the dangers incurred in being in or about such places. But it seems to the court that doctrine is inapplicable to the mere act of allowing children to get upon cars fitted up and used for the conveyance of all classes of persons, young and old, experienced and inexperienced; and that actionable negligence must consist in something more—such as want of proper care in guarding the safety of those entering such vehicles, in getting on or off, or in traveling on them.

Moreover, the court thinks that an ordinance should have been admitted in evidence which provided that: "Any person, not being a regular employe or officer of the railway company who shall, within this city, jump on or off, cling to or hang on any street railway car while the same is in motion, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not less than two dollars nor more than one hundred dollars." The court says that the objection that there was no evidence or offer of evidence that the boy "had discretion sufficient to understand the nature and illegality of the act constituting the offense" was not urged in the trial court. Besides, he testified before the jury concerning the transaction on which he based his right to recover, and whether or not he had the requisite degree of intelligence was a question for the jury. Furthermore, the facts were in dispute, and the jury might have found that the boy got on and off the car without the consent of the motorman and as a trespasser. If this were true, the ordinance might not be necessary to the protection of the company, but it was still, the court thinks, entitled to have it admitted in evidence, and its effect explained to the jury. The court is further of an opinion that a plaintiff complaining of an injury caused or contributed to by his violation of a valid ordinance of this character should not be allowed to recover damages.

TRANSFERS REQUIRED BY STATUTE IN CASE OF LEASE BY ONE COMPANY TO ANOTHER—ONLY ONE PENALTY RECOVERABLE IN ONE ACTION.

Griffin vs. Interurban Street Railway Co. (N. Y.), 72 N. E. Rep. 513. Nov. 29, 1904.

The New York railroad law provides that any railroad corporation or any corporation owning or operating any railroad or railroad route within the state may contract with any other such corporation for the use of their respective roads or routes, or any part thereof. Section 104 reads: "Every such corporation entering into such contract shall carry or permit any other party thereto to carry between any two points on the railroads or portions thereof embraced in such contract any passenger desiring to make one continuous trip between such points for one single fare, not higher than the fare lawfully chargeable by either of such corporations for an adult passenger. Every such corporation shall upon demand, and without extra charge, give to each passenger paying one single fare a transfer, entitling such passenger to one continuous trip to any point or portion of any railroad embraced in such contract, to the end that the public convenience may be promoted by the operation of the railroads embraced in such contract substantially as a single railroad with a single rate of fare. For every refusal to comply with the requirements of this section the corporation so refusing shall forfeit fifty dollars to the aggrieved party. The provisions of this section shall only apply to railroads wholly within the limits of any one incorporated city or village." The court of appeals of New York holds that this section was intended by the legislature to apply to, and covers, the case of a lease by one railroad of the lines of another.

The court further says that it is quite obvious that the legislative intention to permit the recovery of cumulative penalties for refusals of the defendant to comply with the provisions of the railroad law in regard to the transfer of passengers is as clearly manifested as in any of the cases cited. Notwithstanding this fact, a majority of the court are of opinion that, while the rule for the recovery of cumulative penalties is firmly established by the earlier decisions of this court, yet the changed conditions in the modern life in our great cities render its modification imperative. There have been presented at the bar of this court civil and criminal cases where the aggregate penalties sought to be recovered have amounted to enormous and well-nigh appalling sums by reason of plaintiffs permitting a long period to elapse before beginning actions. Actions of this nature have become highly speculative, and present a phase of litigation that ought not to be encouraged. The court is of opinion that, if cumulative recoveries are to be permitted, the legislature should state its intention in so many words; that a more definite form of statement be substituted for the words hitherto deemed sufficient. The court says that it intends no reflection upon the plaintiffs in the cases here under consideration, but is dealing with a great abuse which demands immediate correction. A sound public policy requires that only one penalty should be recovered in a single action, and that the institution of an action for a penalty is to be regarded as a waiver of all previous penalties incurred.

Fine Type of Semi-Convertible Car for Lancaster & York Furnace.

The Lancaster & York Furnace Railway Co. has recently received from the J. G. Brill Co. a combination passenger and baggage car like the one shown in the engraving. The railway company operates a line connecting Lancaster and York Furnace, a distance of about 12 miles, through a populous country, and the car shown admirably

SEMI-CONVERTIBLE CAR FOR LANCASTER & YORK FURNACE.

meets the conditions. It is mounted on Brill No. 27-G trucks, which are particularly adapted to such service, and also has the builders' semi-convertible window system, which makes the car light and attractive in winter, and in summer, when the windows are raised into the roof pockets, gives an open appearance, as well as plenty of fresh air. The baggage compartment at the end in no wise detracts from the comfort of the passengers. Parks at York Furnace Station and Pequea are reached by the company's lines.

The general dimensions are as follows: Length over end panels, 29 ft.; over crown pieces and vestibules, 38 ft. 5 in.; panel over crown piece, 4 ft. 8½ in.; width over sills, 7 ft. 10½ in.; over posts at belt, 8 ft. 2 in.; sweep of posts, 1¾ in.; side sill size, 4¾ x 7¾ in.; end sill size, 5¼ x 6⅞ in.; sill plates, ⅜ x 12 in.; thickness of corner post, 3¾ in.; side post, 3¼ in.; length of seats, 36 in.; width of aisle, 22 in. The interior is finished in cherry, with ceilings of decorated birch. The trucks have a wheel base of 4 ft., wheel diameter of 33 in., and 4-in. axles. Brill angle iron bumpers, radial drawbars, ratchet brake handles, "Dedenda" gongs, "Retriever" conductors' bells, "Step-over" seats, armrests, and door controlling devices are included in the furnishings.

Third Rail Bonds on the Long Island R. R.

Some extremely interesting work is now being carried out by Westinghouse, Church, Kerr & Co., on the Long Island R. R. in connection with the change to electric motive power and among the novel and important features are the conductor rail, the bonds and the method of their application to the rail.

The rail is of special design, weighing 100 lb. per yd. and having a web 1½ in. thick. To bond this rail up to its full carrying capacity with modern compressed terminal bonds was quite a problem, inasmuch as the web was too thick a section in which to bore holes through and compress terminal studs. It was therefore necessary to put all bonding on the base of the rail.

The approximate electrical carrying capacity of this rail is equivalent to 1,500,000 c.m. copper, and to apply that amount of copper in two bonds was impracticable, as the size of terminal studs required for bonds of 750,000 c.m. section would be so large as to cut away practically all of the rail base. It was therefore decided to apply four bonds, one overlapping the other, on each edge of the rail base.

The inner, or short bond, is of 350,000 c.m. section with terminals ⅞ in. in diameter, 7 in. long between centers of terminals when straight, and formed to 5 in. The outer bond is of 400,000-c.m. section with terminals ⅞ in. in diameter, 12¼ in. long between centers of terminals when straight, and formed to 10 in.

The configuration of the body portion of the bonds is such as to make one fit into the other, allowing proper clearance between the [illegible] of the inner bond, as well as for any movement of the flexible body during expansion and contraction.

Both sizes of bonds are of the form known as the "Protected" rail bond type L-3, being made with special beveled heads conforming to the bevel or slope of the rail base, so that when the compressing tool is applied the bearing lines of the under part of the terminal block and the upper end of the terminal stud are parallel. give the compressing tool a firm bearing on the material and permit the compressing pressure to to be exerted directly parallel with the axis of the terminal stud.

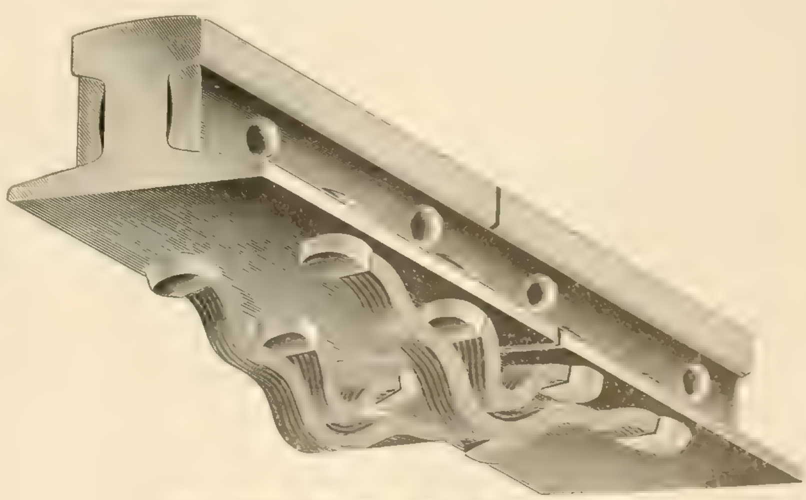
It was considered that drilling the holes for these bonds with any drilling apparatus now on the market would be a tedious and expensive operation, and accordingly there was designed and perfected hydraulic apparatus for doing this class of work. The hydraulic punch for cutting the bond holes is of 100 tons capacity, and is so constructed and adjusted as to balance itself on the rail at a right angle with the top surface of the rail base. This angle is usually 13 degrees with the horizontal. The ram and cutting punch of this tool are in the bottom, and in operation the punch starts to cut the hole upwardly from the under side of rail base and at right angle with the upper surface of the base. The female die bears against the top surface of the base, and is about ⅛ in. larger in diameter than the punch, giving a tapered hole, larger at the top.

After the holes are cut the bond studs are inserted from underneath and a 35-ton hydraulic compressor is used for expanding the terminal studs. These compressors are so arranged as to enable the operator to draw the bond up close to the under surface of the rail base, giving the shoulder or base of the terminal a proper contact with the rail. While held in this position the compressing ram, operating downwards, forces the copper terminal back into the hole against the taper. With the 35 tons exerted by this tool it is possible to compress the copper terminal to about 80 per cent of its original size. It is even possible to continue compressing after the copper is flush with the rail, and thereby stretch and swell out the edge of the rail proper; this is of course neither desirable nor necessary, and mention is made of it merely to show the power of this compressing tool. This enormous pressure is produced with only one of the operator's hands, applied to the pumping handle. It is claimed by the designers of these tools that one man with a boy helper can punch 20 holes per hour, or 200 holes per day, with the 100-ton tool, which is more than five times the number of holes that can be drilled by any hand drilling apparatus.

One man with a boy helper to insert the bonds in the punched holes can compress 300 terminals, or 150 bonds per day.

The rail bonds for this work, and the hydraulic apparatus, were designed and supplied by the Mayer & Englund Co., of Philadelphia.

During January the New York subway handled about 400,000 passengers daily.



RAIL SECTION AND BONDS FOR LONG ISLAND R. R.

Personal.

[illegible] Co., of Chicago, with his wife, is making a trip through Cuba.

MR. CLARENCE G. WHERRY has been appointed traffic manager of the Indian Territory Traction Co., with headquarters at South McAlester, I. T.

MR. JOHN H. FISHER has been appointed general manager of the San Bernardino Valley Traction Co., San Bernardino, Cal., vice Mr. A. C. Denman, jr., resigned.

MR. F. E. SMITH, auditor of the Chicago Union Traction Co., with his family, sailed from New Orleans, La., Saturday, February 11th, for a trip of three or four weeks in Cuba.

MR. CHARLES E. HOTT has been appointed master mechanic of the Columbus Railway & Light Co., Columbus, O. Mr. Hott entered the employ of the company in 1892 as a carpenter.

MR. GUY A. HAGAR has been appointed sales agent of the Weber Railway Joint Manufacturing Co., of New York, with headquarters in the Frisco Building, St. Louis, Mo., effective February 1st.

MR. A. L. DRUM, general manager of the Indiana Union Traction Co., Anderson, Ind., has resigned this position to become general manager of the Chicago & Milwaukee Electric Railroad Co., Chicago.

MR. RICHARD McCULLOCH, assistant general manager of the St. Louis Transit Co., delivered a lecture on "The Evolution of the Street Railway," in Memorial Hall, Washington University, January 31st.

MR. R. A. WHITE has resigned his position as engineer in the Birmingham, Ala., office of Ford, Bacon & Davis, to become engineer and assistant manager of the Mobile Light & Railroad Co., Mobile, Ala.

MR. W. E. MUSE, formerly connected with the general offices of the Heine Safety Boiler Co., St. Louis, Mo., has been appointed manager of the Boston office of this company, vice Mr. E. S. McGregory, resigned.

MR. T. W. SHELTON, electrical engineer of the Northern Ohio Traction & Light Co., has been appointed general superintendent of the Fort Wayne & Springfield Railway Co., with headquarters at Decatur, Ind.

MR. FRED L. LUCAS, general manager of the Bloomington, Pontiac & Joliet Electric Railway Co., Pontiac, Ill., called on the "Review" recently when in Chicago. Mr. Lucas stated that his road would be open for operation in February.

MR. CHARLES R. MORLEY, general manager of the Stark Electric Railroad Co., has left for a four months' trip through Egypt and up the Nile. Prior to his departure, the employes of the company made him a present of a very fine watch.

MR. A. S. RICHEY has been appointed chief engineer of the Indiana Union Traction Co., Anderson, Ind., and will henceforth have charge of the track and roadway, in addition to the duties of his old position, which was that of electrical engineer.

MR. G. G. ROSE, local agent of the Pennsylvania & Mahoning Valley Railway Co., at New Castle, has been appointed general freight and passenger agent of the company, with headquarters at Youngstown, O. He succeeds the late Mr. Fred Carpenter.

MR. T. DeG. BRABSTON has been appointed assistant freight traffic manager of the Birmingham Railway, Light & Power Co., of Birmingham, Ala., an office recently created. Mr. Brabston was promoted from the position of chief clerk to the superintendent of the railway department.

MR. HOWARD ELDRIDGE, auditor of the Indianapolis & Northwestern Traction Co. since it was opened to traffic, has resigned to accept a similar position with the Great Northern Power Co., at Duluth, Wis. He is succeeded at Lebanon by Mr. E. M. Boykin, of Philadelphia.

MR. ISAAC SMITH has been appointed chief engineer of the Cincinnati, Dayton & Toledo Traction Co., with headquarters at Trenton, O. Mr. Martin Schoenhalls has been appointed master mechanic of this company, with headquarters at Trenton, vice Mr. L. M. Sheldon, resigned.

MR. EDWIN HALLIDAY has resigned his position as superintendent of the Cairo Electric & Traction Co., Cairo, Ill., and the duties of that position will be divided between Mr. Wood Rittenhouse, chief engineer, and Mr. Edwin T. Aisthorpe, chief clerk to the general manager. Mr. Rittenhouse will have charge of car barns and electrical equipment, while operating matters will be looked after by Mr. Aisthorpe.

MR. WILLIAM R. KING, consulting engineer, formerly of 39 Cortlandt St., New York, has become associated with Sanderson & Porter, 52 William St., New York, January 16th, in the company's general practice as consulting engineers and contractors for the development of railway, light, hydraulic and power propositions.

MR. C. O. SIMPSON, secretary and auditor of the Birmingham Railway, Light & Power Co., has been retained as consulting auditor by the Meridian (Miss.) Light & Railway Co., and will open the books for that company in accordance with the Street Railway Accountant's standards, and advise concerning the accounting department.

MR. ROBERT T. GUNN has resigned as general superintendent of the Norfolk (Va.) Railway & Light Co. to become general manager of the Lexington Railway Co., Lexington, Ky., vice Mr. Thomas Fitzgerald, jr., resigned. Mr. Fitzgerald has been appointed assistant to the vice-president of the Cincinnati Traction Co., Cincinnati, O.

MR. CHARLES M. BLACK, chief engineer of the Metropolitan Street Railway Co., Kansas City, Mo., has been appointed general manager. He will retain the title of chief engineer, in which capacity he has served since Sept. 1, 1904. The title of general manager has heretofore been held by Mr. Bernard Corrigan, president of the company.

MR. GUY C. BARTON has been elected president of the Omaha & Council Bluffs Street Railway Co., to succeed the late Mr. Frank Murphy. Mr. Barton was first vice-president before his recent election and has been succeeded in that position by Mr. G. W. Wattles. Mr. M. F. Hopkins, of Columbus, O., was elected second vice-president.

MR. HENRY C. MORTIMER, JR., of the General Electric Inspection Co., has joined the New York office staff of the Crocker-Wheeler Co. He will assist Mr. F. B. DeGrass, manager of that office, and will succeed Mr. A. J. Thompson, who has accepted a position with the New York branch of the Bullock Electric Manufacturing Co.

MR. CHARLES MARK has resigned as master mechanic of the Pennsylvania & Mahoning Valley Railway Co., at Youngstown O., to become master mechanic of the Sheboygan Light, Power & Railway Co., Sheboygan, Wis. Prior to his service with the Pennsylvania & Mahoning Valley Railway Co., Mr. Mark held similar positions with the Aurora, Elgin & Chicago Railway Co., and the Albany & Hudson Railroad Co.

MR. EUGENE KLAPP, until recently division engineer of the New York Rapid Transit Commission, has been appointed consulting engineer of the Brooklyn Rapid Transit Co. Mr. Klapp is a native of Orange, N. Y., and a graduate of Columbia University School of Mines. In 1889 he was appointed chief engineer for the South Side Elevated Railroad Co., of Chicago, and in 1898 he was chosen captain of volunteer engineers in the Spanish-American War. After the war, he became manager of the National Constructing Co., of New Orleans.

MR. A. C. FROST, president of the Chicago & Milwaukee Electric Railroad Co., has been elected president of a new company formed to take over the property of the Alaska Central Railway Co., which is being built from Seward on Resurrection Bay northwardly to the head of navigation on the Tanana River, a distance of 463 miles. There is also a branch 30 miles long to the Matenuaka coal fields. The other officers of the company are: General manager and chief engineer, W. B. Poland, formerly connected with the Baltimore & Ohio; engineer of construction, J. B. Cameron; engineer of surveys, George A. Kyle; purchasing agent, Frank Brown; treasurer, F. H. Stewart. The general offices are at Seattle, Wash., and Seward, Alaska.

MR. R. W. KING has assumed charge as general manager of the Rapid Transit Co. of Chattanooga, Tenn., succeeding Mr. H. M. Littell. Mr. King was formerly at Chattanooga as superintendent of this company. Before going to Chattanooga Mr. King was superintendent of the Wilmington & New Castle Electric Railway Co., connecting Wilmington and New Castle, Del., in which capacity he served four years, becoming superintendent of the Rapid Transit Co. at Chattanooga in 1901. A year later he resigned this position and until he returned to Chattanooga as manager was engaged in

electric light work. The Rapid Transit Co. has termini at Ninth and Market Sts. and at Broad and Ninth Sts., in Chattanooga, and operates lines to all the suburban towns, a line to Chickamauga Park and two inclines up Lookout Mountain, one to the Lookout Inn and the other to the Point Hotel, and also an electric railway on top of Lookout Mountain.

MR. ARTHUR L. LINN, JR., has been appointed general manager of the Fairmont & Clarksburg Traction Co., of Fairmont, W. Va., having resigned his position as assistant secretary and treasurer of the Utica & Mohawk Valley Railway Co. Mr. Linn has been assistant secretary and treasurer at Utica for about four years, having gone there at the time the Utica & Mohawk Valley property was taken over by a syndicate headed by Mr. John J. Stanley and Mr. Horace E. Andrews. Mr. Linn has been associated with Mr. Stanley for some 12 years, holding a responsible position with the Cleveland Electric Railway Co. prior to his appointment at Utica. There are some 50 coal mines in the territory covered by the trolley system in the south with which he became associated on February 1st and he takes the position at a time when the development of the surrounding country is going on rapidly, plans now being under consideration for the extension of the Fairmont & Clarksburg line 20 miles.

MR. W. ELWELL GOLDSBOROUGH, director of the school of electrical engineering, Purdue University, and for the past three years chief of the Department of Electricity at the Louisiana Purchase Exposition, has lately become associated with J. G. White & Co., of New York City. Mr. Goldsborough was graduated from Cornell University with the mechanical engineering class in 1892, and during the succeeding ten years held positions with the Colliery Engineering Co., Arkansas University, and Purdue University, at which latter school he was assistant professor and later professor of electrical engineering and director of the electrical laboratory. In connection with his other work, Mr. Goldsborough has carried on several series of exhaustive power station and complete electrical railway tests, which have been the basis of reports read before the American Institute of Electrical Engineers. He is a member of many technical and scientific societies, both in this country and abroad, and has the distinction of having been decorated by the King of Italy with the Order of Knight of the Crown.

MR. W. N. STEVENS, who has for some time filled the position of assistant mechanical engineer of the Rapid Transit Subway Construction Co., has accepted a position with J. G. White & Co., New York City. Mr. Stevens has had a wide experience as a constructing engineer in the designing and active construction of important power plants. He had much to do with the design and construction of the 12th St. power house of New York Edison Co. He also has had charge of the design and construction of the mechanical equipment of the 74th St. power house, and has lately been engaged on the work of designing and building the 59th St. power house, nine transformer stations, car barns, shops, and other adjuncts to the construction and equipment of the Rapid Transit system in New York City. During his professional career, Mr. Stevens has also been engaged in engineering undertakings in other parts of this country and abroad, he having made both the preliminary and afterwards the final plans for the machinery of the power house for the tramways of Sydney, Australia. J. G. White & Co. are to be congratulated in having secured the able services of Mr. Stevens in their mechanical engineering department.

MR. J. M. YOUNT has resigned as superintendent of rolling stock for the Public Service Corporation of New Jersey and has become affiliated with James H. Fogarty, of New York City, in the handling of street railway specialties, among which is Mr. Fogarty's detachable rim gear. Mr. Yount was graduated from Purdue University in 1896; he then worked two and a half years in the shops and power house of the Citizens' Street Railway Co., of Indianapolis, Ind. From there he went to the Metropolitan Street Railway Co., New York City, being employed in the construction of the 25th St. power house. In May, 1899, he began work with the New Jersey Street Railway Co., at Newark, N. J., as foreman of the armature room, from which position he rose to that of assistant master mechanic, and in January, 1901, he was appointed master mechanic of the Jersey City, Hoboken & Paterson Street Ry., at West Hoboken, N. J. In July, 1901, Mr. Yount again took up his work with the North Jersey Street Railway Co., at Newark, N. J., as master mechanic, which position he held until the Public Service Corporation [illegible] superintendent [illegible]

Obituary.

MR. EDWARD [illegible] day evening, January 25th, at his home, in Milburn, N. J. Mr. Mullin was born in Castlederg, County Tyrone, Ireland, Oct. 22, 1859. He was educated in Belfast where, in 1881, he was given a bachelor's degree with honors in physics and chemistry. For the [illegible]

EDWARD H. MULLIN

work in New York City until Feb. 1, 1898, when he entered the service of the General Electric Co., at first as manager of its advertising department and later as confidential representative of the company. He was a member of many secret, social and engineering societies. He was a consistent student, and as a writer was distinguished for clarity of style and Anglo-Saxon simplicity of diction, which made his essays on technical subjects very easy reading.

New Generators at Hamilton, Ontario.

The Hamilton Cataract Power, Light & Traction Co. of Hamilton, Ont., has recently started the two 500-kw. Westinghouse generators in its De Cew Falls power station. Power is supplied from Welland Canal feeders, tapped in about 14 miles above the power station, and at the station the water has a head of 267 feet. The Westinghouse generators are of the two-bearing type, direct connected to Escher-Wyss water-wheels, and run at a speed of 286 r. p. m. They generate 3-phase current at a frequency of 66 cycles and a pressure of 2,400 volts. The power is transmitted to the city of Hamilton where it is used for lighting, street railway and manufacturing purposes. A reserve steam-driven station is located at Hamilton, which contains two 1,000-kw. Westinghouse generators. The entire station and high tension apparatus are of Westinghouse design. The company has two separate three-phase transmission lines to Hamilton, a distance of about 35 miles. The high tension apparatus is designed for a pressure of 40,000 volts, but will be operated for a time at 20,000 volts. Mr. Wm. C. Hawkins is general manager of the Hamilton company, and is also engineer in charge of the installation.

It is reported that surveys have been made and construction stakes set for the purpose of reducing the curvature of the Fort Wayne & Wabash Valley line between Logansport and Fort Wayne. When this work is completed this company intends to put on limited cars which will make the run between these two cities in 3 hours and local service which will run in 3 hours and 20 minutes.

Annual Report of the Massachusetts Board of Railroad Commissioners.

The following data concerning street railways from the 36th annual report of the Massachusetts Railroad Commissioners for the year ending Sept. 20, 1904, wili be of interest:

Reports were received from 102 street railway companies operating within the state, together with reports from 2 roads operating in New Hampshire and 1 in Connecticut, the latter being owned in Massachuetts. Two new companies were organized under the general law and one under the special law. Ten were dropped from the list by reason of consolidation with other companies; one road was abandoned during construction and one road was sold under foreclosure. By reason of consolidation there were at the end of the fiscal year 97 existing companies; 66 of these operate their railways; five railways were operated by receivers; 19 were operated under lease or contract by other companies and in four instances by foreign companies; one was in process of construction; and five companies had organized and paid in a portion of their capital stock but had not yet commenced construction.

Street Railway Mileage Owned, 1903 and 1904.

MILEAGE OWNED.	1903.	1904.	Increase.
	Miles.	Miles.	Miles.
Length of railway line	2,158.973	2,191.812	32.839
Length of second track	363.937	382.840	18.903
Total length of main track	2,522.910	2,574.652	51.742
Length of side track	147.822	149.660	1.838
Total, reckoned as single track, .	2,670.732	2,724.312	53.580

During the last year there have been added to the mileage of the Massachusetts companies 32.839 miles of street railway line, 18.903 miles of second track and 1.838 miles of side track, making a total addition of 53.580 miles of track reckoned as single track. The total miles of main track (including trackage rights) operated is 2654.479, an increase of 33.517 over the previous year. There are now owned by the Massachusetts companies 2191.812 miles of street railway lines, 382.840 miles of second track and 149.660 miles of side track, making a total length of track owned 2724.312 miles. This statement excludes subway track. All the street railway mileage owned is located in Massachusetts with the exception of 19.526 miles of track in Rhode Island. All the track owned is surface street railway track with the exception of 13.112 miles of the Boston Elevated railway. Of the sidings all are surface with the exception of 2.903 miles of elevated track. All of the elevated track is confined to Boston. There are operated by the Massachusetts companies 52.591 miles of track located outside of the state.

Gross Assets, September 30, 1903 and 1904.

ASSETS.	1903.	1904.	Increase
Construction, .	$65,632,216	$69,581,366	$3,949,150
Equipment, .	25,214,728	26,201,913	987,185
Land and buildings, ...	30,415,216	32,296,112	1,880,896
Other permanent property, .	1,237,951	1,446,944	208,993
Cash and current assets, .	10,455,046	6,554,738	3,900,308*
Miscellaneous assets, .	5,909,058	4,762,667	1,146,391*
Gross assets, ...	$138,864,215	$140,843,740	$1,979,525

* Decrease.

Capital Stock, Net Income and Dividends, 1895–1904.

YEARS	Capital Stock.	Net Divisible Income.	Dividends Declared.	Percentage on Total Capital Stock.
1895, ...	$27,906,685	$2,257,355	$1,606,196	5.76
1896, . .	30,727,818	2,280,776	1,802,847	5.87
1897, . . .	32,670,273	2,593,147	1,965,243	6.02
1898, .	38,933,917	2,534,002	2,076,233	5.33
1899, ...	41,380,143	2,502,942	2,318,398	5.60
1900, ...	48,971,168	3,037,502	2,409,874	4.92
1901, ...	54,069,933	3,398,183	3,417,117	6.32
1902, . .	60,036,328	3,388,851	3,138,711	5.23
1903, ...	68,404,480	3,602,917	3,586,248	5.24
1904, ...	68,542,038	2,998,114	3,214,496	4.69

The report shows that the gross assets of the companies Sept. 30, 1904, were $140,843,739.79, and the gross liabilities at the same date, including capital stock, were $136,049,485.24. While in the past year there was an increase in the gross liabilities of $2,928,075, there was an increase in the gross assets of only $1,979,525, thus reducing the aggregate surplus of the companies by the amount of $948,550. The aggregate funded debt of the companies Sept. 30, 1904, was $46,674,884, an increase of $5,263,384 over the preceding year.

The total amount of capital stock of the 97 companies, Sept. 30, 1904, was $68,542,037.50, a net increase of $137,558 over the preceding year. The total amount of dividends declared during the year was $3,214,496.24, a decrease of $371,752 of the preceding year.

Cost and Capital Investment per Mile of Main Track, 1895–1904.

YEARS	Construction.	Equipment.	Other Permanent Property.*	Total Cost per Mile.	Capital Investment per Mile †
1895, . . .	$23,984	$10,479	$14,266	$48,729	$49,120
1896, . . .	23,396	9,805	12,840	46,041	46,373
1897, . . .	22,755	9,374	12,329	44,458	44,683
1898, . . .	22,537	8,957	11,735	43,229	44,958
1899, . . .	22,863	8,518	11,598	42,979	45,040
1900, . . .	23,443	8,510	11,684	43,637	44,273
1901, . . .	23,953	8,678	11,666	44,297	45,757
1902, . . .	24,495	9,026	11,889	45,410	46,261
1903, . . .	26,015	9,994	12,546	48,555	48,621
1904, . . .	27,025	10,177	13,106	50,308	50,295

* Chiefly lands, buildings and power plants. † Outstanding capital stock and net debt.

Thirty-eight out of the 102 companies paid dividends ranging from 1 to 11 per cent and 64 companies paid or declared no dividends.

The average cost of street railways of the state per mile of main track (including the cost but not the length of side track) at date of report was $27,025.14 for construction; $10,176.73 for equipment; and $13,105.68 for lands, buildings (including power plants), and other permanent property, making a total average cost of $50,307.55 per mile of main track.

The total income of the Massachusetts companies from all sources for the year ending Sept. 30, 1904, was $27,759,334.51 and the total expenditures including dividends were $27,975,717.19, making a net loss of $216,382.68 to be deducted from the surplus of previous years. The total number of passengers carried by the 102 railway companies which made returns to the board for the last year was 520,056,511, an increase of 15,394,268 passengers over the previous year. The total car-mileage was 107,897,456, an increase of 390,644 over the previous year.

Volume of Traffic for Ten Years, 1895–1904.

YEARS.	Total Passengers Carried.	Average Number per Mile of Main Track Operated.	Total Car Miles Run.
1895, ...	259,794,308	238,963	43,655,560
1896, ...	292,358,943	226,452	53,613,685
1897, ...	308,684,224	212,403	61,577,917
1898, ...	330,889,629	207,982	68,206,418
1899, ...	356,724,213	205,098	73,367,235
1900, ...	395,027,198	200,262	81,750,768
1901, ...	433,526,935	195,683	93,005,225
1902, ...	465,474,382	188,787	100,280,687
1903, ...	504,662,243	192,548	107,506,812
1904, ...	520,056,511	195,917	107,897,456

During the year ending Sept. 30, 1904, the Massachusetts companies reported that the whole number of persons injured in connection with street railway operation was 5,078, of whom 92 received fatal injuries and 4,986 injuries not fatal. The number of passengers injured was 3,372, of whom 21 were injured fatally.

There were 161 employes injured, 5 fatally. The number of travelers injured on the street was 1,542, of which 66 were fatal.

There are now 415 bridge spans classified as street railway bridges by the state bridge engineer. This includes all bridges which either have been built or are maintained in whole or in part by street railway companies, and for which they are therefore in some degree

responsible. These may be classified as follows: Forty-two pile bridge, 28 wooden trestles, 10 steel trestles, 40 wooden stringers, 4 braced or trussed wooden stringers, 4 wooden trusses, 6 stone or brick arches, 106 I-beams, 83 plate girders, 76 riveted trusses, 12 pin connected trusses and 4 movable bridges.

The report states that the returns of the year are suggestive: Of 74 operating companies, 30 failed to earn expenses and fixed charges; 25 paid dividends; and but 14 of these paying dividends earned them during the year. Five companies have been in the hands of the receivers. In explaining the cause for the financial results shown in the report, the commissioners state that many of the roads have been "over built" and that experience has shown that with the more expensive roadbed and equipment, the heavier rail and larger cars, there has not been the corresponding and expected development of permanent business. Operating cost, too, in

Percentage of Operating Expenses to Gross Earnings, 1895–1904.

YEARS.	Gross Earnings from Operation.	Operating Expenses.	Percentage of Expenses to Earnings.	Net Earnings.
1895,	$13,184,342	$9,088,086	68.93	$4,096,256
1896,	11,844,262	10,563,371	71.16	4,280,891
1897,	15,815,267	[illegible]	68.95	4,911,227
1898,	16,915,405	11,672,731	69.01	5,242,674
1899,	18,151,550	12,378,488	68.20	5,773,062
1900,	19,999,640	13,159,947	65.80	[illegible]
1901,	21,766,340	14,565,141	66.92	7,201,199
1902,	23,486,474	15,912,852	67.75	7,573,622
1903,	25,540,811	17,519,367	68.59	8,021,444
1904,	26,207,247	18,397,291	70.20	7,809,956

heating cars and in repair and renewal of plant, has proved larger than was expected. With the new accommodation and the nearer approach to railroad conditions has come the increased demand of the public for expenditures in the interest of safety and comfort which had not been counted upon, as for example, in construction of double tracks, installment of signal systems and establishment of waiting rooms. Hurried along by the natural enthusiasm for the new type of railway with its many most attractive features, capital, sometimes deliberately misled, has been invested in undertakings for which there was no sufficient demand and which are now rep-

Gross and Net Earnings from Operation per Mile of Main Track Owned, 1895–1904.

YEARS.	Average per Mile of Track Owned. Gross Earnings.	Expenses of Operation.	Net Earnings.
1895,	$12,127	$8,359	$3,768
1896,	11,627	8,274	[illegible]
1897,	11,187	7,713	3,474
1898,	10,998	7,589	3,409
1899,	10,459	7,132	3,327
1900,	10,452	6,878	3,574
1901,	9,998	6,690	3,308
1902,	9,609	6,510	3,099
1903,	10,124	6,944	3,180
1904,	10,178	7,145	3,033

resented by roads run, not only without return upon the investment, but at an actual loss of capital. In each case the future promises as possible events: the acceptance of an unsatisfactory service as better than nothing; an increase in fares; or the abandonment of the railway. It is a source of gratification that under our restrictive laws, while capital has taken its own risk as to the earning capacity of these enterprises, in no case has there been an issue of stock or bonds in excess of the fair cost of the railway property, to act as a contributing factor to the existing troubles.

Another incident of the present situation, is stated, has been the enforcement upon certain systems of a seemingly arbitrary distinction between the long and short distance ride. The zone system of rating fares has never been in favor in Massachusetts. The report states that confusion exists in some of the street railway laws in consequence of legislation at different times to accomplish specific purposes under new conditions without regard to harmony in the whole body of the law. Illustrations are given and a recommendation made that such statutes be revised upon some simple principle which would preserve original jurisdiction in local boards of aldermen or selectmen and give supervisory power to the board of railroad commissioners as the public good might require.

[illegible]

YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1895,	30.20	20.82	9.38	5.07	[illegible]	[illegible]
1896,	27.69	[illegible]	[illegible]	[illegible]	[illegible]	1.47
1897,	25.68	[illegible]	[illegible]	5.12	[illegible]	[illegible]
1898,	[illegible]	17.11	7.69	[illegible]	3.52	[illegible]
1899,	24.74	16.87	[illegible]	[illegible]	[illegible]	1.62
1900,	24.46	16.10	[illegible]	[illegible]	3.33	1.73
1901,	[illegible]	15.66	7.74	5.02	3.36	1.66
1902,	23.42	[illegible]	7.55	5.05	[illegible]	1.63
1903,	[illegible]	[illegible]	7.46	5.06	3.47	[illegible]
1904,	[illegible]	17.05	[illegible]	5.04	[illegible]	[illegible]

The commissioners review the subject of the absorption of electric railways by steam railroads as follows: "A prominent feature in the recent history of steam railroads has been the growth of a policy favoring the purchase of street railway properties. Whatever may be urged against this policy, it may be said in its favor that it brings into the conduct of street railway affairs the judg-

Employees and Equipment, 1895–1904.

YEARS.	Employees	Cars	[illegible]	[illegible]
1895,	8,048	[illegible]	1,755	[illegible]
1896,	9,130	4,913	[illegible]	5,958
1897,	9,716	[illegible]	[illegible]	[illegible]
1898,	10,416	[illegible]	[illegible]	[illegible]
1899,	11,944	6,042	2,076	[illegible]
1900,	12,766	6,531	2,371	9,545
1901,	14,740	[illegible]	2,488	11,284
1902,	15,292	7,144	2,577	[illegible]
1903,	15,823	7,403	[illegible]	13,611
1904,	16,519	7,383	2,728	[illegible]

ment and knowledge which come from long experience in dealing with transportation problems and as well greater financial strength and larger resources.

"The usefulness of the street railway in bringing people to the steam railroad from the different sections of the cities and towns which it serves and in distributing them again at the end of the railroad journey will be generally recognized. Even where these railways have been interurban in character and to some extent competitors of the railroads, we doubt if the passing of control into the hands of their rivals need be attended by detriment to the public interests. The competition between the steam railroad and

[illegible]

KILLED AND INJURED	[illegible]		[illegible]		[illegible]	
	1903.	1904.	1903.	1904.	1903.	1904.
Passengers,	16	[illegible]	2,552	[illegible]	2,568	3,372
Employees,	[illegible]	[illegible]	[illegible]	[illegible]	161	161
Other persons,	[illegible]	66	1,186	1,479	1,245	1,545
Totals,	[illegible]	[illegible]	3,890	[illegible]	[illegible]	[illegible]

the street railway must eventually end in each system giving to the public the service which it is best capable of performing, and it is by no means clear that in order to bring this about in the wisest way it is at all essential that the competitive conflict between these companies be prolonged. The two systems ought to work together advantageously under one administration, subject, as they would be, to the supervision enforced under our statutes, changes in service upon one or the other being made only in furtherance of a greater comfort and convenience in travel."

Selling Car Advertising Space.

An electric railway company which contemplates the sale of advertising space in its cars is confronted by three alternative propositions:

1. It may place the matter in charge of an individual in its own employ.

2. It may lease the space to a local advertising man.

3. It may lease the space to a general agent controlling advertising space throughout a large territory.

Past experience has shown rather conclusively that an individual in the direct employ of a traction company is able to secure only local advertising for the car spaces and is so far removed from the general national advertisers, that he is seldom able to get into proper touch with them. Experience has also shown that the presence of national advertisers in the street cars is one of the strongest advantages in assisting the local solicitor in securing contracts from local firms.

The conditions which confront the solicitor in the direct employ of the traction company, confront also the local man who may pay the traction company a flat sum for the control of its street car advertising space. Many companies or individuals whose space control is confined to a limited territory have struggled hard for a short period, but, lacking the assistance of national advertisers, have failed to secure the necessary local advertising to make the space pay, and many traction companies have lost money through the failure of these local lessees of space.

In letting their advertisng space the great majority of traction companies have found it to their advantage to deal with a reliable concern with control of the car advertising privileges throughout a large territory. Some of these who control widely distributed space, have again found it advisable to place their out of town advertising business in the hands of an individual who is thoroughly in touch with national advertisers throughout the country. They have made an arrangement by which local advertising in the towns under their control is handled by their own solicitors, while the accounts of national advertisers whose showings in the cars are of valuable assistance to the solicitor of local advertising, are put in the hands of a firm or individual who is in a position to be thoroughly in touch with them.

An interesting outgrowth of this condition has been the business of Barron G. Collier, who directly controls the car advertising leases in the Southern towns from Baltimore and Washington to San Antonio, Texas, and as a broker, represents the national advertising privileges in some 350 towns.

The advantages of securing the aid of experienced men in this line appear in the saving of bother in arranging details,as well as in the general financial results.

Tape for Electrical Usage.

Any friction tape which will withstand the test of use in the electrical field must be good material, some of the important qualities are: The rolls must be so constructed that they will unwind smoothly and thus help toward making a neat, close-fitting joint. The tape must have exceptional adhesive qualities so that, when the lap is but small, a firm joint will still be made. The composition with which the tape is covered must be able to stand extreme heat for long periods and yet retain its stickiness, not drying out easily. The insulation resistance must be comparatively high and should be uniform throughout all the tape, so that when the necessary number of wraps is once determined, this number will always suffice for the required insulation. In order that this last may be accomplished there must be an uncommonly high percentage of insulation composition withheld among the fibers of the tape.

The Morgan & Wright Co., of Chicago, has been manufacturing tape since the early days, when rubber tires were first used, and therefore has had a long experience in the methods which are necessary to give a tape desirable characteristics.

The brands of tape made by this company are offered to the trade as of uniform excellence, and so particularly adapted to electrical usage that the company has a steadily increasing business among the largest and most exacting tape users in the country. A neat folder, containing 6-in. samples of the "Perfection" and the "X" brands of tape, together with a number of testimonials regarding this material, may be had by addressing the manufacturer at any one of the district offices.

Only One Grand Prize to Air Compressors.

The value of the Louisiana Purchase Exposition in the promotion of commerce and manufactures is illustrated, in one instance, by the fact that the two large compressors in Machinery Hall, which furnished all compressed air used at the Exposition, were both sold before the closing day. The larger one goes to Shaft No. 3 of the Doe Run Lead Co., at Central, Mo., and the smaller one to the city of Columbia, Mo., for the air-lift water supply system. The first machine received the only grand prize awarded at the Exposition for air compressors. It has a capacity of 1,300 cu. ft. of free air per minute when running at 125 revolutions, and is distinguished by several novel features, the most important of which is the Cincinnati valve gear. By this the opening and closing of the admission and the closing of the exhaust are controlled mechanically, while the opening of the exhaust is determined by poppet valves, thus permitting high speed without throttling of the air and wear and rattling of the valves. The smaller machine is fitted with mechanically-moved inlet valves and is rated at a displacement of 500 cu. ft. per minute. Its good workmanship and perfect operation at the Exposition so much impressed the officials of the city of Columbia that they countermanded an order on another manufacturer in order to take this compressor. The machines were built by the Laidlaw-Dunn-Gordon Co., of 114 Liberty St., New York City.

Exhibit of the Goldschmidt Thermit Co. at Washington.

The United States Government has recently requested the Goldschmidt Thermit Co. to present its exhibit, which received a grand prize at the Louisiana Purchase Exposition, to the National Museum at Washington, D. C., with which request the company has complied, and the entire exhibit will be advantageously arranged and placed in the museum.

The collection gives a complete picture of various applications of alumino-thermics and consists of: Large and bulky pieces of pure, rare metal, free from carbon, such as chromium, manganese, molybdenum, ferro-vanadium, ferro-titanium and others; diagrams and models showing the numerous applications developed by Dr. Hans Goldschmidt, of his process of utilizing the heat of "Thermit;" numerous pieces of welded girder rails, showing the very successful operations performed by this process in joining and fusing iron and steel, and models and specimens of the appliances used.

The Goldschmidt Thermit Co. gives from this collection with considerable regret, but felt that the fact that the embodiment of the progress made in a few years in the alumino-thermic science would find a permanent home in the National Museum warranted it in making the sacrifice.

Lengthening the Life of Motor Brushes.

The Hiko Co., Allenhurst, N. J., has placed upon the market a full line of carbon brushes, treated with its well known "Hiko" compound, which for some time has enjoyed a large sale among leading foreign electrical firms.

On account of the difficulty in reaching the commutators of enclosed street railway motors, the manufacturers of "Hiko" treat carbon brushes suitable for all classes of motors, and furnish them direct to the trade. It is claimed that brushes which have been treated with "Hiko" greatly reduce the commutator friction, insure better contact, and have double the life of the untreated brushes. In a recent test made by an eastern road to determine the life of treated and untreated brushes, one motor on a car was fitted with brushes without the treatment, while the other motor used brushes which had been treated with the compound. It was found necessary to replace the untreated brushes after the car had run 5,300 miles, but the treated brushes were left on until the car had traveled 9,830 miles. The manufacturer states that the treated brushes would easily have stood 10,000 more miles of service.

Report of the Connecticut Railroads.

The fifty second annual report of the Board of Railroad Commissioners of Connecticut, containing the reports of the operation of the steam railroad and street railway companies for the year ending June 30, 1904, has just been issued in book form as a state public document No. 12. The report consists of 360 pages, together with an appendix of 110 pages, which is a reprint of the laws relating especially to railroads. Maps of the steam and electric railways in Connecticut are included in the report. In the sections of this book devoted to street railways, the organization of the Consolidated Railway Co. is first considered. Next are described the different railways and extensions, the construction of which the commission has approved during the last year.

There were in Connecticut at the date of this report 560.247 miles of first main track; 109.087 miles of second main track, making the total length of main tracks 669.334 miles; length of sidings and turnouts, 31.512 miles; total computed as single track, 700.855 miles.

In introducing the financial reports of the Connecticut railway companies the commissioners say that because so many of the companies are chartered to operate gas, electric light, power and water plants, in connection with their railways, and because the stocks and bonds of these companies are issued upon the property as a whole, that there is great difficulty in determining what portion of the expense should be chargeable to operation of the street railway, and what to the other parts of the property. This combination of purposes in one corporation plays havoc with the average street railway statistics, but it was made to appear to the General Assembly that the public interests would be better and more economically subserved by permitting it to be done.

The total capital stock of the street railway companies outstanding is $30,659,748, representing 631.825 miles of street railway owned; also, in some instances, gas and electric properties. If this stock was all considered as applicable to street railways, it would show the average stock per mile to be $48,525. The total bonded debt of the same companies is $22,207,342. This shows an issue of $34,609.58 per mile. As a matter of fact, the bonds cover only 610.620 miles of the roads owned which shows an average bonded indebtedness of $36,680.43 per mile on the roads so covered. The floating indebtedness of the companies is $2,540,189.30, and the total stock, bonds and floating indebtedness is $55,407,279.57. The cost of construction and equipment reported is $55,570,086.57, which includes the cost of street railways, gas and electric light properties.

When reduced to the basis of cost per mile for a street railway this amount varies between $15,000 and $165,000 per mile. The gross earnings for the past year were $4,924,151.46, being $420,580.17 more than the preceding year. The gross earnings per mile of road operated were $7,187.20, and per car-mile run 21.64 cents. The number of miles operated was 685.128. The gross earnings per car-hour were $3.23. The New London Street Railway Co. reported the largest gross earnings per mile operated, which were $10,819.24. The operating expenses of the Connecticut roads for the year were $3,287,113.55, being an increase of $122,514.48 over the previous year, which is $4,797.81 per mile operated and $0.1445 per mile run. The operating expenses were 66.75 per cent of the gross earnings.

The net earnings for the year were $1,637,037.91, as compared with $1,338,972.22 for the preceding year, and were $2,389.39 per mile of road operated and 7.19 cents per car-mile run. Eight roads paid $120,050 in dividends upon capital stock amounting to $1,900,000, while no dividends were reported as paid on $28,759,748 of capital stock. This is $249,766.24 less than the amount paid last year, which is principally due to the fact that no dividends were paid by one road whose dividends last year amounted to $245,486. The sum of $876,659 in interest was paid on a total bonded and floating indebtedness amounting to $24,747,531.57. The amount of taxes paid to the state by the various companies was $260,046.07.

The number of car-miles run as reported was 22,750,560, which is 1,720,671 more than last year.

The number of fare passengers carried was 93,111,402, which is a decrease of 3,746,380, as compared with the year before. The number of fare passengers per mile run was 4.09, or a total of 135,903 fare passengers per mile of track operated. The number of employes was 3,297, averaging about 4.8 per mile of road operated.

The number of persons injured in the operation of the Connecticut street railways during the past year was 383, compared with 370 for the previous year, of which number 23 were killed, four more than last year. The number of passengers injured was 212, of which number 4 were killed; the number of employees injured 20, of which number 2 were killed and the number of other persons injured 151, of which number 17 were killed.

Summary of [illegible]

	[illegible]	1904	[illegible]
Capital stock outstanding	[illegible]	[illegible]	[illegible]
Bonds outstanding	[illegible]	[illegible]	[illegible]
Floating indebtedness	[illegible]	[illegible]	*173,841.62
Cost of construction and equipment...	[illegible]	[illegible]	[illegible]
Gross earnings	[illegible]	[illegible]	[illegible]
Operating expenses	[illegible]	[illegible]	122,514.48
Net earnings	[illegible]	1,637,037.91	[illegible]
Dividends	[illegible]	[illegible]	[illegible]
Interest paid	[illegible]	[illegible]	[illegible]
Taxes paid State	[illegible]	[illegible]	[illegible]
	[illegible]	Miles.	[illegible]
Length of road exclusive of sidings	[illegible]	[illegible]	[illegible]
Length of road including sidings	[illegible]	[illegible]	[illegible]
Miles run	[illegible]	[illegible]	1,720,671
Fare passengers carried	[illegible]	93,111,402	*3,746,380
Number of employees	3,403	[illegible]	[illegible]
Number of persons injured fatally	[illegible]	2	4
Number of persons injured, not fatally	[illegible]	[illegible]	[illegible]

*Decrease.

Very complete statistics are given in this report, showing the finances, costs of construction and equipment, operating expenses, taxes, interest and dividends paid, mileage owned and passengers carried throughout the year, a summary of these statistics being given herewith. There are 200 pages of this report used in the detail exhibits of the financial conditions and results of operation of each of the Connecticut street railways.

The report concludes with a reprint of the Connecticut statutes relating especially to railroads, and is signed by Washington F. Wilcox (chairman), Wm. O. Seymour and Orsamus R. Fyler, Railroad Commissioners.

Windsor & Tecumseh Electric Railway Co.

The Windsor & Tecumseh Electric Railway Co., which was incorporated by a special act of the legislature of Ontario, March 17, 1904, has recently taken over the interest of the Ontario Traction Co., Ltd., which was organized in the fall of 1903. The new line will be operated from the post office in Windsor to and through Walkerville, Sandwick and Tecumseh, a distance of 10 miles, with a line to the factory district of Walkerville. The construction of the road has been commenced and 5 of the 10 miles are now ready for ties and steel. Except within the cities where the company has secured franchises in the street, the right of way is private and 40 ft. wide for nearly the entire length of the line. The general offices of the company are at Walkerville, Ont., in the Canadian Bank of Commerce Building. The officers of the company are: President, C. M. Walker; vice-president and general manager, Willis F. Brown; secretary, J. H. Coburn; treasurer, E. F. Ladore. Mr. Willis F. Brown, who was one of the original incorporators and directors of the company, and was appointed general manager and chief engineer at the time of its organization, is a man of considerable ability and to him is due a large part of the success the company has met with. Since 1879 he has been connected with the Clover Leaf Route as division engineer; assistant engineer of the Wheeling & Lake Erie Bridge Co., of Toledo; assistant engineer of the Toledo Belt Ry.; chief engineer of the Cleveland, Delphos & St. Louis Ry.; assistant engineer of the L. S. & M. S. Ry.; assistant chief engineer of the C. H. & D. Ry., and twice elected city engineer of Toledo, O. Since his retirement as city engineer in 1901, he has been connected with various traction interests, among which are the Cincinnati, Toledo & Detroit Short Line, the Toledo, Bay Shore & Michigan Ry. and the Georgia Traction Co.

Arrangements are being completed for a through freight service over the lines of the Cleveland, Painesville & Eastern and the Cleveland, Painesville & Ashtabula traction lines between Cleveland and Ashtabula. The companies will each operate freight cars and will run them through over the lines of the other company.

Directory of Street Railway Associations.

AMERICAN STREET RAILWAY ASSOCIATION.

President, W. Caryl Ely, president International Railway Co., Buffalo, N. Y. First Vice-President, Elwin C. Foster, president New Orleans Railways Co., New Orleans, La. Second Vice-President, John I. Beggs, president and general manager The Milwaukee Electric Railway & Light Co., Milwaukee, Wis. Third Vice-President, Richard McCulloch, assistant general manager, St. Louis Transit Co., St. Louis, Mo. Secretary and Treasurer, T. C. Penington, treasurer Chicago City Railway Co., Chicago, Ill. Executive Committee: The President, the Vice-Presidents, W. G. Ross, president Street Railway Accountants' Association; C. F. Baker, president American Railway Mechanical and Electrical Association, ex officio, and John J. Stanley, general manager Cleveland Electric Railway Co., Cleveland, Ohio; Howard F. Grant, manager Seattle Electric Co., Seattle, Wash.; C. G. Goodrich, vice-president Twin City Rapid Transit Co., Minneapolis, Minn.; Frank G. Jones, vice-president and general manager Memphis Street Railway Co., Memphis, Tenn.; W. E. Harrington, general superintendent Public Service Corporation of New Jersey, Camden, N. J.

Next meeting, Philadelphia, Pa., week of Sept. 25, 1905.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION

President, W. G. Ross, managing director Montreal Street Railway Co., Montreal, Quebec. First Vice-President, Frank R. Henry, auditor St. Louis Transit Co., St. Louis, Mo. Second Vice-President, Isaac McQuilkin, comptroller Indiana Union Traction Co., Anderson, Ind. Third Vice-President, J. W. Lester, treasurer Worcester Consolidated Street Railway Co., Worcester, Mass. Secretary and Treasurer, Elmer M. White, cashier Hartford Street Railway Co., Hartford, Conn. Executive Committee: The officers and F. E. Smith, auditor for receivers Chicago Union Traction Co., Chicago, Ill.; G. B. Willcutt, treasurer United Railroads of San Francisco, San Francisco, Cal.; Arthur L. Linn, Jr., assistant secretary and treasurer, Utica & Mohawk Valley Railway Co., Utica, N. Y.; P. S. Young, comptroller Public Service Corporation of New Jersey, Newark, N. J.

Next meeting, Philadelphia, Pa., week of Sept. 25, 1905.

AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

President, C. F. Baker, superintendent motive power and machinery Boston Elevated Railway Co., Boston, Mass. First Vice-President, H. H. Adams, superintendent of shops The United Railways & Electric Co. of Baltimore, Baltimore, Md. Second Vice-President, John Millar, master mechanic International Railway Co., Buffalo, N. Y. Third Vice-President, F. G. Simmons, superintendent of way Milwaukee Electric Railway & Light Co., Milwaukee, Wis. Secretary and Treasurer, S. W. Mower, division superintendent Rapid Railway System, Detroit United Railways, Detroit, Mich. Executive Committee: The Officers and D. F. Carver, chief engineer railway department Public Service Corporation of New Jersey, Newark, N. J.; J. S. Doyle, master mechanic Interborough Rapid Transit Co., New York, N. Y.; C. C. Lewis, chief engineer Schenectady Railway Co., Schenectady, N. Y.; W. H. McAloney, superintendent of shops Denver City Tramway Co., Denver, Colorado.

Next meeting, Philadelphia, Pa., week of Sept. 25, 1905.

AMERICAN ASSOCIATION OF STREET RAILWAY CLAIM AGENTS.

President, W. A. Dibbs, general claim agent New York City Railway Co., New York, N. Y. Vice-President, E. W. O'Connor, claim adjuster Savannah Electric Co., Savannah, Ga. Secretary and Treasurer, B. B. Davis, claim agent Columbus Railway & Light Co., Columbus, Ohio. Executive Committee: The President, chairman ex officio, the Secretary, and W. H. Renaud, Jr., claim agent New Orleans Railways Co., New Orleans, La.; William White, claim agent Chicago City Railway Co., Chicago, Ill.; J. P. Feeney, claim agent, Public Service Corporation of New Jersey, Newark, N. J.

Next meeting, Philadelphia, Pa., week of Sept. 25, 1905.

AMERICAN STREET RAILWAY MANUFACTURERS' ASSOCIATION.

Daniel M. Brady, president Brady Brass Co., New York, Chairman; John A. Brill, vice-president J. G. Brill Co., Philadelphia; William J. Cooke, vice-president McGuire-Cummings Manufacturing Co., Chicago; Fred S. Kenfield, president Kenfield Publishing Co., Chicago; Charles K. King, secretary Ohio Brass Co., Mansfield, O.; George J. Kobusch, president St. Louis Car Co., St. Louis; John R. Lovejoy, manager Railway Department, General Electric Co., Schenectady; Howard F. Martin, general manager of sales, Pennsylvania Steel Co., Philadelphia; James H. McGraw, president McGraw Publishing Co., New York; John W. Nute, president and manager St. Louis Car Wheel Co., St. Louis; Frank C. Randall, vice-president National Electric Co., Milwaukee; Newton Carlton, Westinghouse Electric & Manufacturing Co., New York; William Wharton, jr., president William Wharton, jr., & Co., Inc., Philadelphia; W. H. Whiteside, general manager of sales, Allis-Chalmers Co., Chicago; E. M. Williams, director Sherwin-Williams Co., Cleveland.

E. H. Baker, Chairman Finance Committee, Galena Signal Oil Co., 26 Broadway, New York City. C. O. Price, Chairman Entertainment Committee, General Electric Co., Boston.

George Keegan, assistant to general manager Interborough Rapid Transit Co., Room 2302, No. 15 Park Row, New York City, secretary.

THE COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION.

President, John A. Beeler, vice-president and general manager Denver City Tramway Co., Denver, Col. Vice-president, C. E. Doolittle, vice-president and manager The Roaring Fork Electric Light & Power Co., Aspen, Col. Secretary and treasurer, George B. Tripp, general manager Colorado Springs Electric Co., Colorado Springs, Col. Executive Committee: The officers and Wm. Mayher, treasurer and manager Greeley Power & Light Co., Greeley, Col.; J. F. Vail, general manager, Pueblo & Suburban Traction & Lighting Co., Pueblo, Col.

Date and place of next meeting not decided upon.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

President, C. Loomis Allen, general manager Utica & Mohawk Valley Ry., Utica, N. Y. First Vice-President, J. H. Pardee, president Ontario Light & Traction Co., Canandaigua, N. Y. Second Vice-President, A. B. Colvin, president Hudson Valley Railway Co., Glens Falls, N. Y. Secretary and Treasurer, William W. Cole, vice-president and general manager Elmira Water, Light & Railroad Co., Elmira, N. Y. Executive Committee: E. G. Connette, vice-president and general manager Syracuse Rapid Transit Railway Co., Syracuse, N. Y.; R. E. Danforth, general manager Rochester Railway Co., Rochester, N. Y.; B. B. Nostrand, jr., president Peekskill Lighting & Railroad Co., Peekskill, N. Y.; E. F. Peck, general manager Schenectady Railway Co., Schenectady, N. Y.

Next meeting at Niagara Falls, Sept. 12-13, 1905.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.

President, F. B. Musser, general manager Harrisburg Traction Co. Secretary, C. H. Smith, superintendent Lebanon Valley Street Railway Co., Lebanon, Pa. Treasurer, W. H. Lanius, president York Traction Co.

MASSACHUSETTS STREET RAILWAY ASSOCIATION.

President, Edward P. Shaw, Newburyport. First Vice-President, Francis H. Dewey, Worcester. Second Vice-President, Robert S. Goff, Fall River. Treasurer, Fred H. Smith, Quincy. Secretary, Charles S. Clark, Boston. Executive Committee: The President, the Vice-Presidents and H. H. Crapo, New Bedford; P. F. Sullivan, Lowell; W. S. Loomis, Holyoke; W. W. Sargent, Fitchburg; R. T. Laffin, Worcester. Auditing Committee: Charles F. Grosvenor, Palmer; George W. Cook, Springfield; H. C. Page, Pittsfield.

CONNECTICUT STREET RAILWAY ASSOCIATION.

President, John B. Carrington, vice-president Fair Haven & Westville Railroad Co., New Haven, Conn. Vice-president, A. M. Young, president Connecticut Railway & Lighting Co., Bridgeport, Conn. Treasurer, E. S. Goodrich, president Hartford Street Railway Co., Hartford, Conn. Secretary, E. W. Poole, assistant treasurer and assistant secretary Connecticut Railway & Lighting Co., Bridgeport, Conn. Executive Committee: The officers and J. E. Sewell, general manager Connecticut Railway & Lighting Co., Bridgeport, Conn.; C. S. Treadway, president Bristol & Plainville Tramway Co., Bristol, Conn.; Walter Learned, president New London Street Railway Co., New London, Conn.

Date and place of next meeting not decided upon.

IOWA STREET & INTERURBAN RAILWAY ASSOCIATION

President, George B. Hippee, general manager Des Moines City Railway Co., Des Moines. Vice-President, J. F. Lardner, general manager Tri-City Railway Co., Davenport. Secretary and Treasurer, L. D. Mathes, general manager Union Electric Co., Dubuque. Executive Cimmittee: The officers of the association.

Next meeting at Dubuque, spring of 1905.

CANADIAN STREET RAILWAY ASSOCIATION.

President, W. G. Ross, managing director Montreal Street Railway Co., Montreal, Canada. Vice-president, W. H. Moore, assistant to the president of the Toronto Railway Co., Toronto, Canada. Secretary-treasurer, Allan H. Royce, vice-president Toronto Suburban Street Railway Co., Toronto Junction, Canada. Attorney, Col. H. H. McLean, K. C., director St. John Railway Co., St. John, New Brunswick. Executive Committee: The President, Vice-president and C. E. A. Carr, general manager London Street Railway Co., London, Ontario; E. A. Evans, general manager and chief engineer Quebec Railway, Light & Power Co., Quebec; Duncan McDonald, manager Montreal Street Railway Co., Montreal.

Annual meeting, first week in June; other meetings, first week in September, December and March.

INDIANA ELECTRIC RAILWAY ASSOCIATION.

President, Charles L. Henry, president and general manager Indianapolis & Cincinnati Traction Co., Indianapolis, Ind. Vice President, J. W. Chipman, general manager Indianapolis & Eastern Traction Co., Indianapolis, Ind. Secretary, Paul H. White, general manager Indianapolis & Martinsville Rapid Transit Co., Indianapolis, Ind. Treasurer, W. F. Milholland, treasurer Indianapolis Traction & Terminal Co., Indianapolis, Ind. Executive Committee: A. L. Drum, general manager Indiana Union Traction Co., Anderson, Ind.; C. C. Reynolds, general manager Indianapolis & Northwestern Traction Co., Indianapolis, Ind.; Gardner F. Wells, general manager Terre Haute Traction & Light Co., Terre Haute, Ind. Finance Committee: Charles Murdock, president Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind.; W. G. Irvin, general manager Indianapolis, Columbus & Southern Traction Co., Indianapolis, Ind.

Regular meetings on the second Thursday of each month.

NORTHWESTERN ELECTRICAL ASSOCIATION.

President, C. H. Williams, Madison, Wis. First vice-president, R. N. Kimball, Kenosha, Wis. Second vice-president, H. Almert, Oak Park, Ill. Secretary-treasurer, Thomas R. Mercein, Milwaukee, Wis. Directors: P. H. Korst, Janesville, Wis.; Ernest Gozenbach, Sheboygan, Wis.; H. S. Gille, St. Paul, Minn.

Annual meeting, January, 1906.

THE NEW ENGLAND STREET RAILWAY CLUB.

President, E. E. Potter, general superintendent Union Street Railway Co., New Bedford, Mass. Vice-presidents for States: Paul Winsor, Boston, Mass.; Norman McD. Crawford, Hartford, Conn.; L. N. Wheelock, Claremont, N. H.; A. J. Crosby, Springfield, Vt.; J. E. Thielsen, Providence, R. I.; George E. Macomber, Augusta, Me. Secretary, John J. Lane, editor Street Railway Bulletin, 12 Pearl St., Boston, Mass. Treasurer, N. L. Wood, with Frank Ridlon Co., Boston, Mass.

THE OHIO INTERURBAN RAILWAY ASSOCIATION.

President, Edward C. Spring, general superintendent Dayton, Covington & Piqua Traction Co., Dayton, O. Vice-president, Warren F. Bicknell, president Lake Shore Electric Railway Co., Cleveland. Secretary, F. W. Coen, general freight agent, Lake Shore Electric Railway Co., Cleveland O. Treasurer, R. E. DeWeese, superintendent Dayton & Northern Traction Co., Dayton. Executive Committee: F. J. J. Sloat, general manager Cincinnati, Dayton & Toledo Traction Co., Hamilton; F. D. Carpenter, general manager Western Ohio Railway Co., Lima; J. R. Harrigan, general manager Newark & Granville Street Railway Co., Newark; W. B. Tarkington, general superintendent Detroit, Monroe & Toledo Short Line, Monroe; F. J. Green, general manager Springfield, Troy & Piqua Railway Co., Springfield. Finance Committee: The president and J. H. Merrill, auditor Western Ohio Railway Co., Lima, and A. W. Anderson, superintendent Dayton & Xenia Transit Co., Dayton.

UNION INTERNATIONAL DE TRAMWAYS ET DE CHEMINS DE FER D'INTERET LOCAL.

President, Leon Janssen. Secretary General, P. t'Serstevens, 6 Impasse, due Parc, Brussels, Belgium.

THE TRAMWAY AND LIGHT RAILWAY ASSOCIATION.

President, Alfred Baker, Esq., general manager Birmingham Corporation Tramways, 254 Corporation St., Birmingham. Vice-president, W. M. Murphy, Esq., chairman of the Dublin United Tramways Co., Ltd., 39 Dame St., Dublin. Secretary, Ernest Benedict, Esq., M. I. C. E., Clun House, Surrey St., Strand, W. C. The offices of the association are at Clun House, Surrey St., Strand, W. C. James W. Courtenay, Esq., managing director of the Tramway & Railway World, Amberley House, Norfolk St., Strand, W. C., is secretary to the Tramways exhibition to be held in 1906.

MUNICIPAL TRAMWAYS ASSOCIATION.

President, C. R. Bellamy, Esq., A. M. I. C. E., Liverpool Corporation Tramways, 6 Sir Thomas St., Liverpool. Vice-president, A. Baker, Esq., Birmingham Corporation Tramways, 254a Corporation St., Birmingham. Secretary and treasurer, J. M. McElroy, Esq., 55 Piccadilly, Manchester. Executive Committee: J. Aldworth, Esq., general manager Nottingham Corporation Tramways; Councillor Boyle, chairman tramway committee Manchester Corporation Tramways; A. R. Fearnley, Esq., general manager, Sheffield Corporation Tramways; A. L. C. Fell, Esq., chief officer London County Council Tramways; P. Fisher, Esq., manager Dundee Corporation Tramways; J. B. Hamilton, Esq., general manager Leeds Corporation Tramways; Bailie Paton, Esq., chairman tramway committee, Glasgow Corporation Tramways; Councillor Smithson, chairman tramway committee, Leeds Corporation Tramways; C. J. Spencer, general manager Bradford Corporation Tramways.

John Stephenson Car and Truck Plant Sold.

The final arrangement to take over the large plant of the John Stephenson Co., of Elizabeth, N. J., was consummated Jan. 18, 1905, by parties connected with the J. G. Brill Co., of Philadelphia. A complete transfer of all the capital stock has been made to the new owners, and the work on the orders now in hand will be continued without interruption. The new company, which will do business under the old name, has the following officers: William H. Heulings, jr., president; Samuel M. Curwen, vice-president; James Rawle, treasurer, and J. G. Root, secretary and assistant treasurer. Peter M. Kling, who has been the general manager for several years, and E. J. Lawless, sales agent, are retained in the same capacity. Mr. Heulings, the new president of the Stephenson company, has been identified with the J. G. Brill Co. since he left school, entering the employ of the company at the age of 14 years as a stenographer, and has, through his integrity, industry and ability, risen to the position of vice-president of the Brill company and president of the Stephenson company. As the same interests have already taken over the Brownell Car Co. and American Car Co. of St. Louis, and the G. C. Kuhlman Car Co., of Cleveland, rumors to the effect that there would be a general consolidation of all the car building interests in the United States have been current. We can state positively that no such thing is contemplated, and that the purpose of the purchases is simply to reduce freight rates and afford better facilities for conducting business. The companies are organized separately, and other than being licensees of the Brill patented cars and trucks and specialties, have as companies no connection with the J. G. Brill Co.

W. H. HEULINGS, JR.

The Stephenson plant at Elizabeth is comparatively new, the company moving there from New York about five years ago. The plant is in the southern suburbs of the town on a tract of 89 acres, and covers one-fourth of this area. The works are accessible to the principal railroads of the east, have a water front on Staten Island and are also in the heart of an unsurpassed labor market, both as to skill and quantity. It is conceded that the company has one of the best manufacturing sites in the vicinity of New York Harbor. The shops have every modern improvement, and the latest types of electrically driven machinery. During the last three years the capacity of the plant has been tripled.

John Stephenson, the founder of the company, is known as the father of American street railway industry. He designed and built the first street railway car in 1831. He also developed the type of horse car with which all cities and countries are familiar, and was the first in the field when cable and electric cars were adopted. During his life he built over 25,000 cable and electric cars. Since his death the business of the company has steadily increased, and today Stephenson cars can be found in all parts of the world.

The company exhibited at the St. Louis Exposition a car weighing 108,000 lb., the largest electric car ever built. The car is capable of running at a speed of two miles per minute, and is mounted on the first six-wheeled trucks made for electric service.

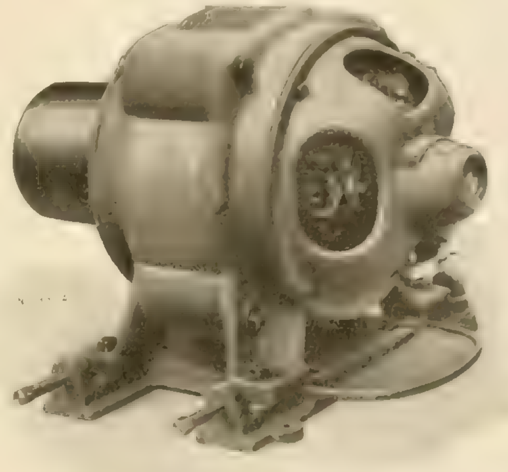
The Lundell Universal Motors.

A new motor for repair shop work and similar use has recently been placed upon the market by the National Electric Co. That the advent of this motor in the direct current field is a noteworthy development in the art of construction has been proved at several severe tests carried on before the public. During these tests the motors have shown a remarkable efficiency and rapid adjustment to serious change in load.

It may be of interest to describe, in a general way, this new form of motor construction. The frame of the Lundell motor consists of two cast iron housings, which contain laminated yoke rings and support the bearing brackets. The rear one of these housings has cast upon it four hollow extension arms of rather heavy cross section, accurately bored to engage and support the yoke laminations which are assembled between the two halves of the frame. These two halves are clamped tightly and rigidly against the yoke laminations by bolts, and when bolted together, the entire frame [illegible] the laminations, and at the same time the overall dimensions of the magnet yoke are not exceeded.

[illegible] Lundell laminated yoke is built up of punched mild steel rings, secured and accurately centered in the rigid frame just described. The outer and inner perimeters of these rings are concentric circles. The pole pieces are separately punched from the same material as the yoke rings and are provided with end plates of a design which furnishes ventilating ducts to dissipate the heat generated in the field coils. These end plates are tapped and retaining bolts pass through the frames accurately clamping the pole core into a position of rigid contact with the inner circumference of the yoke rings. By removing these bolts the pole pieces and field coils can then readily be taken off.

In machines of this type up to 60 h. p. it is not necessary to introduce ventilation into the center of the armature as the losses in these machines are exceptionally low. The foregoing characteristic of the Lundell "Universal" motor enables it to save space which other types of motors must use, and the extremely low losses also make it possible to enclose these motors at lower temperature rises than is possible with motors in which the losses are greater and the temperature rise consequently higher. The armature coils are form wound and are separately insulated independently of slot insulation.



LUNDELL UNIVERSAL MOTOR.

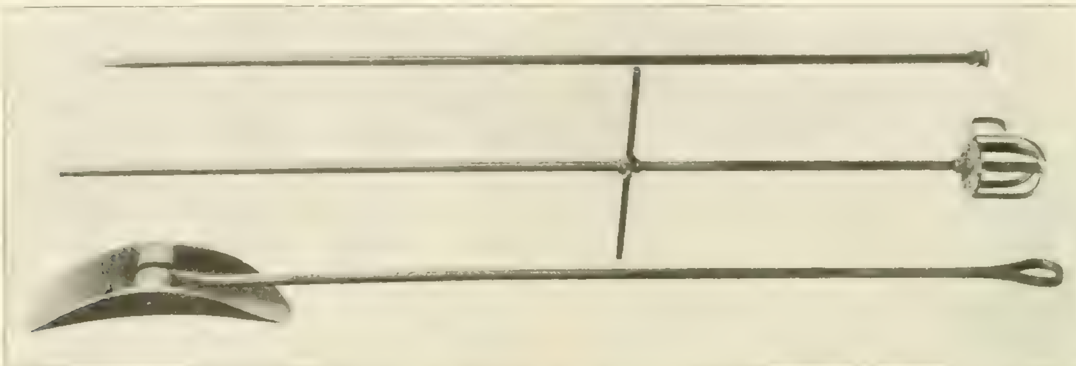
The commutators are built on the lines of the standard street railway practice giving a rigid support to the bars. The commutator shells are ventilated through their centers, which construction aids in securing cool running of the commutators.

A new principle is involved in the brush device of this motor, namely: the placing of two carbon brushes in tandem on one stud. The total brush surface in this construction is the same as though the brushes were side by side, but as any irregularity in the commutator does not lift both tandem brushes from the commutator at the same time a better contact and therefore, a cooler, smoother running commutator is obtained. For variable speed work the brush at the leaving edge is made of high resistance carbon to take care of the sparking conditions and the other brush of high conductivity to care for the current, which combination is successful.

The Birmingham Railway, Light & Power Co. has in force a modified "Brown" system of discipline, with the workings of which it is very well satisfied. The principal point of difference in the scheme as adopted at Birmingham lies in the preponderance of the merits as compared to the demerits. Employes are not discharged on their merit and demerit record, but for special offenses only. The advantage, therefore, of the merit and demerit record, as this company keeps it, is to differentiate among the good men rather than among the poor ones, as this is shown by their individual records on which appear credit balances of merits.

Miller Anchors.

The accompanying illustration is that of the Miller anchor for railway wrecking purposes, together with auger for setting them. These anchors can be set in from 30 to 40 minutes, eight feet deep, and will stand a strain of 40 to 50 tons. The anchors are made in three sizes, 10 x 25 in., with 1¼-in. rod, 9 ft. long; 10 x 30 in., with 1⅜-in. rod, 9 ft. long; 10 x 30 in., with 1½-in. rod, 9 ft. long. The anchors are made of cast iron and the rods of wrought iron. The auger has a 9-ft. stem, one inch in diameter, with an adjustable handle, as the auger goes down the handle can be moved up the stem.

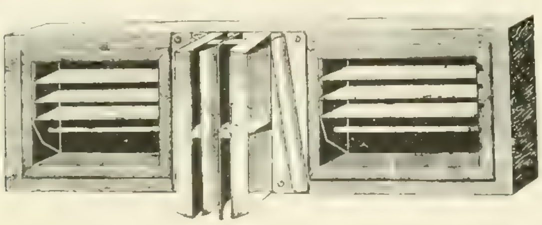


MILLER ANCHOR AND AUGER

The Miller Anchor Co., Norwalk, O., which manufactures these wrecking anchors, also manufactures a line of smaller anchors for anchoring guy wires to telephone and trolley poles, together with a combination auger with two boring heads for the different size anchors. The Miller rock anchor is also a product of this company and can be used in any kind of rock. They are 1¼ in. in diameter and 3½ ft. long, with a ⅝-in. rod, and will stand a strain of 15,000 lb. The Miller products have met with a great deal of success and are used extensively throughout the country by such concerns as the Bell Telephone Co., the Appleyard Syndicate, the Detroit & Toledo Construction Co. and the United States Telephone Co.

The American Ventilating Co.

The American Ventilating Co., owner of the Joseph Leather United States patents, is manufacturing a new ventilator which is illustrated in the accompanying engraving. This ventilator is manufactured of chilled steel, in any desired finish, and there are five types for cars, as well as special designs for various classes of buildings. As may be seen in the illustration, the ventilator comprises a double deflector and two airways, so that when the train or car is in motion the deflector intercepts the air and injects it through the forward airway, first taking out the cinders, dust and smoke. A partial vacuum is maintained behind the deflector so that the foul air is drawn out through the rear airway and thereby the air in a car is changed in a very short time. Cars in service may be equipped in the deck sash without damage or detriment of their appearance. These ventilators are now in use on the London & North-Western railway, the Midland railway and the Southeastern railway, of England, the Liverpool Corporation tramways, Liverpool Overhead railway and a number of other electric railways, including several controlled by the British Electric Traction Co., Ltd., and have given very satisfactory results.



AMERICAN STEAM AND ELECTRIC CAR VENTILATOR

The sales office of the American Ventilating Co. is at 15 Cortlandt St., New York City, and the officers of the company are: President, Anderson Fowler; secretary, Richard B. Kelly, who is vice-president of the Fifth National Bank; treasurer and general manager, H. M. Shaw.

The Buckeye Automatic Lowering Jack.

The jack shown in the accompanying illustration is a product of the Buckeye Jack Manufacturing Co., of Louisville, O., and is what is known as its No. 2 automatic lowering jack, being suitable for all general lifting purposes. This jack is one that has given general satisfaction and gratifying results as used by electric railway companies in track construction, and in emergency cases, such as a derailment or accident. Its operation is simple and easy, operating at any angle. The load may be moved up or down half a notch at each stroke, and the direction is easily controlled by the eccentric at the side of the frame. The frame or base is of malleable iron; the rack is of forged steel, with machine-cut teeth; the pawls are dropped forged, open hearth steel of high carbon; the fulcrum pin is of high carbon rolled steel, machined; the bearings are of hardened steel and the handles made of selected ash or hickory. The capacity of the No. 2 jack is 10 tons, and is of the following dimensions: height with bar down, 21 in.; raise of bar, 10 in.; height with bar raised, 31 in.; size of bar, 1⅝ x 1½ in., and weight, 65 lb. The Buckeye Jack Manufacturing Co., which has a large and well appointed factory at Louisville, O., has for some years given special attention to the manufacture of jacks to meet the demands of both steam and electric railroads and manufacture several other types and sizes of jacks than that illustrated.

NO. 2 AUTOMATIC LOWERING JACK.

The Old Colony Street Railway Co. is making arrangements for hauling the product of neighboring shoe factories over its lines.

A New Combination Mail and Express Car.

The accompanying illustration shows the type of new combination mail and express car recently built by the Laconia Car Company Works for the Portsmouth, Dover & York Street Railway Co., Portsmouth, N. H. The car is of the following dimensions: Length over corner posts, 28 ft. 8 in.; length over bumpers, 38 ft. 8 in.; width over corner posts, 8 ft. 3 in.; width inside, 7 ft. 4⅜ in.; height from bottom of sills to top of running board, 9 ft. ¾ in.; length of mail compartment inside, 15 ft., and length of baggage compartment inside, 12 ft. 11 in.

The car is built on the lines of those for steam railroad service, having straight sides, sheathed; extended monitor roof; two windows on a side in the mail compartment; vestibules at each end with

COMBINATION MAIL AND EXPRESS CAR

single swing doors, also single sliding door in one end of the baggage compartment; two side baggage room doors and two side mail room doors. The car is sheathed on the inside with hard pine and the ceilings are sheathed and painted. Mail boxes are arranged on each side of the mail room and slots are provided in the sides of the car directly over the mail boxes so that letters may be dropped in. The mail room is also fitted up with one Harrison bag rack and one slotted shelf is located over the bag rack, which is supported by chains and can be folded back against the side of the car. A table is provided opposite the bag rack; it is supported by iron stands and may be folded back against the side of the car when not in use. The car is equipped with eight No. 93 T "Consolidated" heaters, DeWitt sand boxes, Wilson trolley retrievers, Laconia scrapers and Sterling safety hand brakes.

The Platt Iron Works Co.

The Platt Iron Works Co. was organized in October last to take over the plant, business and good will of the Stillwell-Bierce & Smith-Vaile Co., of Dayton, O.; all of the assets of that company were purchased from the receivers and also the new company has secured the addition to the plant built for the old company by Colonel Platt. This gives the company a total ground area of 22 acres, conveniently situated as regards shipping facilities. The equipment throughout is modern and the new company is in a position to build all kinds of steam and hydraulic machinery. The total capitalization of the Platt Iron Works Co. is $1,600,000, of which $800,000 is capital stock and $800,000 is bonds; of the latter, one-half remains in the treasury. The officers of the company are: President, H. E. Talbott; vice-president and treasurer, E. F. Platt; secretary, G. B. Smith. The directors include J. D. Platt, president of the Barney & Smith Car Co., A. M. Kittredge, E. Frank Platt, H. E. Talbott and J. S. McMahon.

Westinghouse Crane Motor.

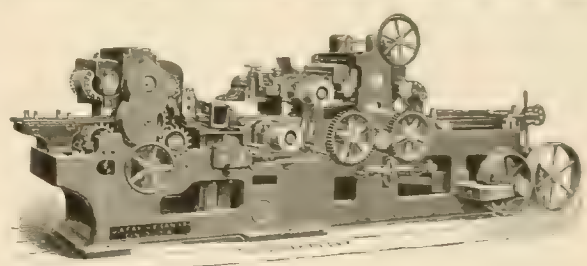
The Westinghouse Electric & Manufacturing Co., which has long been actively engaged in the construction of electric crane machinery, has developed a type of motors designed for the operation of cranes, hoists, etc., where the service is intermittent and where heavy starting torques and wide speed variations are required. These are known as type K motors and are made in 10 standard sizes, including capacities from 2 to 40 h. p. The frames are of the wholly enclosed form to guard against dust or moisture, but the working part may be opened [illegible] without dismantling.

Type K motors [illegible] is magnetized by a separate field coil. The motors are series-wound and are designed [illegible] 220 to 500 volts. The frames are of cast steel, excepting the three smallest sizes, and they are extremely compact, being nearly square in section and requiring [illegible] on a crane. The frame is built in two parts divided in a plane passing through the shaft of the armature and at an angle of 34° with the horizontal. This arrangement allows the upper half of the field to be removed without disturbing the gears or the shaft. The lower frame has four feet with holes for bolting to the support. The opening around the commutator is entirely closed by a sheet steel band fastened by thumb screws which permits ready access to the commutators and brush holders. The pole pieces are built up of soft steel punchings riveted between iron end plates and the armature core is built up in the same way. The shells are lined with either brass or babbitt and are mounted in housings which may be removed without separating the motor frame. The shafts are of ample strength and may be extended at either end to accommodate pulleys, pinions or brake disks.

The brush holders of the type K [illegible] sliding type and possess a number of points of merit. The individual holders may be independently adjusted. Tension is provided by means of a coil spring which acts through a short brass strip so that the spring responds immediately to any movement of the brush. An adjustment is also included to compensate for the wear of the commutator. All but two smaller sizes of the type K motors have a shunt connected with the tip of the spring which is extended back over the spring and securely fastened to the brush holder, thus relieving the spring from carrying current. Flexible leads are brought out through insulating bushings in the upper frame and are either connected to terminal blocks mounted on the motor or are directly connected to the controller lines.

A New Flooring Machine.

Realizing the demand for an efficient flooring machine suitable for turning out the many different kinds of matched lumber which are used in car shops, the J. A. Fay & Egan Co., 230 W. Front St., Cincinnati, O., has lately perfected and placed upon the market its new style double cylinder "Lightning" floorer No. 106. This machine has all the advantages which made the earlier machines of this company so useful and universally satisfactory, but to these advantages have been added a great many new improvements, so that this new machine is one of the most efficient [illegible]



No. 106 [illegible]

The machine is built with a heavy frame having its separate parts held together rigidly and securely. Care has been taken in the design so that all adjustments can be easily and rapidly made. The machine is highly recommended for making flooring, ceiling, casing and siding and will work the four sides of material 15 in. wide by 6 in. thick, matching as narrow as 1½ in. and handling twisted and warped lumber with facility.

Printed matter further detailing the features of this new tool, together with a catalog of the many other types of wood working machines which are made by this company may be had by addressing the J. A. Fay & Egan Co.

Ornamental Wire Fences for Parks.

The rapid and extensive development of amusement parks by railway companies has been rewarded in most cases by large attendance and has made the fencing problem an important one. High board fences are highly objectionable and recent improvements in wire fences have attracted the attention of the discerning ones and managers and purchasing agents are finding the solution of their troubles in extra heavy wire constructions.

In the modern wire fences, as shown in Fig. 1, the upright wickets or other cross wires are made of stock even heavier than that of the running wires and long after the galvanizing wears off there is a sufficiently large core of good tough steel inside the rust to maintain the strength of the fence. Sagging and stretching are always occasioned by the heat of summer and are scientifically provided for by a ratchet, as shown in Fig. 2. This automatic ratchet is placed on the back of the post, and each strand passes through a small hole in the post and onto the ratchet. The staples on the intermediate posts are under control of the ratches on the end post, and a turn or two of the control of the ratchets take up whatever slack may be occasioned by the wear and tear of time and hard usage. The end posts have to be well set and braced very securely, but the intermediate posts require no bracing or anchoring except when on curves or in gullies.

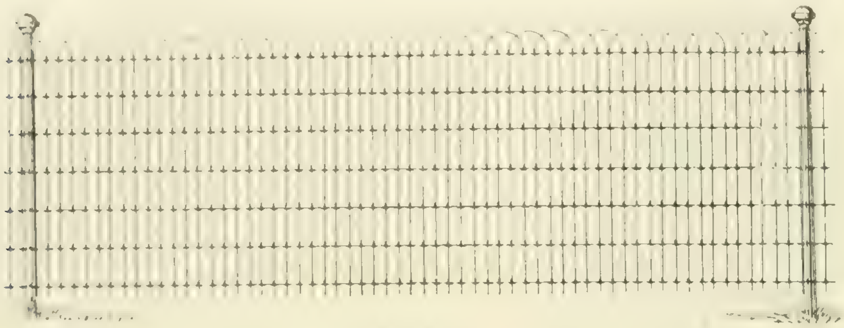


FIG. 1

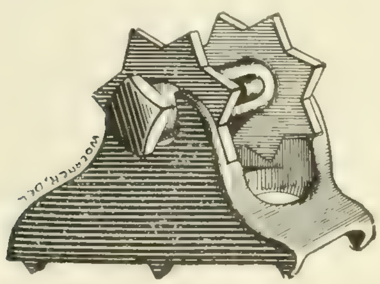


FIG. 2

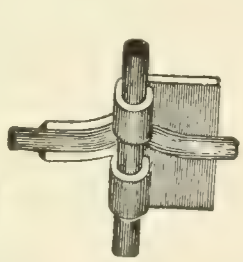


FIG. 3

Game preserves and deer parks demand fences of special height, strength and size of mesh. The fence designed for this purpose is one that is built on the ground, each strand being run and made taut separately, with spacing to suit particular conditions. The upright stays are clamped on at more or less frequent intervals at the option of the builder, and each joint should be absolutely rigid. The anchor clamps shown in Fig. 3 are used extensively for this purpose with universal satisfaction. They are made from No. 16 gage steel 1 in. wide and galvanized after cutting. The clamp pincher shown in Fig. 4 closes the clamp with one stroke, and at the same time crimps both the horizontal and upright wires so that slipping is prevented.

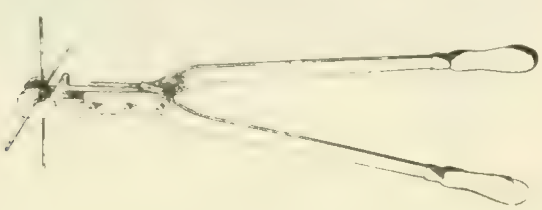


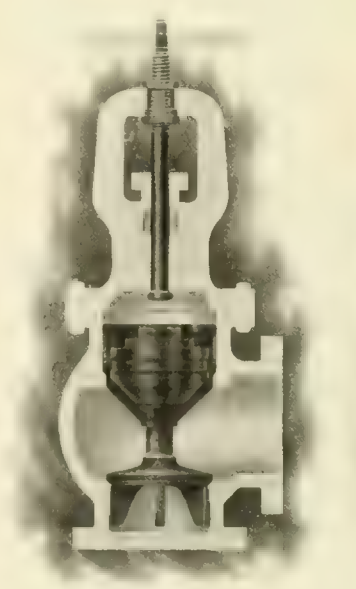
FIG. 4.

A wide mesh anchor fence was erected at the Trans-Mississippi Exposition at Omaha, to confine the largest buffalo ever held in captivity. The fence was 9 ft. high, with the posts 20 ft. apart. The animal was brought by the Indians from Wyoming and broke a number of the 6-in. posts, but not a single wire or clamp. This remarkable exhibition of strength and durability secured for the anchor fence the highest award and gold medal at the Omaha Exposition. The anchor fence has been awarded over 30 first premiums and gold medals at other expositions in America, Canada, and Australia. Catalog giving particulars and illustrating styles used for ornamental fencing and similar purposes may be obtained of M. D. Jones & Co., 71-73 Portland St., Boston, Mass.

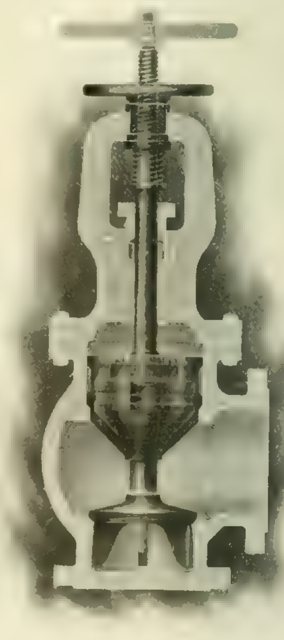
The Anderson Patent Cushioned Non-Return Valve.

Two new valves that have recently been placed on the market by the Best Manufacturing Co., of Pittsburg, Pa., are shown in the accompanying illustrations. They are known as the Anderson patent cushioned non-return valve and the Anderson patent combination cushioned non-return valve.

These valves cover a very vital point in the general piping system of power plants. When placed between the boiler and the header they will equalize the pressure between the different units of a battery of boilers as they remain closed as long as the boiler pressure is lower than that of the header. When the boiler pressure equals that of the header, they open and will remain in that position without chattering or hammering. They will automatically cut off a boiler in case of accident to the boiler, such as the bursting of a tube, and will also act as a safety stop to prevent steam being turned into a cold boiler while men are working inside. The sectional cut shows plainly the well arranged dash-pot for cushioning the valve, which is so essential in order to avoid chattering and hammering in this class of valves. The only difference between the cushioned non-return valves and the combination cushioned non-return valves is the additional feature of being able to open the latter valve and hold it in that position if desired by simply operating the small auxiliary hand wheel.



NON-RETURN VALVE.



COMBINATION VALVE.

The Best Manufacturing Co. furnishes and erects complete piping systems for power plants, making a specialty of high pressure valves and fittings, and besides its Pittsburg office has branch offices at 39 Cortlandt St., New York, and Betz Building, Philadelphia, Pa.

T. E. MITTEN

FIRST VICE-PRESIDENT CHICAGO CITY RAILWAY CO.

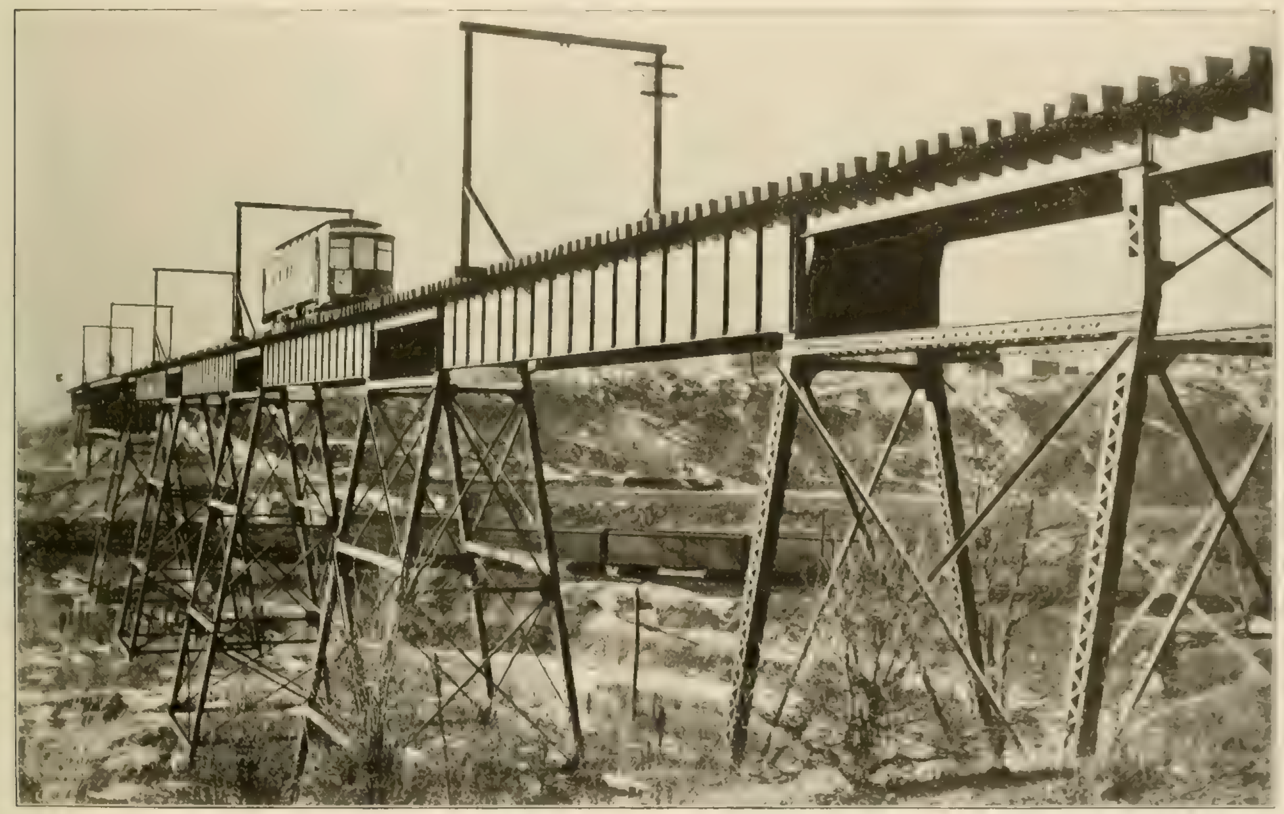
STREET RAILWAY REVIEW

Vol. XV | MARCH 15, 1905 | No. 3

McKinley Syndicate Properties of Northern Illinois. I.

Describing the Interurban Line of the Illinois Valley Ry. from Ladd, Ill., East to Marseilles.

In the "Review" for September and December, 1904, were described the McKinley syndicate properties of central Illinois, which include what will eventually form an unbroken line of interurban railways extending from Danville through Urbana, Champaign, Decatur and Springfield down to St. Louis. In northern Illinois Mr. McKinley also controls two important interurban properties, one of which is the Illinois Valley Railway Co., the headquarters for which are at LaSalle, Ill., and the other an interurban line, at Galesburg, which will be described in a subsequent issue. It should be explained that while Mr. McKinley is at the head of both of the syndicates owning these



ILLINOIS VALLEY RY. BRIDGE AT SPRING VALLEY, ILL.

two groups of interurban properties, that the two syndicates have no connection with each other and outside of Mr. McKinley are composed of two entirely distinct groups of men.

Route.

The Illinois Valley Ry. begins at Ladd, Ill., and runs south to Spring Valley. At Spring Valley the road turns east and runs in a generally easterly direction through to Marseilles. The principal points lying between the termini are Spring Valley, Peru, LaSalle, Utica and Ottawa. The total length of the road is 36 miles, and the entire route at present constructed is shown on the accompanying map.

The total population served is about 42,000, divided as follows: Ladd, 2,000; Marquette, 350; Spring Valley, 8,000; Peru, 7,500; LaSalle, 11,500; Utica, 2,000; Ottawa, 12,000; Marseilles, 4,000, and a rural population between these [illegible]. LaSalle and Peru, with a combined population of 19,000 [illegible] 12,000 population, are the most important cities touched by this road. LaSalle and Peru may be considered as practically one city, the two places having grown together so as to leave no well-defined boundary line between them. Locally they are spoken of as the "twin cities" and both contain many thriving business houses and manufactories. They are also the center of a large coal mining district, and coal mining forms one of the principal industries of a number of the cities along the western end of this road. Ladd is almost exclusively a mining town, and Marquette, otherwise known as "No. 3", consists merely of a settlement at one of the mine shafts. At a point on the electric line three miles from Ladd, the Chicago, Milwaukee & St. Paul Ry. is opening a mine which it is stated will have one of the largest outputs in the world.

The Illinois Valley Ry. parallels the Chicago, Rock Island & Pacific Ry. from Marseilles to Spring Valley and the Chicago, Burlington & Quincy R. R. from LaSalle to Ladd. It crosses the Chicago, Burlington & Quincy at Ottawa, the Chicago, Rock Island & Pacific at Split Rock, the Illinois Central at LaSalle, the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific and the Indiana, Illinois & Iowa railroads at Spring Valley. Of these crossings three are at grade and the others are either overhead or under crossings. The three grade crossings are all with transfer tracks or branch lines, none of the three main line rail-

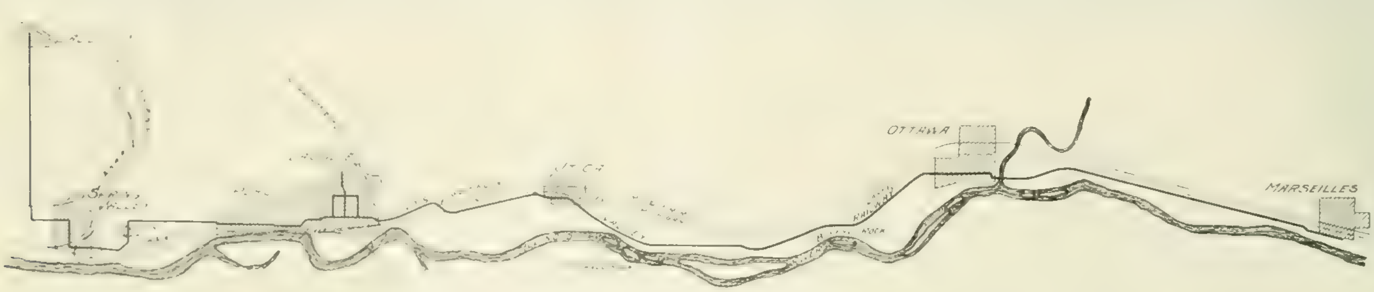
roads crossing at grade. The route of the electric line follows Illinois River quite closely for a greater part of its length, and for a considerable distance lies between the Illinois River and the Illinois & M[illegible] places very irregular; the route selected is apparently the only available one, and it offers many unavoidable sharp curves and several heavy grades. It also required the building of a number of bridges. These conditions explain the fact that in building the road very high speed was not taken into consideration. Aside, however, from the difficult profile of the line, there is apparently no reason for a specially high speed service, as the road does not connect any large centers of population calling for a fast through service, but rather the traffic is very evenly distributed between a comparatively small number of medium-sized towns.

Between Ottawa and LaSalle the road lies in a picturesque country, in which there are several notable points of interest. Just as the road leaves LaSalle it makes a crossing with the Illinois Central railroad, and has a short but steep descent of 7 per cent down to the river valley. A short distance beyond this it crosses the Vermillion River, and the next and principal point of scenic interest on the route is Split Rock, several views of which are shown herewith. As will be seen from the illustrations, the formation of the country at this point is very interesting. Two steam roads pass through Split Rock, one through a natural opening and another through a tunnel cut through the solid rock. The electric road makes an overhead crossing with the two steam roads and with the Illinois & Michigan Canal, which also passes through Split Rock, by means of two steel bridges thrown across the openings through which the two steam roads run.

SPLIT ROCK BRIDGE, 2 MILES EAST OF LA SALLE, ILL.

LOOKING EAST FROM SPLIT ROCK BRIDGE.

SPLIT ROCK BRIDGES.



MAP OF THE ILLINOIS VALLEY RY.

A short distance farther on, a peat bog was encountered in the construction of the road, and this part of the roadbed which covers a distance of two miles had to be cut out by men with shovels and

wheelbarrow. At Utica the route is through a corner of the town about two blocks from the main thoroughfare. Beyond Utica is a popular summer resort known as Starved Rock. This is a huge flat rock of considerable size, which lies isolated upon the plain and obtains its name from the legend of a band of Indians ... to have been stranded upon this rock during a warfaring expedition, where they were confined until all starved to death. Near this point is a group of sulphur springs, which are locally celebrated, and which draw considerable excursion traffic. The company's gravel pit lies a short distance beyond this, and in this pit 45,000 yards of gravel have already been dug and utilized for ballast upon the road. Buffalo Rock is the next point of scenic interest, and is a

[illegible] designed for 50-ton interurban cars. All these bridges are of steel, and rest on concrete abutments. The longest bridge is located in [illegible]

FOX RIVER BRIDGE AT OTTAWA, ILL.

curious rock formation about 100 ft. high, three quarters of a mile long and one quarter of a mile wide. The LaSalle County farm lies a short distance beyond this, and the Chautauqua Park is the next point of interest, before reaching Ottawa, which is the county seat. There are no points of special interest between Ottawa and Marseilles, the present terminus. The latter place is developing a large manufacturing interest operated by means of a considerable water power which the Illinois River affords. Paper manufacturing is the predominant industry here.

Roadbed.

The track is laid with 60-lb. T-rails of the A. S. C. E. standard section, rolled by the Cambria Iron Works, and in passing through parts of the city a 6-in. T-rail is used. These rails are laid on white oak ties of standard size spaced 24 in. between centers. The line is well ballasted, four miles being built with cinder ballast, and the rest with gravel ballast taken from the pit previously mentioned. The maximum grade is 7 per cent, the maximum fill 35 ft. high, and

TRACK CONSTRUCTION TWO MILES EAST OF UTICA, ILL.

the maximum cut 20 ft. deep, this being the rock cut. A special style of painting the poles has been adopted for warning signals on approaching down grades or sharp curves. At a distance of 8 poles from the beginning of a grade or curve, the pole is painted with a 6-in. black ring around it, then a white ring, next a narrow black ring and then 18 in. of bright red, and then white down to the ground. The white section is made longer and longer on each successive pole as the point of the grade or curve is approached.

One of the illustrations shows a long tangent located two miles east of Utica, Ill., and this illustrates the character of the roadbed and overhead construction on most of the road. The overhead work is principally span work, the high-tension lines being carried on the poles on one side, while the low-tension feeders, telephone lines and block signal wires are carried on the opposite side of the poles. A separate high-tension pole line three miles long has also been built.

The trolley wire is No. 0000 copper wire of figure 8 section, and there are two No. 0000 bare copper feeders on the low-tension side. The overhead fittings are of the Ohio Brass Co. make and were furnished by Porter & Berg. United States block signals are used on parts of the line. The telephones are of the Stromberg make.

Rolling Stock.

The company operates 11 interurban cars, two of which were built by the John Stephenson Co., seven by the St. Louis Car Co., and two by the Kuhlman Car Co. These cars are all mounted on St.

[illegible]

Louis Car Co.'s M. C. B. trucks, and each is equipped with four G. E. 57 motors and K 14 controllers. Two of the cars are 28 ft., two 30 ft., two 32 ft., and five 34 ft. in length. There is also one baggage and express double truck car, mounted on Peckham trucks, and equipped with four Westinghouse No. 69 motors.

For the local line in LaSalle there are three 20-ft. cars, three 16-ft. cars, and two 10-bench open cars, all with single trucks, part [illegible]

Westinghouse No. 69 motors. K10 controllers are used on all the local cars. The 34-ft. interurban cars have smoking rooms and toilet rooms, and are equipped with Christensen air brakes and Peter Smith hot-water heaters. Among the devices with which the interurban cars are equipped may be mentioned Wagenhals headlights, Wilson trolley retrievers and St. Louis sand boxes. The standard color for the exterior of the cars is Valentine's coach red.

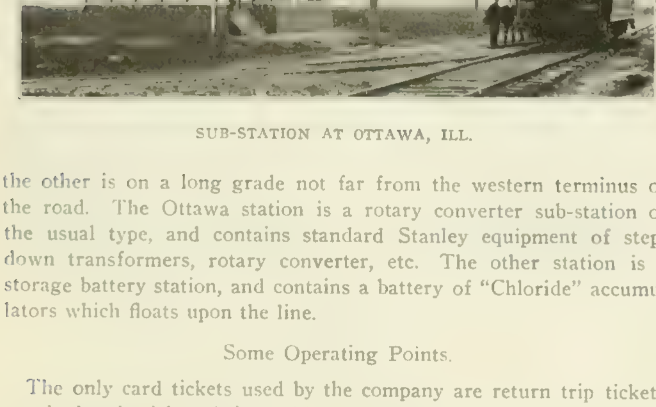
The company owns two home-made nose plows, two side-dump double-truck cars, two side-dump single-truck cars, six center-dump single-truck cars, and one single-truck construction car. The company [illegible] quite an extensive construction equipment at the

LOOKING WEST FROM SPLIT ROCK BRIDGE

gravel pit; there is a number of both wheeled and slip scrapers which are used in digging gravel. At the gravel pit are a storage house for feed, a cook house, with full kitchen outfit, and a bunk house for 15 men. The company does considerable business in supplying gravel for building some of the local country roads, and has supplied as much as 16 car loads per day to Spring Valley. At another pit in Webster Park, 10 cu. yd. of gravel per hour are delivered with two teams.

Sub-Stations.

There are two sub-stations along the line, one of which is near Ottawa, and is shown in one of the accompanying illustrations, and



SUB-STATION AT OTTAWA, ILL.

the other is on a long grade not far from the western terminus of the road. The Ottawa station is a rotary converter sub-station of the usual type, and contains standard Stanley equipment of step-down transformers, rotary converter, etc. The other station is a storage battery station, and contains a battery of "Chloride" accumulators which floats upon the line.

Some Operating Points.

The only card tickets used by the company are return trip tickets, no single trip tickets being sold. A reduction of 5 cents is made on return tickets. Three styles of books of tickets are in use, one of which is a commutation book, issued for an individual, between two given points. Another book contains 100 coupon tickets of a face value of five dollars, which is sold for $4.50, or a reduction of 10 per cent. The other book is a 100-ticket coupon book with a time limit, on which the following rebates may be collected if the book cover is returned within the time limits specified: If used up within 30 days from date of sale, a rebate of $2.00 is allowed; if within 60 days from date of sale a rebate of $1.00, and if within 90 days, a rebate of 50 cents is allowed.

For the purpose of determining fares, the road is divided into a number of fare sections, or divisions, on each of which a 5-cent fare is charged, and a passenger entering a car pays a 5-cent fare for the division from which he starts, and 5 cents more for each division into which he travels. All employes entitled to ride on the company's cars are provided with pads of 100 tickets, and no riding on badges is permitted. The collector must collect either a cash fare or a ticket from every passenger.

A rather unusual method of making conductors' returns is in vogue on this road. No cash is turned in to the office by the conductors, but instead of this each conductor at the end of his day's run deposits all his cash fares at the company's bank, together with a remittance slip, merely giving the amount of currency, silver and copper deposited, which is signed by the conductor. This remittance slip has a duplicate slip attached, upon which the cashier of the bank acknowledges each deposit made by the conductor, and this part of the slip is forwarded to the cashier of the railway company.

The two slips together measure 7¼ x 6¼ in. and perforated so as to be readily torn apart. The text of the deposit slip is as follows:

B

ILLINOIS VALLEY RAILWAY CO.

Remittance Slip.

LaSalle, Ill., ...190..

To the LaSalle State Bank:

Please find enclosed the following remittance and place the same to the credit of the Illinois Valley Railway Co.:

Currency .... $...........
Silver ....
Copper ....

Total .... $...........

ILLINOIS VALLEY RAILWAY CO.,

....

Conductor.

The text of the other half of the remittance blank is as follows:

A

ILLINOIS VALLEY RAILWAY CO.

Remittance Slip.

LaSalle, Ill., ...190..

To the Cashier, I. V. Ry. Co.:

We have received the following remittance from................ ...., Conductor, and placed the same to the credit of the Illinois Valley Railway Co.:

Currency .... $...........
Silver ....
Copper ....

Total .... $...........

LA SALLE STATE BANK,

....

Cashier.

The management considers that this practice saves considerable office work, as it dispenses with the handling and counting of large amounts of currency of small denomination. At the same time the conductor deposits his money at the bank he deposits an envelope at the office of the railway company containing his tickets and transfers collected, on the outside of which is a form which he fills in and signs. This form includes the date, route, starting and closing time, register and key number, transfers, tickets and fares collected, cash deposited, car number, trips and mileage. The cash deposited, which is entered on this envelope, must agree with the acknowledgement from the cashier of the bank.

The company employs about 50 men in the uniformed force, two attendants at the rotary converter sub-station, and in the power house there are one chief and two assistant engineers, two firemen and two helpers, and one man for the ash pit. The lighting machinery in the station runs 24 hours per day, and the railway machinery 18 hours per day. The cost of power in this station has been reduced to a very satisfactory figure, being about .9 cent per kilowatt-hour, with coal at $1.60 per ton.

During the winter there are six interurban and three local cars in regular operation, and during the summer seven interurban and three local cars, with extra cars on Saturdays and Sundays.

The company's rules for employes are practically identical with the A. S. R. A. rules, with the exception of one rule in regard to the painted posts at grades and sharp curves. On approaching a painted pole the conductor rings one bell and the motorman answers with three whistles. He then receives two bells to go ahead.

The general system of accounting used by the company follows the Accountants' Association standard. The freight and express business of the company has not been very fully developed, owing largely to the fact that while the road has been in operation on both sides of LaSalle for over a year, the tracks have only recently been connected through this city, previous to which it was necessary to transfer passengers across this break in the road. It is unlikely that the company will attempt to develop any business in heavy freight, owing to the heavy grades and sharp curves on certain parts of the line. An excellent opportunity, however, is offered for the development of light package express business between the different towns along the line, and a good start has already been made in this direction.

The portion of this road already built may be considered as the beginning only of a future system of considerable extent. Plans have already been prepared for further extension of the road in both an easterly and a westerly direction. It is probable that the next step will be in the direction of an extension running east from Marseilles, and the purpose is to ultimately extend this eastern branch to connect with some of the suburban lines entering Chicago.

The officers and heads of departments of the company are: W. B. McKinley, president; George F. Duncan, vice-president; Edward Woodman, secretary and treasurer; H. E. Chubbuck, general manager; Frank Bedard, superintendent; Charles R. McMillin, assistant superintendent and master mechanic.

(To be continued.)

March Meeting of the Indiana Electric Railway Association.

The regular meeting of the Indiana Electric Railway Association was held at Lebanon, Ind., March 9th. The Indianapolis & Northwestern Traction Co. provided a special car leaving Indianapolis shortly after 9 o'clock. On reaching Lebanon a brief inspection was made of the power house and shops of the Indianapolis & Northwestern Traction Co., after which the meeting was called to order at 11:20 a. m. in Castle Hall.

In the absence of President Henry, who is now in California for a trip of several weeks, the vice-president, Mr. J. W. Chipman, general manager of the Indianapolis & Eastern Railway Co., presided. Mr. Paul H. White was also unavoidably absent, and Mr. E. G. Hendrickson, auditor of the Indianapolis & Martinsville Rapid Transit Co., served as secretary.

After the reading and approval of the minutes of the last meeting, the subject for discussion, "Coupon Ticket Books," was opened by Mr. F. D. Norviel, who stated that after three meetings of the committee, the compilation of data concerning rates on the Indiana electric lines, and conferences with representatives of the Ohio Interurban Railway Association, the committee felt that it could not report definitely at this time, and asked that it be given another month for further consideration. He suggested, however, that a preliminary report, which had been prepared by Mr. W. R. McKown, be read and discussed at this time.

Mr. McKown reported that the committee had secured from the Indiana roads interesting information as to the number of miles operated, the rates per mile one way on which fares were based, the percentage of reduction allowed on round trip tickets, and the percentage of reduction given on mileage books now used. These reports show that the rate per mile varies from 1¼ to 2¼ cents, the average being 1.7 cents per mile. For this reason, the committee believed that a mileage book would be entirely impracticable, and therefore recommended a coupon ticket book that would be interchangeable. At present Indiana companies are selling mileage books, coupon books or 100-ride books, to meet various local conditions, and on these the discounts range from 10 per cent to 60 per cent.

The difficulty standing in the way of adopting the Ohio interchangeable coupon book is that the roads in Ohio receive nearly 2 cents per mile, so that with a discount of 16 2-3 per cent the net rate received by them is between 1½ and 1 2-3 cents. With a rate on mileage books on the Indiana lines that is about 1½ cents now a discount of one-sixth more would reduce the net rate to 1¼ cents, which is considered as too low. Mr. McKown, in this report of progress, made a number of recommendations as to the coupon book that would best serve the needs of the Indiana roads. The report was afterwards withdrawn, so that its recommendations are not available for publication at this time.

A general discussion as to conditions to be met in designing a book that would be satisfactory for both the Indiana and Ohio roads followed.

Mr. E. C. Spring, president of the Ohio Interurban Railway Association, was present and addressed the meeting. He stated that it had been difficult to agree upon the Ohio book, which has been in use for several months and is now very popular, and expressed the belief that the Indiana association could solve the question before it in an equally satisfactory manner. He suggested that data similar to that compiled by Mr. McKown be secured for all of those Ohio roads which could be parties to any contract that might be entered into by the Indiana companies. At this time all Ohio interurban roads, except the Appleyard properties, are using the Ohio book, and it is expected that arrangements will very shortly be made by which the Appleyard lines can join the others, thus making the books available for through service between Zanesville and Richmond, and also from Cincinnati through to Toledo and Cleveland, as soon as the Findlay-Lima road shall be completed.

Mr. Charles G. Lohman, superintendent of transportation of the Indiana Railway Co., South Bend, was added to the ticket committee, which was given a month longer and instructed to confer with a committee of the Ohio association before making its final report.

The resignation of Mr. A. L. Drum as a member of the executive committee was received and accepted.

The meeting then adjourned, after a vote of thanks to Mr. C. C. Reynolds and the Indianapolis & Northwestern Traction Co. for the courtesies extended on the occasion of this meeting.

After dinner at the Richey House, the party boarded a special car, which made the run to Lafayette and then returned to Indianapolis. Very fast time was made in both directions, the run from Lafayette to the terminal station in Indianapolis being made in something less than 2¼ hours.

Terminal Station for Detroit.

Messrs. Henry A. Everett, C. W. Wason and Warren Bicknell, of Cleveland, O.; J. C. Hutchins, of Detroit, and Valentine Winters, of Dayton, on March 9th, visited Indianapolis to inspect the Traction and Terminal Building. Mr. Hutchins advises us that he is not satisfied with the present terminal station for interurban passengers in Detroit, and the company is casting about for better arrangements, but as yet has not determined upon a plan. Practically the same situation exists at Toledo and something will probably be done there also.

The Power Plant of the Chattanooga Electric Co.

The power plant of the Chattanooga Electric Co., of Chattanooga, Tenn., is of especial interest as a steam turbine station for a considerable time in practical operation, and also for several features of design and operation, among which may be mentioned the installation for cooling condensing water and the unusually complete equipment of meters in the station. The principal business of the company is lighting and power, but it has since July 3, 1904, furnished all the current used by the Chattanooga Electric Railway Co., and part of it since July, 1902.

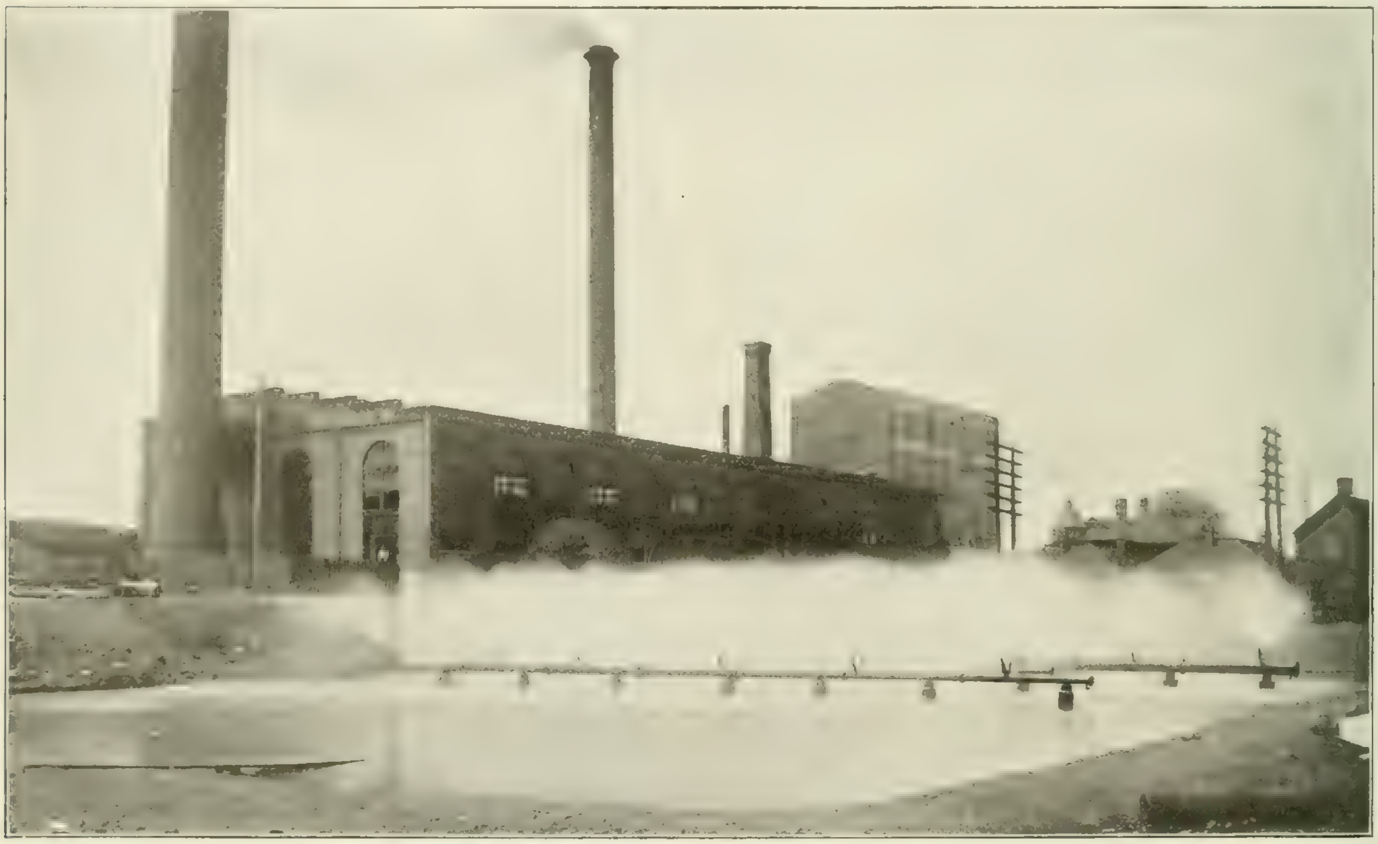
The Chattanooga Electric Co. was organized Mar. 1, 1903, and Jan. 1, 1904, took over the Chattanooga Light & Power Co., which had at that time nearly completed the work of building an addition to its power plant. The old station had an aggregate capacity of 1,640 kw., besides two Brush arc machines of 100 lights each. The 1,640 kw. included 500-volt machines of 1,000 kw. capacity and alternating current machines of 580 kw. capacity. The addition to the old station was 75 ft. long, making the present engine room 165 ft. long by 45 ft. 10 in. wide. The boiler room is somewhat longer, its dimensions being 180 ft. by 36 ft. 4 in.

The building is of brick, with roof of book tile covered with asphalt and gravel, and carried on steel trusses. There are now installed 2,640 h. p. of boilers, and foundations are now in place for two more of 410 h. p. each. Four new Babcock & Wilcox boilers of 410 h. p. each, provided with superheaters and designed for 200 lb. working pressure, although the pressure carried at present is 150 lb., were placed in the new portion of the station.

The stacks are two in number and situated at opposite ends of the building. That for the old portion of the station is 150 ft. high and 6 ft. internal diameter. The new stack, which was designed by Sargent & Lundy, of Chicago, is 200 ft. high and 10 ft. internal diameter and lined throughout with fire brick. The foundation for this is of broken stone concrete, 30 ft. square and 25 ft. deep. The main flue at its greatest cross section measures 7 ft. in width and 10 ft. 6 in. in height.

In the generator room are three 500-kw. Curtis steam turbines, which drive three-phase, 2,300-volt, 60-cycle alternators. These three units constitute the new generating equipment at present installed. A 1,500-kw. turbine unit will be next installed when the demand on the station justifies its use. A 400-h. p. tandem compound engine driving a 500-volt direct current generator, and a 200-kw. three-phase alternator, which constituted part of the old equipment, are held as a reserve.

There are provided three Worthington surface condensers with 2,000 sq. ft. of cooling surface each, and each is equipped with auxiliary coolers. For circulating the condensing water there are two 75-h. p. Worthington centrifugal pumps, one of which is a single stage pump driven by a 75-h. p. G. E. induction motor, and the other a two-stage pump driven by throttle valve simple engine, the exhaust of which is used to heat the feeder water; the feed-water heater is of 3,000 h. p. capacity of the "National" closed coil type. The air pumps are Worthington make, known as the rotative vacuum pump, and both are steam driven.



POWER HOUSE OF CHATTANOOGA ELECTRIC CO., COOLING POND IN FOREGROUND.

The transformer equipment of the station includes four 300-kw. rotary converters, 600 volts on the direct current side and 400 volts six-phase on the alternating current side; and four 330-kw., 2,300-volt-440-volt, three-phase-six-phase transformers. Three of the rotary converters are used for the street railway and the fourth motor loads.

The auxiliary apparatus includes three exciters, one of 35-kw. capacity driven by a G. E. vertical compound marine type engine operating at 450 r. p. m., one of 35 kw. driven by a 50-h. p. three-phase induction motor, and one of 13 kw. driven by a 20-h. p. induction motor.

On the switchboard are eight railway feeder panels, four lighting

feeder panels, with oil switches and two three phase feeder panel[illegible]

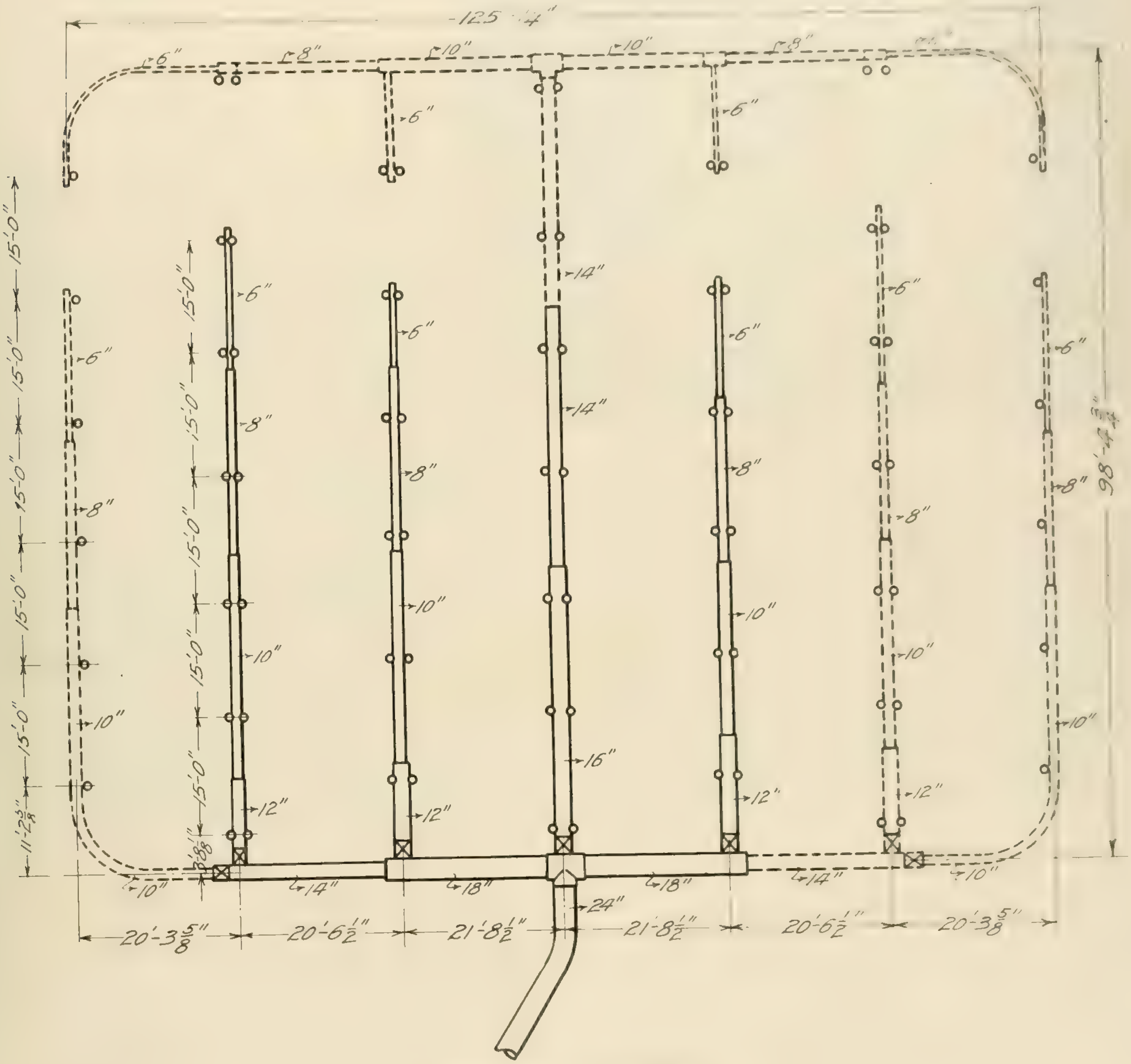
The station is provided with meter[illegible] so that the entire output may be carefully and systematically measured, including the power required for operating all the electric auxiliaries in the station itself. There are altogether 26 meters in the station, all being Thompson induction wattmeters, single phase and polyphase, excepting the four on the direct current ends of the rotary converters. This meter equipment will enable interesting and valuable data to be secured, though they have been in service too short time to enable results to be presented in connection with this article.

One of the most interesting features of this station is the method of cooling the condensing water. Adjoining the building a pond about 150 x 300 ft. was excavated to a depth of 4 ft., the level of the water being about 8 ft. below the condensers. Circulating water returned from the condensers is distributed through a set of pipes provided with 42 nozzles, through which the water is discharged upward. The complete design for the distributing piping is shown in one of the accompanying illustrations and provides for 78 nozzles. The portion of the piping not yet installed is indicated in the drawing by dotted lines.

The rectangle defined by the center lines of the outermost pipes is 98 ft. 4 in. by 125 ft. The pipes are supported upon brick piers spaced at intervals of about 20 ft. in each direction; for the larger sized piping [illegible] and the other piers are 12 in. square with footings 18 in. square. One of the [illegible] top of the piers [illegible] pipe. For the [illegible] ing pond the rollers consist of 2-in. cylinders 12 in. long.

The nozzles were furnished by the Schutte-Korting Co., of Philadelphia. The discharge opening is 1¼ in. in diameter and the interior of the nozzle is provided with spiraling so that in its passage the water is given a rotary motion, the effect of which is to greatly increase the spraying or dispersion of the water after leaving the nozzle. The nozzles, except on the extreme outer lines of piping, where they are single, are placed in pairs with the axes in a vertical plane at right angles to the center line of the supply pipe, the axis of each nozzle making an angle of 30 degrees, with a vertical plane through the center of the supply pipe. The connection of each nozzle to the supply pipe is by a 3-in. nipple 6 in. long. The effect of each pair of nozzles is to throw a mass of spray to the height of about 15 ft., which in falling covers an area of 15 x 30 ft. The central pipe of the cooling system, when the additional piping now indicated by the dotted lines of the diagram is installed, will be provided with an expansion joint.

A dike extending [illegible]



PIPING DIAGRAM OF COOLING POND

a canal through which water is conducted to the suction chamber, the object being to draw the supply from distant parts of the pond to give greater time for cooling. The suction chamber is a brick well, 14 ft. 6 in. square, with an entrance 12 ft. wide fitted with racks; controlling the flow of the water are two gates 4x 4 ft. The suction pipe is 24 in. in diameter.

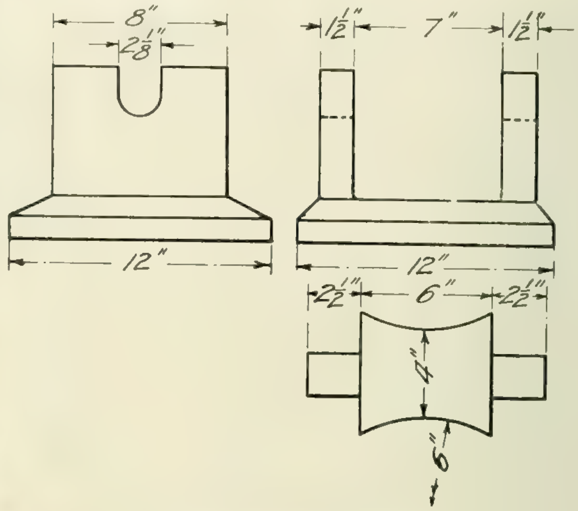
THREE 500-KW. CURTIS TURBINE UNITS.

The loss of water in the pond is supplied from a well 550 ft. deep, from which water is drawn by means of an air lift. An Ingersoll-Sergeant air compressor supplies air for this purpose; this machine is located in the boiler room of the station.

The operation of the cooling pond for a warm month and for a cold month is shown by the curves in two of the accompanying diagrams. It will be observed that during the month of September, 1904, the circulating water was cooled from 10½ to 15 degrees by being sprayed through the air. This variation in the extent of cooling is due to the difference in relative humidity and the effect of a very humid atmosphere can be very easily traced on the diagram as shown.

During the month of January, 1905, the cooling effect varied from 16½ to 19½ degrees. In the temperature curves shown the temperature for each day is the average of readings taken at intervals of three hours. The humidity curves shown were plotted from data furnished by the United States weather bureau at Chattanooga, the humidity for each day being the average of observations made at 7 a. m. and at 7 p. m.

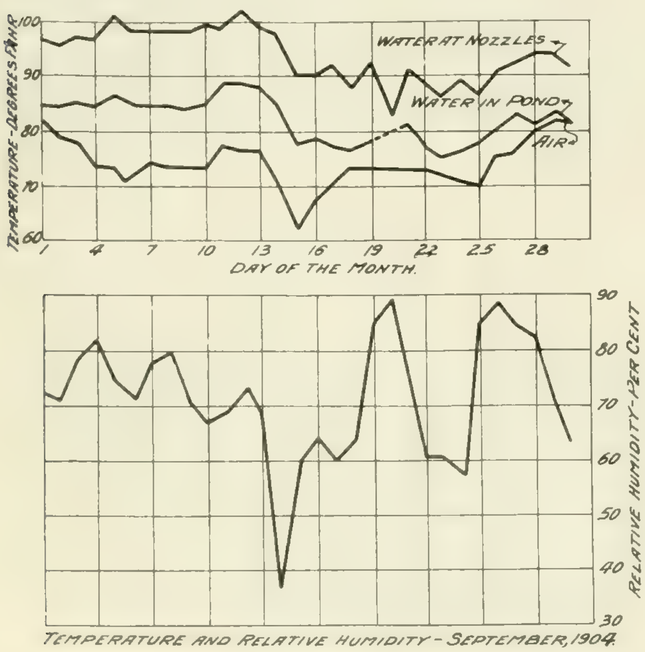
The new equipment of the station was put in complete operation July 3, 1904, since which time the three turbine units have been in continuous daily operation, supplying all the current required by the Chattanooga Electric Railway Co. and the lighting of the city, without any interruptions whatever.



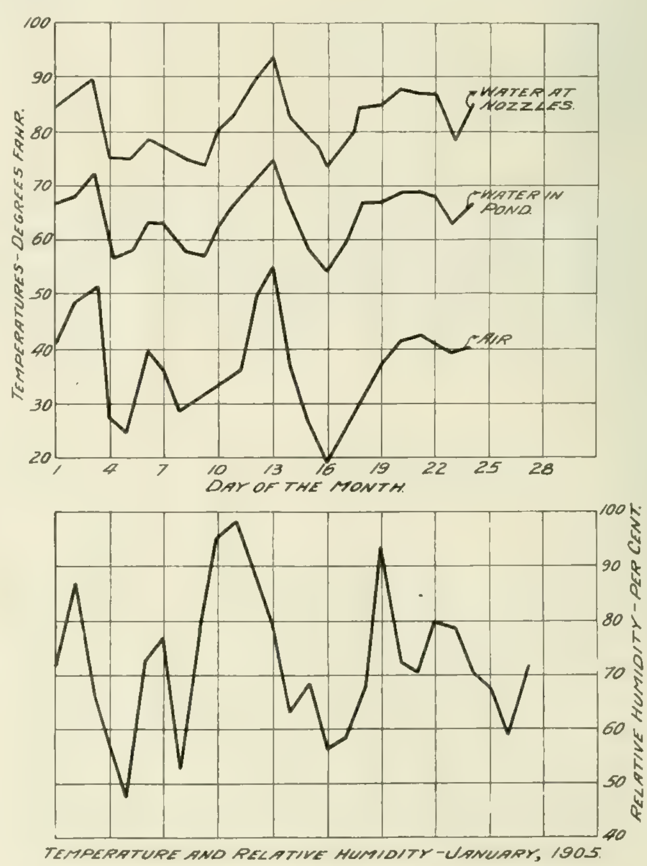
TYPE OF ROLLER BEARING ON PIERS.

The plant was planned by the engineers of the General Electric Co., which furnished the machinery and did the construction work. Sargent & Lundy, of Chicago, were in consultation on portions of the station, having designed the new stack and advised as to the cooling pond and condenser installation.

The manager of the Chattanooga Electric Co. is Mr. Byron T. Burt, to whom we are greatly indebted for the foregoing data and illustrations.



TEMPERATURE AND RELATIVE HUMIDITY-SEPTEMBER, 1904.



TEMPERATURE AND RELATIVE HUMIDITY-JANUARY, 1905.

Recent Work of the Electric Railway Test Commission.

BY HENRY H. NORRIS, SUPERINTENDENT OF ELECTRIC RAILWAY [illegible]

The field work of the Electric Railway Test Commission is now nearing completion, the test corps now being at work upon the [illegible] of the Indiana Union Traction Co. investigating the air resistance to the motion of car bodies. As will be remembered, the Commission, consisting of Messrs. J. G. White, H. H. Vreeland, J. H. McGraw, W. J. Wilgus and G. F. McCulloch, was appointed over a year ago by President Francis of the Louisiana Purchase Exposition in consultation with Professor W. E. Goldsborough, chief of the Department of Electricity. The Commission immediately began preparation for tests at St. Louis and elsewhere and early in the summer actual testing was begun. A test corps of ample size, selected from various technical schools, has been at work making such tests as were recommended by a number of engineering committees appointed by the Commission to act in an advisory capacity. The tests have comprised studies of the alternating current losses in rails; of the efficiency of various methods of braking and accelerating both city and interurban cars; of the energy consumption in

INTERIOR VIEW OF TEST CAR

cars with different kinds of service; and of the resistance offered by the air to the motion of cars at high speeds.

While the earlier part of the work has been described in some detail in the technical press, but little has been said regarding the special dynamometer car designed and constructed for the purpose of measuring directly the head and rear pressures and the side and roof resistances of car bodies. This car was recently completed at the shops of the Indiana Traction Co. at Anderson, Ind., this company having co-operated heartily in the rather tedious work incident to an experiment of this sort. The equipment for the car was secured partly by loan and partly by purchase of supplies through funds donated to the work by various electric and steam railway companies and by engineers interested in the investigation of important railway problems. The Indiana Union Traction Co., in addition to the facilities offered in its shops and offices, placed at the disposal of the commission a pair of high-speed Baldwin trucks and a set of four Westinghouse No. 85 motors, rated at 75 h. p. each. The Baldwin Locomotive Works made the changes in the center plates and side bearings of the trucks necessary to enable them to turn freely under the frame of a steel flat car loaned by the Pressed Steel Car Co. A motor-compressor of ample size with governor and brake cylinder was furnished by the National Electric Co. and the test corps designed and constructed the special brake rigging necessary to adapt these to the steel car frame. A [illegible] buffers were constructed to prevent damage to other cars in coupling, and heavy chains were used to prevent excessive motion of the car frame with respect to the trucks. As the frame was raised considerably above its usual height by the changes mentioned, this was considered desirable.

An interurban car body, 32 ft. long without vestibules, rolls freely upon rails screwed to the flat car floor. This body with a special steel vestibule and a standard vestibule was supplied by the J. G. Brill Co. Under the side sills of the dynamometer body are mounted eight Chapman double-ball bearings and these carry four axles of 3 7-16 in. diameter, 9 ft. long. Upon the axles are specially chilled wheels, 12 in. in diameter with ground treads. The rails are also ground where they come into contact with the wheels. By this method of mounting there is, for practical purposes, no friction between the body and the flat car floor. The body is restrained from excessive motion by various effective safety devices. The pressure of the air upon the body is measured by means of scale beams, constructed for the tests by Fairbanks, Morse & Co. and lent by them. The beams are supplied with dashpots, and the weighing mechanism consists of the regular beam with weights and

VIEW SHOWING MOVABLE VESTIBULE AND GUIDE FRAME

poise, and in addition a spring balance with dial is employed to render easier the manipulation of the machine.

For the purpose of separating the head and rear resistances from the total, the vestibule is independent of the body, but is carried therefrom by means of a link suspension. In order to guide the vestibule and to transmit the pressure to the weighing device a steel-trussed oak frame, attached to the vestibule, projects into the car a distance of 8 ft. and is guided on all sides by small Chapman bearings. This method of suspension has proved very satisfactory. In order to secure stability of the vestibule and body, each of these is held against the scales by counterweights, the forces of which are transmitted through bell-cranks and levers, all equipped with knife-edge contacts.

In order to eliminate from the measurements all forces but those due to the air, the controllers are mounted upon iron stands carried upon the floor of the flat car and projecting into the car body, thus removing the effect of stiffness in the controller cables, a serious matter in a car of this size. Similarly the trolley base is inside the car, carried upon the top of an oak post which projects upward from the flat car. No error is possible, therefore, from the resistance between trolley wheel and wire. While the forces mentioned are small in amount, the sensitiveness of the apparatus is such that the precautions taken are necessary.

The construction of the air resistance car was carried out by the

test corps, which put in about three months in the actual detail work. This included the assembling of the equipment, the construction of the special brake rigging and other equipment, with the exception of the heavy steel and wood work, which was done by outside parties from the funds of the Commission. The corps also wired the car for a double-end controller arrangement, one controller of the Westinghouse L-4 type being loaned by the Traction company, the other by the Westinghouse company, the latter also supplying a pair of circuit breakers and a large number of resistance grids for controlling the running speed of the cars.

The Commission has realized the necessity of making exact measurements of all of the quantities involved in these tests, especially in regard to the matter of speed. For this purpose two independent plans are employed. The test track, somewhat over 25,000 ft. in length, is divided in sections of 1,000 ft. each. The sections are marked by large signs plainly numbered. The instant of passing each sign is indicated on the graphical record of a General Electric recording ammeter, which is also used for the current record. This ammeter records upon a strip of paper regular intervals of five seconds each. Upon this record is superimposed the time of passing

"LOUISIANA," WITH PARABOLA VESTIBULE.

each of the section signs, this being accomplished by closing a switch for an instant as each of these signs are passed. Thus the time of passing through a section of 1,000 ft. is accurately recorded.

The second speed device consists of a small dynamo carried upon the truck frame and geared to the car axle by sprocket wheels and chain. This dynamo is an "Apple" igniter of the Dayton Electrical Manufacturing Co. It has permanently magnetized field poles, but these also carry exciting coils through which the field current of the recording ammeter is also passed. As this current must be maintained accurately at a value of one ampere for current measuring purposes, it is admirably adapted for the purpose mentioned. The e. m. f. generated by the dynamo is read upon a Weston voltmeter specially arranged for this purpose. The e. m. f. at 60 m. p. h. is about 7 volts. The readings are directly proportional to the speed. This apparatus has now been in operation for some weeks and has demonstrated its accuracy and convenience.

In addition to the speed measurements, accurate readings at 5-second intervals of motor e. m. f. are recorded, and the current record is continuously checked by means of a direct-reading ammeter in the same circuit. The direction and velocity of the wind are also taken at frequent intervals, accurate anemometers having been supplied by Queen & Co. for the purpose.

The tests on the "Louisiana," as the air resistance car has been named, will continue until sufficient data are at hand to determine the resistance to the motion of different shapes of car front at all speeds reached by modern interurban cars, up to 70 miles per hour, this limit being set by the line and motor capacities. A speed of 72 miles per hour has been reached for a short period.

During the past few days another important investigation has been completed by the use of a car exhibited by the Cincinnati Car Co. at the Exposition. This car is supplied with the same motor equipment as the "Louisiana," but it has in addition the latest type of Westinghouse electro-pneumatic control. The test made upon this car were designed to supplement those previously made and to supply important data, not only in regard to the control system, but having reference in general to heavy interurban car operation problems. An interesting feature of these tests was that all records were taken autographically, a special recording table having been constructed along the line of the experience gained at St. Louis. A wide strip of paper is carried by motor power across a glass table, on opposite sides of which the observers are stationed with their instruments. Opposite each is a guide and pencil carriage, the latter of which is operated by a cord carried over a drum attached to a pointer over the instrument needle. The observer simply follows the motion of the needle with his pointer and the result is recorded. The base line for each record is traced by a separate pencil carried by an electro-magnet, through which passes the current from a time-marker recording five-second intervals, thus synchronizing all of the records. While somewhat similar to other recording apparatus in use, this equipment was designed independently and has some features of its own.

The results of all the work of the Commission will be published in full in a report to be issued as soon as practicable after the completion of the work.

Data on Cost of Power.

Mr. A. M. Frazee, master mechanic of the Columbus, Buckeye Lake & Newark Traction Co., at the February meeting of the Ohio Interurban Railway Association, stated the cost of power on that line was .41 cent per kilowatt-hour at the switchboard. This cost includes labor, fuel, lubricants and repairs, but no charge for interest on investment or for depreciation.

The station has 1,800 h. p. of boilers and two 1,200-h. p. Hamilton-Corliss engines direct connected to 800-kw. 13,200-volt alternators, and one 2,500-h. p. Allis-Chalmers engine direct connected to a 1,500-kw. alternator. The fuel is natural gas at 8 cents per 1,000 cu. ft. (8 oz. pressure).

The station output is from 585,000 kw. h. to 640,000 kw. h. per month. The energy consumption is 5.6 kw. h. per car-mile.

Elevated Railway Accident in Chicago.

The rear car of a shuttle-train which operates over the tracks of the Chicago & Oak Park Elevated Ry. from Canal St. to the old terminus of the line at Market and Madison Sts. was derailed and overturned in a fog on the morning of March 7th. The accident was one of that peculiar class, the cause for which is unaccountable, because in this case the frog and switch points were properly locked in their correct position and the detector bar was unworn. The first two cars of the train took the switch and curve properly, but the last car was derailed and overturned in such a manner that the front trucks followed the forward cars around the curve and the rear end of the car with its trucks was swung at right angles across the double track structure and stopped on the opposite track. There were 60 people in the car at the time of the accident, but none was injured fatally.

Membership Committee, A. S. R. A.

At the meeting of the Executive Committee of the American Street Railway Association held in New York, February 3rd, President Ely appointed the following committee on membership, which was authorized at the last convention:

H. H. Vreeland, president New York City Railway Co.

C. S. Sergeant, vice-president Boston Elevated Railway Co.

James F. Shaw, president Boston & Worcester Electric Railway Co.

William A. House, general manager United Railways & Electric Co.

H. J. McGowan, president Indianapolis Traction & Terminal Co.

W. Caryl Ely, president International Railway Co.

Daniel Royse, editor "Street Railway Review."

James H. McGraw, Street Railway Journal.

John G. Lane, editor Street Railway Bulletin.

At the annual meeting of the Ft. Wayne & Wabash Valley Traction Co. stockholders, the old directors and officers were re-elected.

Rapid Theater Construction in Elmira.

Within three miles of the business district of Elmira, N. Y., nestled among the hills close to the Chemung River, is a charming pleasure resort known as Rorick's Glen Park. Nature has been very liberal in bestowing her gifts upon this locality, its natural beauties being many. A short ride on the electric railway brings one to the park terminal, an illustration of which is shown. This is an appropriately arranged building at the entrance of the resort. A rustic foot bridge leading to the park grounds spans the river near the terminal station. Rorick's Glen Park is laid out in an attractive manner, with well made roads and paths winding about through thickly wooded knolls and ravines.

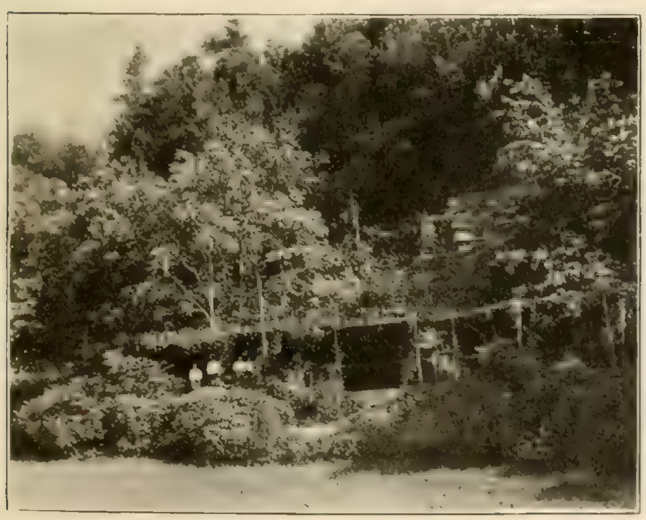
JUNE 24.—RUINS OF BURNED CASINO.

Added to the natural advantages of the park are a large number of such pleasure attractions as are usually found at outing places. In originally fitting up Rorick's Park as a street railway enterprise, the company showed its forethought by providing a great number of well constructed buildings for the use of visitors. The amusements located throughout these buildings and the park are of such a class that they will compare favorably with those of any park of equal size. Among other favorite attractions are a merry-go-round of unusual size and fine workmanship, a miniature railway, and many well kept pleasure boats which may be rented at a nominal charge.

PARK TERMINAL BUILDING.

The grounds are lighted throughout with arc and incandescent lamps, special stress having been laid upon arranging the lighting of the theater in such a way that the illumination adds greatly to the attractiveness of the productions given on the stage. The river, by which the entire north side of the park is bounded, adds greatly to the value of Rorick's Glen as a recreation place.

The Elmira Water, Light & Railway Co., which controls Rorick's Park, has traffic arrangement with the steam roads entering Elmira by which excursion parties coming to Elmira from other cities are sold through tickets to the park. This company operates the park under its own management, and maintains a high standard for its



VIEW IN RORICK'S GLEN PARK.

VIEW IN RORICK'S GLEN PARK.

attractions. Admission to the park is free to patrons of the road. In order to handle the traffic, which averages throughout the summer season 2,000 passengers a day, the company runs trains of three

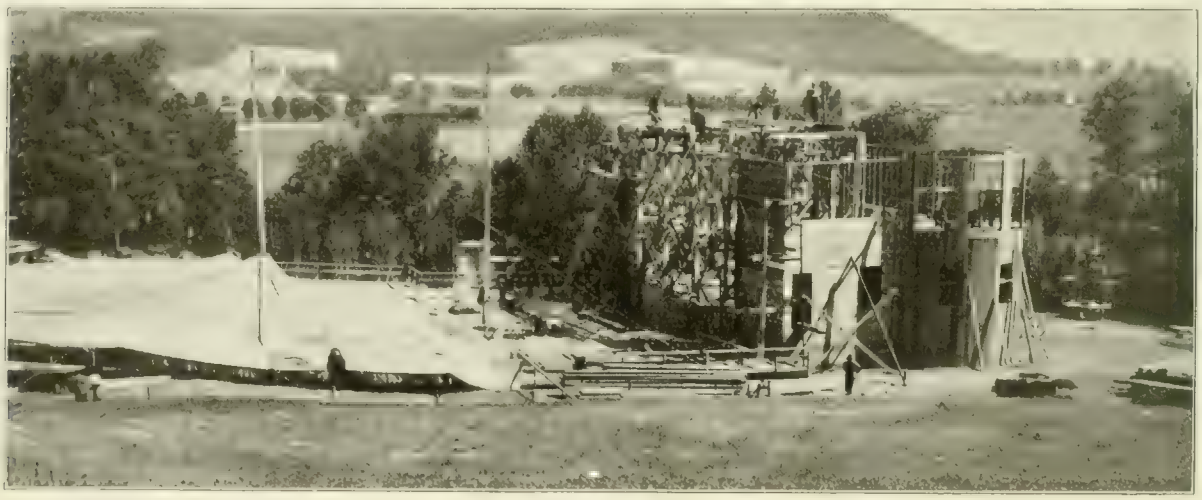
JUNE 27—LAYING NEW FLOOR.

cars each, with two extra trains running as sections of the regular train. During the winter months the traffic on this line is handled by single cars.

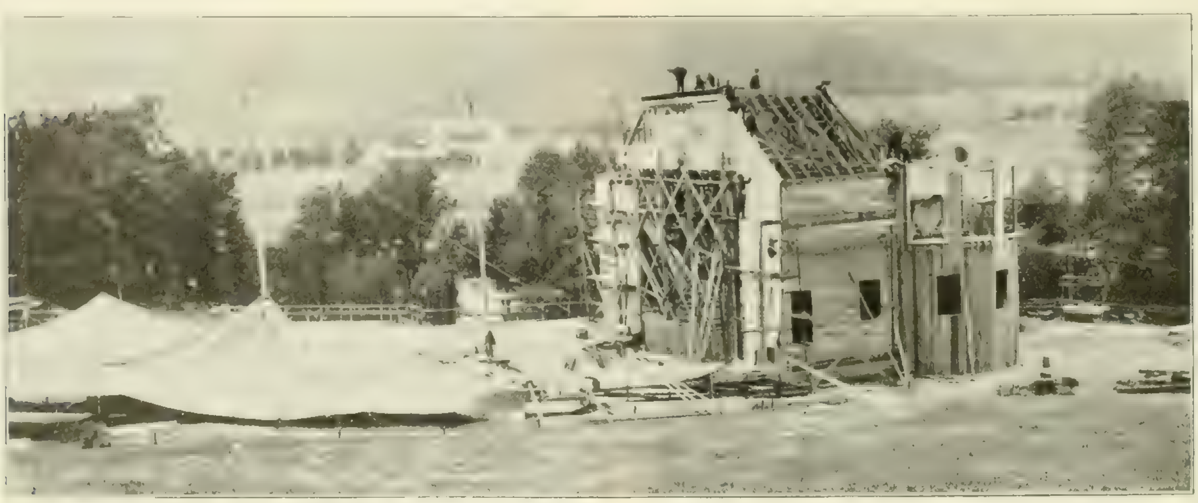
When the company originally fitted up this park as a street railway enterprise, a casino with a seating capacity for 1,200 persons was built, and a large stage at one end was fully equipped and stocked with scenery suitable for the production of the vaudeville and light opera performances which are presented twice a day during the summer season. These productions are well managed, and have been so popular an attraction that throughout the summer seasons there have scarcely ever been any vacant seats during a performance.

On June 24, 1904, this casino caught fire and burned to the ground, leaving the railroad company without means for continuing its best park attraction. One of the illustrations shows the ruined building immediately after this fire. At the time of the fire a stock opera company was playing to the full seating capacity of the casino. After the burning of the building this company was not released, but on the other hand steps were at once taken to quickly rebuild the theater so that the loss in passenger traffic between the city and the park would be as small as possible. The accompanying illustrations show in an interesting way the unique methods used by the management in hastening this work.

After the debris had been cleared away, the floor of the entire building was laid in its finished condition. This work was well on the way by the night of June 27th. July 1st saw the completion of that part of the new theater which contains the stage, scenery and dressing rooms. During the three days occupied in building the floor and the stage a large circus tent had been ordered by wire and brought to the park. The next two days, July 2d and 3d, were occupied in adding the finishing touches to the parts of the building already constructed, and in raising the tent over the seating portion of the theater. The evening of July 3d saw the completion of this work and other details, so that on the 4th of July the theater performance was given as though no interruption had occurred. Since this time the roof has been extended over the entire theater, and now the com-



JUNE 30—BUILDING STAGE



JULY 1—STAGE COMPLETED.

pany has a building which is larger and better suited to the purpose than the old one. The seating capacity of this new [illegible] 1,400.

The rapidity with which this emergency was met and [illegible]fully

JULY 3. STAGE AND TENT

overcome may be credited to the energy and skill of Mr. W. W. Cole, vice-president and general manager of Elmira Water, Light & Railroad Co. Mr. Cole took personal charge and pushed the work of construction as rapidly as possible.

Motor Buses vs. Electric Tramways.

BY J. CLIFTON ROBINSON.*

"The Financier and Bullionist" in a recent issue spoke with no uncertain voice on this matter, and was good enough to accredit some remarks of mine as the ultimate end of all knowledge on the question of London traffic. That journal said:

"We are glad to see that the folly of this pernicious propaganda has been ruthlessly exposed by no less an authority than Mr. Clifton Robinson, whose little finger has greater knowledge of London's traffic problem than the combined craniums of Carmelite House. In asserting that 'a more unheard-of, pretentious and stupid tirade had never been before suggested by any sensible body of men than had been printed lately in certain newspapers,' Mr. Clifton Robinson was merely expressing what all persons of experience have been thinking ever since the Daily Mail started its latest sensation. All the schemes brought forward are merely airy suggestions, and as commercial propositions are beneath contempt. To assert, as has been done, that motor buses are destined to supersede electric tramways is the very acme of absurdity. Motor buses may have their uses as feeders of electric trams and railways, and their employment in place of the existing horse-driven vehicles may be only a question of time. But even on that point it is impossible to make any definite prediction."

Whilst I am human enough to appreciate the high compliment conveyed, I can regard it only as far transcending any merits I may have acquired in the course of a somewhat long and varied experience in traction economics. I am, however, none the less emboldened by such an unequivocal endorsement of my views; and the opinion of so eminent and astute a financial organ, long recognized in the city as representing the practical—in contra-distinction to the sensational—element in journalism, has, I venture to think, a significant bearing upon this controversy.

It will be gathered from what is here said that I do not consider seriously the threatened supersession of electric tramways by motor omnibuses, nor do I anticipate any panic amongst either directors or shareholders. That a mechanically driven vehicle will, in the plentitude of time, supplant that anachronism, the horse bus, is beyond question. [illegible] must ultimately be driven into the shades of oblivion "unwept, unhonored and unsung."

The Hon. Arthur Stanley, president of the Tramways and Light Railways [illegible] day, and [illegible] wheel on a metal rail, it would displace tramways, but this was certainly not [illegible] course strikes at the root of the matter, and it will be long before it can be demonstrated that a mechanically propelled vehicle can be operated along rough and unprepared roadways more economically than an electric tram car representing, as it does, motion over two smooth surfaces, steel upon steel.

I should further like to quote what Sir George White, in addressing the shareholders of the Bristol Tramways and Carriage Co. at Bristol on February 16th said on this subject:

"Personally, with some experience as an owner of private cars, I believe there is a future for mechanically propelled vehicles of various kinds, and my colleagues and I have spent considerable time during the last few years in following up the practical details of cost of working any vehicles of this class which have up to the present been produced. Motor omnibuses today cannot be accepted as a commercial success."

In this practical pronouncement I thoroughly agree.

The motor bus, chassis, and tires, equal to the onerous conditions of street and road passenger service, have not yet been evolved. The thing is still in its experimental stage. Burdened with the weight of its own motor equipment, and running on an ordinary roadway, such a vehicle must necessarily demand, in proportion to its weight and carrying capacity, a far greater propulsive power than an electric car, proceeding, as I have said, along smooth rails by energy transmitted from one central source of supply. How any one with the most elementary knowledge of physics can imagine that a vehicle propelled on an ordinary macadam road can, given equal conditions in other respects, compete with another running upon rails, is incomprehensible. The factor of vibration is necessarily one that must largely dominate the problem of motor transit.

On the question of expenditure, to put it broadly, it is wholesale against retail, and I, as one of a family of motorists of many years' experience, do not hesitate to say that the motor bus must necessarily, because of the heavy outlays involved, exact from the public two pence for a service that the electric car now renders profitably for one penny.

Owing to the limited and sporadic nature of their operations, it is difficult to obtain any reliable figures bearing upon the running of public motor buses, but taking those that are generally accepted, applied in connection with the favorable conditions afforded by the streets of London, where such vehicles have every opportunity for successful demonstration, a comparison with existing electric tramways is worth considering.

Taking the maximum carrying capacity of a motor bus at 32 passengers, we get a maximum earning power of 1s. 4d. per car-mile.

The London United Electric cars carry 70 passengers, representing 2s. 10½d. per car-mile run. The average annual revenue per electric car-mile run works out at 10d. against a total expenditure of 6d., and last year 50,000,000 passengers used the cars at fares averaging less than half that sum for the working classes, the lines being maintained in full operation for 20 hours out of every 24 all the year round.

Taking the published figures of the operations with motor buses in London, we find the earnings quoted at 12.52d. per mile run, whilst the working expenses are given as 10.52d. Whether the working expenses include repairs is not stated, though this particular item is of vital importance. Further, they are based on what is almost purely novelty traffic. On the routes over which they run, they of course rob the horse buses, and until their adoption becomes more general, no really reliable data can be obtained on the salient points of earning capacity, depreciation and renewals. If these figures are carefully considered it will be seen at once what an absurd foundation, commercially speaking, there is for the motor bus in competition with the electric tram car.

In some isolated districts where there are as yet no tramways, the motor bus may for a time become the local juggernaut and be allowed to pursue its rocky and dangerous course. It is at present

*Mr Robinson is managing director and engineer of the London United Tramways Co., Ltd., and of the Middlesborough, Stockton-on-Tees & Thornaby Electric Tramways; chief engineer of the Bristol Tramways & Carriage Co., Ltd., and director of the Metropolitan District Railway Co., which is now equipping its lines for electrical operation.

a "box of tricks" liable to breakdown, explosion and fire, and not only dangerous to life and property, but like the camel, cited by a writer famous in the two hemispheres, it "smells most awful vile!"

The period covered by these particular ventures thus far has not been sufficient to justify a sound judgment on the results likely to accrue under even favorable conditions, but in my opinion there is not the slightest justification for this hysterical outburst. Justification, as I say, there is none; explanation is not far to seek. The scare bears on the face of it the marks of a desire on the part of obviously interested parties, who synchronized the occasion to boom the unproved motor bus at the expense of other proved and successful methods of mechanical traction.

Free trade in omnibuses, whereby any and every person and snydicate having the means may congest the streets with motor buses, is to be deprecated. Over production would ensue, and competition, so fostered, and without the control which legislation has enabled local authorities and the Board of Trade to exercise over electric tramways, would be disastrous to motor bus promoters and the public alike. More than this, the prospects of a really effective mechanically propelled vehicle to replace the horse bus and cab would be seriously handicapped and most likely indefinitely delayed.

I should of course hesitate to say that the motor bus has no future, and representing, as I do, very important tramway interests in various parts of the country, I recognize that the time may come when manufacturers may produce a really efficient mechanically driven public vehicle and one which may be accepted as an auxiliary to electric tramways. But the day seems remote when they can even to this extent be adopted.

Experience has proved to demonstration that horse buses cannot "live with" electric tramways. The cars are quicker, cheaper, and more comfortable. In only one of these three essential points is the motor bus an improvement on the horsed variety. It may be a little faster—though there is so far no proof of that—but it cannot be cheaper (which is a question of working cost plus maintenance), nor will it be more comfortable (which is a question of road surface). In consequence of their (possibly) greater pace, motor buses may displace horse buses, but because they cannot give the same comfort and the same low fares they do not menace the existence of electric tramways.

The "Pall Mall" of Feb. 25, 1905, makes the following trenchant contribution to the controversy:

"The chances of motor omnibuses competing successfully with electric tramways are still being vigorously discussed in various quarters, most distinguished by conspicuous ignorance of the subject. For instance, the claim is constantly made that the motor bus must succeed because no capital has to be sunk in permanent way and in a power station. One reply is that so long as it is necessary to use india rubber tires on the wheels of the buses the claim is a pure illusion. The tire makers maintain solid rubber tires at a cost of two pence per mile run, and india rubber is not likely to become cheaper. For a business requiring a bus in each direction every four or five minutes—not a heavy city business—about 500 bus-miles per mile of route will be run per day, or, say, 180,000 miles per annum. Tire maintenance at two pence per mile run will accordingly amount to £1,500 per year for this mile of route. Capitalized at 5 per cent, that represents £30,000, which is a greater sum than an electric tramway, power station, cars and everything complete would cost per mile of route. Further, the maintenance of tramway car wheels costs only a minute fraction of a penny per car-mile run, and the maintenance of an entire tramway undertaking on a large scale can be done for slightly over a penny per mile run. Yet the above two pence still leaves all other bus repairs to be paid for, and a petrol engine cannot be maintained for nothing. Moreover, in order to carry the same number of passengers, double as many buses are required as tramcars, owing to the latter vehicles being so much larger. The first cost of the two buses is about £1,800; the first cost of the tram car is about £600. Therefore, without taking any other points (most of which tell in the same direction) into consideration at all, it will be seen that there is some hope for the tramway yet. The bus, however, will have plenty of scope in regions of small traffic, and on streets, such as those in the City and West End of London, where tramways are not allowed."

In the concluding sentence of this quotation lies the whole crux of the case for the immediate future of the motor bus.

In dealing with heavy passenger traffic, no uncertain and disconnected service, liable at any time to be interrupted or discontinued, will ever acquire or retain confidence, and this aspect of the matter very directly affects that great question of the housing problem for the solution of which electric tramways have done so much. In the permanence of a properly organized tramway the public has the same confidence as in that of our great railways.

The "London Times" of Feb. 27, 1905, dealt with this subject at some length, and its summing up briefly enumerates many of the points I have already discussed at greater length. Our leading journal delivers itself as follows:

"But wherever tramways can be conveniently laid, provided the population is great enough, their capital outlay will be justified, to say nothing of the frequency of service they will always give as compared with omnibuses. In the city, where tramways are impossible, motor-omnibuses will most certainly prove a boon, and it is more than likely that many of the smaller provincial towns which have so boldly embarked on tramways will bitterly regret their precipitation. But after making every allowance for a great success with omnibuses it is impossible to shut one's eyes to their limitations. They are handicapped by hilly routes; having to carry their own power with them they must have engines powerful enough for all gradients. The electric tram takes its power just when it is wanted, and only consumes it according to the work it is doing. More power also has to be generated to drive an omnibus than a tram, and unless local authorities keep the roads in the best of repair engines which at one season will do their work may refuse it at another. One might adduce many such arguments, but enough has been said to show that while there is a great future before the motor omnibuses, yet that the electric tram has also its own sphere, and that within this it has as yet nothing to fear."

In conclusion, I may perhaps be permitted to recall some observations of my own when lecturing before the Cleveland Institute of Engineers, Stockton-on-Tees, nearly five years ago. Summing up the case for electric traction and particularly referring to the overhead trolley system, I then said:

"It is simple in construction, easy in maintenance, cheaper than any rival in capital cost, and more economical in working cost from day to day than any other method yet known. The system is most elastic and comprehensive, for it is capable of meeting the most severe pressure of traffic on occasions, while it can be profitably extended so as to give tramway access to sparse suburbs where the cost of no other method of mechanical traction could be faced. In a word, I can say that an extended experience, embracing nearly the whole of Europe and the Continent of America, and a most careful inquiry into all inventions and proposals, convinces me that the overhead electric trolley system is today, wherever the question of street traction has to be considered scientifically and commercially the only system to which a community, a corporation or a capitalist can reasonably turn."

From that conclusion I see no reason, at present, to depart.

Memphis Street Railway Property Changes Hands.

Ford, Bacon & Davis, of New York, have acquired control of the property of the Memphis Street Railway Co., and several changes in the personnel of the company have occurred. Frank G. Jones retires as vice-president and general manager. George H. Davis, one of the purchasers, is made president. Thomas H. Tutwiler, who was engaged in the construction of the Yazoo & Mississippi Valley railroad, was elected general manager, while E. W. Ford, of New York, becomes superintendent of transportation, and W. H. Burroughs, for a number of years connected with the St. Louis Transit Co., was made secretary and treasurer.

Extensive improvements are contemplated by the new owners, a franchise for an extension of 16 miles having recently been granted by the city council.

The Columbus, Delaware & Marion Electric Railroad Co. has ordered new cars to be used for carrying United States mail between Marion and Columbus. The cars will be the combination style, the front end being used for mail while the rear part will be for passengers.

Correspondence Regarding the A. S. R. A.

NO NEED OF REORGANIZATION—CO-OPERATION IS ESSENTIAL TO GOOD RESULTS.

Editor "Review":

In my opinion the present organization of the American Street Railway Association can accomplish a great deal of good, without any radical change. I believe that the street railway representatives should assemble and put in the better part of a week—say, for instance, five days—and eliminate all trolley parties, banquets and other entertainments, and get down to business. Let the Accountants' and the Mechanical and Electrical associations assemble by themselves in the same city and on the same dates. Engineers and track men should, I believe, also be represented, if not with the Mechanical and Electrical association, by a separate organization.

The officers in charge of transportation, general managers and other officials would find plenty to discuss for two or three days, and could put in the rest of the time visiting the meetings of some of the other associations. I think that certain afternoons and all of the evenings should be devoted to a thorough examination of the exhibits. If the supplymen knew that there were to be no outside entertainments to withdraw the delegates from their exhibits, they would all be on hand every evening, and be more than willing to demonstrate the merits of their various appliances.

The American Street Railway Association should, in my opinion, stand as the parent organization, and assist financially the other organizations, which are virtually a part of that association.

I see no reason why this convention should not result in considerable good, whereas, if the accountants, transportation men, engineers, master mechanics, etc., assemble at different periods and in different places, the supplymen will be unable to give the exhibitions that they have in the past.

Another point is the fact that it is of great benefit for representatives of various departments to get together, possibly not at their meetings, but during the other hours of the gathering. Oftentimes much of the best information is imparted by means of impromptu talks.

The arrangement of the sessions of departmental associations so that delegates may attend all meetings in which they are interested, as described in Mr. McCulloch's proposed plan, expresses the idea I have in mind more clearly and in greater detail.

Yours truly,

JOHN A. BEELER,
Vice-President and General Manager,
Denver City Tramway Co.

Denver, Col.

COMMON MEETING PLACES FOR ASSOCIATIONS DESIRABLE—EFFECT OF STATE ASSOCIATIONS—ASSESSMENT ON BASIS OF GROSS EARNINGS WOULD BE EQUITABLE.

Editor "Review":

I have been of the opinion that our national street railway organization is being divided up into such a number of departments—there being already an organization in the Accounting Department, the Claim Department, and the Electrical, Mechanical and Maintenance of Way Departments—that it is exceedingly difficult for the managing officers to keep in touch with them. I feel that a combination of these departments in the A. S. R. A. would be beneficial. The arrangement should, I feel, be such that representatives of all departments can meet jointly, giving opportunity for the men identified with particular departments to take part in the discussions of papers presented from their own or allied departments. This might be done by assigning Monday for the gathering of delegates, devoting Tuesday to subjects pertaining to accounting, Wednesday to the Mechanical Department, Thursday to the Claim Department, Friday to the Maintenance of Way Department—but having on each day a general paper in which all, or at least several, departments would be interested.

I do not see, however, why any general manager should object (as you in your recent editorial say managers do object) to his auditor or master mechanic taking an active part in the discussions. In fact, I feel that managers should be proud of having their department heads active in the work of the associations. Really the [illegible] employer. We [illegible] being given this opportunity to better their condition.

Because of the state associations of railway men which are now becoming very enthusiastic and holding meetings monthly, we feel it would be [illegible] year. Each department would, however, need a secretary, as you suggest, and these I think should be under one general secretary of the national association.

As to the financial arrangements, we believe that an assessment of the companies which are members according to their gross earnings would be equitable.

For the association to be successful its meetings must not be allowed to become mere junkets for the delegates.

Yours truly,

C. D. EMMONS,
Gen. Supt., Ft. Wayne & Wabash Valley Traction Co.

Ft. Wayne, Ind.

THE A. S. R. A. SHOULD [illegible] THE OTHER ASSOCIATIONS.

Editor "Review":

I feel some hesitancy in criticising the plans for reorganizing the A. S. R. A., because my company is not a member as yet.

However, my observation has been that the A. S. R. A. conventions are a good thing, and, generally speaking, presidents and managers expect to have a good time when attending them. But as these conventions or meetings are intended for the betterment of street railway operation by adding to the knowledge of officers and managers of the companies that are members of the association, it would seem to me that the presidents and managers who hold the purse strings of railway companies, and therefore of the associations, should make it a point to have their operating forces represented at the meetings of the Accountants' Association, Mechanical and Electrical Association, and Claim Agents' Association, and that the A. S. R. A. as a body should "father" and assist in the continuance and enlargement of these departmental associations, as well as to donate to their expenses for carrying on their work, should such be necessary.

Yours truly,

C. E. FLYNN.
Vice-Pres. and Gen. Mgr., Conneaut & Erie Traction Co.

Girard, Pa.

Tramway Progress in the United Kingdom.

Belfast.

J. G. White & Co. have commenced work on their big Belfast contract. Shortly after the start a number of the men working on the track construction struck for higher wages, but an arrangement has been made, and the strikers have returned to their work.

Blackburn.

Cases have occurred in several of the municipal electrical and tramway undertakings in the country of interference by committeemen with the work of the engineers and managers in charge of the works. As a check on this kind of thing, the Blackburn Council has, on the commitee's own recommendation, decreed that any member of the Electricity and Tramways Committee desiring to inspect the works shall first obtain the consent either of the chairman of the committee, the vice-chairman or the town clerk. No restriction, within reason, is to be placed on the number of permits, but the casual interference business will thus be done away with.

For the nine months ending Dec. 31, 1904, the revenue of the municipal trams was £39,397. The expenditure was £23,960, the gross profit being a balance of £15,397. But the interest and sinking fund charges for the period amount to £15,998, so that after paying these there is a net loss of £601.

Newcastle-on-Tyne.

Replying to a shareholder at the recent half-yearly meeting of the Tyneside Tramways & Tramroads Co., Lord Armstrong stated that the company had spent £6,000 in obtaining parliamentary powers to run its trams in Newcastle, and the Newcastle Corporation had

an even bigger bill than this to pay. This is good business from the lawyer's point of view, but not from the point of view of the advancement of tramways in the United Kingdom. The system of through traffic, which the company fought so hard to inaugurate, has proved very successful, and has resulted in an enormous increase in the number of passengers carried. The dividend of the company for the half year is 2 per cent, while £600 is placed to reserve.

Swansea.

The ratepayers of Swansea, having been asked to vote on the question of keeping the tramways clause in the Corporations bill to be presented this session, decided by a large majority that the clause should be included.

Maidstone.

The results of the first half-year's working of the municipal electric tramways are now published. The total revenue for the six months was £3,872, while the works expenses were £1,946. For interest and sinking fund charges £813 has to be allowed; the net profit shown in the half year is £1,113.

Aston Manor.

A report prepared by Mr. R. Green, consulting electrical engineer, has been accepted by the Town Council. The report embraces a scheme for the reconstruction and electrical equipment of the remaining tramways in the town. The total cost of the work, including the overhead equipment, will be about £63,270.

Bath.

The Bath Electric Tramways Co. has had an application for an extension of its lines before the Light Railway Commissioners. The scheme is opposed by the Keynsham District Council, because the extension would serve what is a compartively thinly populated district. The urban council in question considers that the needs of the district would be amply served by motor buses, which would not require the roads to be cut up for the laying of the tram lines. It remains to be seen what the Light Railway Commissioners think of the matter.

Great Yarmouth.

The arbitration proceedings in connection with the purchase of the Gorleston tramways by the Great Yarmouth Corporation started on Feb. 24th. The lines are at present operated by horse traction, and run from the Great Eastern Ry. terminus at Southtown, parallel to the River Yare, to the sea front at Gorleston.

Pontypridd.

The municipal electric tramway system was recently opened. The lines were first inspected, according to custom, by a representative of the Board of Trade.

Kingston-on-Thames.

The London United Tramways Co. has given notice of its intention to proceed shortly with the laying of its lines over Kingston Bridge into Kingston town.

London.

The third annual report of the directors of the London United Tramways (1901), Limited, with accounts covering the year 1904, shows that the gross receipts increased by £15,994, while the operating expenses decreased by £203, notwithstanding the larger mileage open as compared with the previous year. The total number of passengers carried was 48,126,727, an increase of 2,833,254. Owing, however, to the increase in the charges for debenture interest and preference dividend, which together absorb £82,297, as compared with £58,826 in the previous year, the ordinary shareholders receive a dividend of 6 per cent only, as compared with 8 per cent for the two previous periods. Preparations are in progress for the construction of the authorized tramways in Kingston, Surbiton, the Maldens, and Wimbledon, and between Brentford and Hanwell. These Surrey lines will link up important centers of population, and will connect with the London County Council electric tramways at Tooting and over Kingston Bridge with the company's tramways in Middlesex and London.

Railway Matters on the Continent.

SWITZERLAND.

According to the publication in the Registre du Commerce, the Société Electrique de La Cote has renounced the idea of establishing and working an electric railway at Gland-Begnins. The Compagnie du Chemin de Electrique fere Gland Begnins, which took over the concession for the line in question, has a capital of 110,000 francs. The registered offices of the company are at Begnins.

The Société des Ateliers de Construction Oerlikon has been carrying on for some time experiments with monophase traction by means of a Ward-Leonard locomotive. The weight of the locomotive is 42 tons, the power 400 h. p., the tractive force 3,000 kg., with a maximum of 6,000 kg. The maximum speed is 40 km. per hour. The four axles are driven in pairs by two continuous current motors of 220 h. p. each. The generating set is in the center of the locomotive and consists of a monophase asynchronous motor with a short-circuited armature, of 400 h. p. at 1,000 r. p. m., direct connected to a continuous current dynamo supplying 600 amperes at 600-700 volts. The winding of the fixed portion of the asynchronous motor is arranged for pressures from 700 to 1,500 volts with 100 alternations. The exciting of the continuous current dynamo is effected by means of a small dynamo driven by a small asynchronous motor of 700 volts. The latter is also used for starting the large asynchronous motor. A third asynchronous motor drives the air pump for the pneumatic brake. The braking is also done electrically, by acting on the exciting circuit of the generator. The starting current is 700 amperes; when traveling it falls to 30 amperes. The system seems to be very suitable for short lines with numerous stops.

GERMANY.

The latest important event is the probable understanding between the Siemens-Schuckert and the Allgemeine Union E. G. groups, which hitherto competed with each other in a very keen manner. Among the first symptoms of such understanding is mentioned the acceptance, in the name of the two companies, of a large order for China, the building of a central electric station at Tientsin to cost 1,300,000 marks, for lighting and supplying power to the tramways of that city; then the formation of a company for electric lighting of electric and other trains, with a capital of one million marks, in which take part, besides the two groups mentioned, the storage battery works of Berlin-Hagen.

The electric tramway undertaking of Dresden has been using for four months, by way of trial, on a stretch of its line Blasewitz-Tolkewitz, 300 meters long, the Dolter system of surface contacts. For these experiments it has therefore altered one of its cars with storage batteries. The couplers have not been modified in any way; the only thing done was to add a series of contacts to the commutator cylinder, for the purpose of affording passage to the current coming from the contact arm. On the car in question the distance between the axles is only 1.75 meter, nevertheless it has been found possible to place in that restricted space the electro-magnets required for operating the contacts. As the car thus modified does not receive any current when it passes from the overhead portion to the portion with underground conduits with contacts, in order to insure lighting during the short time occupied in passing from the portion worked on one system to the portion worked on the other, an osmium lamp of 12 volts has been installed, to which the energy required is supplied by six storage batteries, which form reserve for exciting the Dolter electro-magnets. The experiments in question having proved satisfactory, the undertaking has received from the government and from the municipality permission to use the contact system, which will be applied to certain lines at present worked with storage batteries.

Electric heating of tramways is an interesting but very difficult problem. Experiments are being tried with various results. The Oberschlesische Kleinbahnen & Elektrizitätswerke has recently fitted up, by way of trial, its motor cars with electric heating installations. Each vehicle is provided with two heating apparatus, consisting of nickeline wire wound about porcelain tubes and coated with a mixture of soluble glass and asbestos. As formerly the company used to heat its cars with charcoal briquettes, it is possible to establish comparison between the expenses of the two systems of heating. Assuming the period of working at 16 hours, it was necessary, for having the same temperature in the car, to spend 1.28 marks with briquettes, and 3.52 marks with electric heating. Although from the financial point of view this comparison seems to be disastrous to the electric heating, the latter has nevertheless advantages, such as the suppression of risk of fire, and also hygienic advantages which compensate for its greater cost.

A new suburban electric line is talked about, the construction of which is estimated at 30,000,000 marks. It is therefore doubted whether the line will ever pay. The point of departure would be

the Zoological Gardens station; the line would be partly underground and would terminate at the Wannsee station.

ITALY.

The Naples-Resina electric railway line has recently been opened. It is 35 km. long, and goes from Naples (Corso Garibaldi) to Resina (Piazza Pugliano), where is situated the lower station of the Vesuvius railway. On the other hand, the Varese-Luino electric railway is nearing its completion. Trial trains have already been run on the line, from one end to the other, with satisfactory results.

The Varese Railways & Electric Tramways Co. has besides decided to build a steam power house, for the purpose of making up the deficiency of the existing hydro-electric station during low water, so as to insure regular service between Varese and Luino at any moment, and to provide for the distribution of power and lighting. The new power house will have three generating sets of 500 h. p. each.

On the other hand, a new Belgian company, which bought the shares of a group of French capitalists, is about to introduce electric traction on the horse tramways of Verona. Another, also a Belgian company, has been formed at Brussels, under the name of Tramways et Eclairage électrique de Catana, with a capital of 24,000,000 lire (francs), and is about to start electric lighting and working of the tramways of the city of Catana, near the Etna.

Finally, the municipality of Cassano Magnano has decided to build and to work itself an electric tramway line with normal gage, between Cassano Magnano and the Gallarate station. The cost of the line is estimated at 194,000 lire.

SPAIN.

The scheme submitted by the Tranvias de Málaga company for an electric tramway starting from the Paseo de Reding and passing through the streets D. Fernando Camino, Arenal and Las Fábricas, in the suburb of Malagueta, has been approved. The same company has applied for permission to replace animal traction by electric traction on the tramways plying between the railway station and the workmen's quarter, Huelin, and between the Plaza de Riego and Plaza de Torrijos.

The concession for the tramway from San Sembastiánto Tolosa has been transferred to the Compañia del Tranvia Eléctrico de San Sebastian á Tolosa, and the Barcelona Tramways Co. has been authorized to place, at certain times of the year and at certain hours, an ordinary car coupled to the motor cars.

SWEDEN.

As before stated, the question of substituting electric for steam traction on the State railways has been under consideration for some time now. The first step in that direction has been taken between Stockholm and Väerten, on the one hand, and Stockholm and Järva on the other. Alternating monophase current will be used, and a credit of 425,000 crowns has been voted for the purpose.

In the beginning, two electric locomotives will be used, one of which with two axles, two motors, one transformer and one Westinghouse regulator, and the other with three axles, one transformer and one regulator, built by Siemens-Schckert works. For the suburban service there will be, moreover, a passenger train comprising four cars equipped by the Allgemeine Elektricitaets Gesellschaft of Berlin. Two of these cars will be motor cars, each provided with Winter-Eichberg motors, with starting and speed-regulating apparatus.

Electricity will be supplied by a steam power house with two Laval turbines connected to monophase current generators.

FRANCE.

Having considered the report of the Commission, the General Council has authorized the prefect to sign the agreements and to take steps for declaring the extension to Meulan of the Versailles-Maule tramway to be a matter of public utility. On the other hand, the Departmental Commission has been granted authority to give the opinion required by the Act of the 18th May, 1881, concerning the substitution of electric traction for steam traction on the Paris-Saint-Germain tramway. The General Council has also given a favorable opinion on the subject of the scheme submitted for electric traction and the building of a new terminal station at Versailles for the Sèvres-Versailles tramways.

By an act passed on Aug. 4, 1903, the building of a tramway line between Bordeaux and Beychac and Caillau has been declared to be of public [illegible] mitted by Mess[illegible] for the tramway [illegible] traction as originally provided for, and for the laying of rails with the normal gage of 1.44 m., the prefect of the Gironde has ordered an inquiry to be made in the cantons of Bordeaux, and of Carbon-Blanc as to the public utility of the new scheme. Finally, an inquiry has been opened as to the public utility of the preliminary scheme for an electric tramway from Bagnères-de-Luchon to the waterfall of the [illegible]

New York Strike.

A general walkout of the trainmen employed by the subway and elevated lines in New York City was brought about on the morning of March 7th by the refusal of Mr. Hedley, as the general manager of the Interborough Rapid Transit Co., to entertain the demands of the subway motormen. The demands made by the men were: Motormen to be relieved from the present form of physical examination, substituting what is called a practical road test. A 9-hour day, with mileage not to exceed 100 miles a day. Relays at the southern terminals when the headway is less than six minutes. All work trains to be run by qualified motormen. On the part of other employes, except the tower switchmen, they asked for a 9-hour day, with time and a half for over time. Eight hours a day with one day off each month, was demanded for the tower switchmen. All employes except motormen asked a 10 per cent increase in wages.

When it is known that an agreement has been in force between the motormen and the company one provision of which stated that motormen would make no new demands before September, 1907, the reason for the company's refusal to listen to such demands is obvious. The announcement of the company's refusal to grant the demands of the motormen was made at midnight March 6th, and a general walkout was then ordered for 4 o'clock the morning of the 7th, with instructions that the train crews, unless interfered with, should leave their posts on reaching the first terminal.

In anticipation of this trouble the Interborough company had made arrangements with the city for complete police protection, and had quartered a force of between 1,500 and 2,000 men on board a steamer which was docked at the Interborough railway docks, 149th St. and Harlem River. During the night of the 6th the emergency cords by which passengers may stop the trains were removed from all cars and every preparation was made by the company to withstand a long strike.

At the scheduled time, 4 o'clock on the morning of the 7th, the union men left the cars at the terminals, but each train was immediately sent out with a crew of new men and a guard of police. The new men not being accustomed to the operating conditions in the subway, had some trouble in keeping up with the schedule, so that there was not room for all the trains to operate successfully. For this reason the management discontinued the morning express trains, but by evening a better service was being given.

The second day of the strike, March 8th, showed a decidedly marked improvement in traffic conditions on both the Interborough and elevated lines, with practically no disorder and but a few minor accidents. The express service was resumed, and with the aid of police at the stations the crowds were handled in a satisfactory manner throughout the day. The strikers realizing at this time that they were losing ground, offered to arbitrate their demands, which offer was flatly refused by Mr. Hedley. On the following two days, March 9th and 10th, many of the strikers, feeling that their cause was lost, appeared at the company's headquarters and asked for reinstatement. Nearly all the guards and ticket sellers were taken back, but as a matter of precaution the motormen were refused their old places. Since March 10th the operation of the Interborough and elevated lines has resumed its normal state, and but few minor demonstrations have been made.

The national organization with which the Interborough motormen's union was affiliated has revoked its charter and severely censured those who overstepped their authority in bringing about the strike, stating that the Brotherhood of Locomotive Engineers has no difference between its organization and the Interborough company that could not have been adjusted in the proper manner.

The Interborough company will reward with two weeks' pay the 2,000 employes who did not strike.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York 39 Cortlandt Street. Cleveland 302 Electric Building.
London Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV MARCH 15, 1905 No. 3

ANNOUNCEMENT.

The April issue of the "Review" will be our annual Construction Number, containing a compilation of data on all the new construction work contemplated by electric railways and data on new equipment orders recently placed or soon to be placed.

CONTENTS OF THIS NUMBER.

THE CHICAGO SITUATION.

The street railways of Chicago have been made a bone of political contention for nearly ten years, and the best interests of patrons and railway companies alike sacrificed to the exigencies of candidates for city office. The cry for municipal ownership has been adopted by all political parties and today the worst charge either of the two leading candidates for mayor makes against the other is that he does not favor municipal ownership.

The only hope for a betterment of the situation lies in the knowledge that the financial condition of the city makes either "immediate municipal ownership" or "immediate steps for municipal ownership" practically impossible, in the belief that the public will no longer consent to be hoodwinked by glittering generalities along these old lines, and in the fact that the recent change in ownership of the Chicago City Railway Co. makes practicable a reorganization of all the Chicago companies, when a franchise renewal can be agreed upon. The desperate condition of Chicago Union Traction finances makes an equitable settlement of matters in dispute between the city and the railways extremely difficult unless there be a consolidation, in which the strength of the City Railway could be used to bolster up the weakness of the Union Traction. The remote possibility of such a consolidation is considered to have been changed to a strong probability by the vesting of control of the Chicago City property in its present owners.

That the eastern owners of Chicago City Ry. stock are confident that a satisfactory settlement of the franchise question will be made is shown by their plans for the rehabilitation of the system, announced at the annual meeting. The public is to be congratulated upon the choice by the Morgan syndicate of Mr. T. E. Mitten to carry out its plans for the Chicago system. Mr. Mitten's record in Milwaukee and in Buffalo has demonstrated his courage in undertaking difficult problems and his executive ability to solve them successfully.

THE LION AND THE LAMB.

The Central Passenger Association has now in hand an investigation of the electric railways operating in the central territory, with a view to learning what are the conditions as to the interchange of passenger traffic. Here again "local conditions" vary, and while some of the steam roads are anxious to enter into traffic agreements with electric lines, because they would find such arrangements profitable, there is a general fear that such interchange agreements would force a reduction of passenger fares. Perhaps there is another side to this, and the electric roads that are now making too low rates might, with the assistance of their elder brothers, succeed in raising fares.

THE INTERBOROUGH STRIKE.

The strike of the employes of the Interborough Rapid Transit Co., of New York City, begun March 7th, proved a miserable failure. The company was, of course, much hampered for a few days, but quickly got new men, and by March 10th the strike was over so far as the public and the company were concerned. The principal reason for this result is that there was no public sympathy for the men worked up by the daily press. The company used every available means of publicity to inform the public that the men taking the places of strikers were experienced railroad men, to inform employes that they would be retained so long as they performed their duties satisfactorily, and to warn all persons of the penalties provided by law for interference with railway property. The want of merit in the claims of the men is best indicated by the action of the national association to which the strikers belonged in withdrawing the Interborough employes' charter.

AUTOMOBILE COMPETITION.

One of the questions which has been the subject of much discussion abroad, and especially in Great Britain, is the extent to which self-propelled road vehicles or motor-buses are or may become practical competitors of tram cars. In America the automobile bus to operate over ordinary pavements is scarcely mentioned as a competitor of street cars, save during the trying times when street railway strikes may be in progress. It is recognized that for the safe, rapid and economical transportation of large numbers of passengers a vehicle operating over rails has overwhelming advantages, and

hence the interest of American railway men in the development of auto cars is with their practicability for operating on railways and not as competitors.

A very good resume of the situation abroad is given by Mr. J. Clifton Robinson in his article on another page, entitled "Motor Buses vs. Electric Tramways." From the perusal of this it will be apparent that the author has none of the fear that may be inspired in the minds of lay readers by the popular claims made for the "motor bus." The bus is handicapped by the greater weight of machinery per unit of capacity needed in order to overcome the greater physical resistance of a bus on a road or street pavement as compared with that of a car operating over rails, lacks capacity, and is expensive to operate. Perhaps the strongest argument against the motor bus is that the cost of tire renewals alone will more than pay fixed charges on the cost of the track and equipment for a railway.

THE A. S. R. A. AND THE STATE ASSOCIATIONS.

In the letter published on another page, Mr. C. D. Emmons makes a point in regard to the existence of active state electric railway associations and their effect upon the national associations and the proposed reorgnization of the latter. It is his idea that a company holding membership in one or more (his own company is a member of two) state associations, would prefer that there not be a multiplicity of national conventions to which it ought to send delegates. We understand, however, that this objection is to the meetings of the national associations being held at different times and places, rather than to the existence of separate, and to a considerable degree independent, associations, such as the Accountants' and the Mechanical and Electrical now are.

That there is no lack of work to be transacted by companies eligible to membership in the American Street Railway Association, is shown by the successful organization of the state associations referred to by Mr. Emmons. Within the past 15 months the Ohio interurban and the Indiana electric railway interests have organized associations which hold regular meetings nine times per year. Reference to the proceedings of these two associations as published in the technical press will show the many subjects that call for concerted action by members and the last Indiana meeting developed that there are several important matters on which joint action by these two state associations is needed at once—among these subjects are those of interchangeable coupon ticket books, road clearances, wheel, truck and special work standards.

Nor let it be thought that it is only the interurban lines that are interested in these matters. Interurban cars run over city tracks and many are the limitations and difficulties that urban track and line construction impose upon interurban car equipment. Much friction in operation can be eliminated by joint investigation of questions of mutual interest, and this fact the managers in the two states named keenly appreciate. A good measure of the success with which the work of these bodies has met is considered to be because they hold monthly meetings.

To revert to the matter of interchangeable coupon tickets, it requires no seer to predict that in the near future, the subject will need concerted action in at least three other states—Pennsylvania, Michigan and Illinois. The good to follow from its discussion will accrue to the electric roads not yet built, for they will see the need of careful consideration of conditions on other lines when fixing rates.

A further and striking confirmation of the usefulness of association work is the organization in January last of the Newman Properties Association, which is almost a private enterprise and its quarterly meetings are analogous to the conventions of the employes which so many manufacturing and insurance companies and other large corporations now hold at regular intervals.

The bond between the railways that are members of the Newman Properties Association is that they have the same owners and general managers. Perhaps this should be put in a little different way, by saying that the financial control of these properties is intrusted to the Newman interests, which exercise general control through Ford, Bacon & Davis, as engineers and managers. It is instructive to consider what subjects were discussed at the first meeting of the Newman Properties Association. Some of these were: "Things We Have Done to Gain and Keep the Good-Will of Employes," "Methods and Points Involved in the Investigation of Damage Suits and Preparation for Trial," "System of Handling [illegible]
[illegible]
Have Done to Save in Operating Expenses."

We believe that the failure of the American Street Railway Asso- [illegible] executive committee to assign for papers subjects that are identified with the executive departments of the railways—that is the failure to choose "presidential" and "managerial" subjects.

[illegible] result in the adoption by the members of the state associations of standards, the most of which could well have been determined by a national association through committees. The pre-emption of this field by the more local associations may have a considerable effect in limiting the field and work of the national body, but we incline to the belief that what is done by the state associations will create a closer bond of union between members of the A. S. R. A. who now have little in common, and eventually greatly enlarge the power and influence of the A. S. R. A.—that is with interurban cars using the tracks of widely separated cities, the urban companies will have more reason than ever to associate themselves closely in an organization that must be national in scope to cover the field.

The future of the A. S. R. A. is dependent principally upon the choice of a proper field for its work—a field that will interest the chief executive officers of the members. In considering this field and planning the work of the A. S. R. A. an element must now be considered, that was negligable a year ago—that is, the state associations.

CARRYING BAGGAGE.

The question of whether baggage shall be checked free on interurban electric lines is a very live one at the present time, especially in Ohio and Indiana, where the efforts of the state associations to promote the use of interline tickets and interchangeable coupon books have emphasized the lack of uniformity of baggage regulations.

The Ohio association recommends that 150 lb. of baggage be checked free, and that a charge of 25 cents per 100 lb. be made for the excess above 150 lb. This policy is based largely upon the experience of the Lake Shore Electric and the Cleveland & Southwestern Traction companies, which state that carrying 150 lb. of baggage free increases their business, and that they must carry baggage free to compete with steam roads. These two companies are, we believe, the only ones in Ohio that on their own lines make no charge for baggage; the other roads in that state which carry baggage make a charge for local traffic, but some which have traffic agreements with connecting lines check 150 lb. free.

In Indiana the Indianapolis & Northwestern and the Indiana Union Traction are understood to favor checking 150 lb. of baggage free, while others favor making a charge, and the differences will perhaps be found difficult to reconcile. The Indianapolis & Northwestern charges $2 for the round trip between Indianapolis and Lafayette, with 25 cents extra each way for baggage, and 20 cents excess fare each way on limited cars, making a total of $2.90 for the passenger on the limited who has baggage to take with him; while the round trip rate or the one way rate for two persons, 150 lb. of baggage checked free, on the competing steam road between these points is only $2. Naturally the passenger department of the electric line is disposed to cut part of its higher rate by allowing passengers 150 lb. of baggage free.

The principal arguments on the other side are: First, the passengers having trunks they desire carried are ¼ of 1 per cent to not more than 2 per cent of the total passengers carried, and therefore if all such patrons were lost the reduction in receipts would not be a serious one. Second, if baggage is carried free the accommodation to two passengers is paid for by the other 98 or 99 who have no trunks, which is an inequitable distribution of expenses. Third, to handle baggage free will reduce the space in the express compartment of the cars, available for carrying paying packages, and which now has an earning capacity that in some cases is quite large. Fourth, the handling of baggage requires that there be baggage rooms and baggage masters at stations, involving an expense out of proportion to the possible benefits. Fifth, the rates now obtaining on most electric lines are so much lower than the steam road tariff (1¼ to 1½ cents per mile, as against a minimum of 2 cents for the

steam roads, save in special cases) that passengers on the electric lines can well afford to pay extra for all baggage.

No matter from what direction a subject connected with electric railway operation is approached, one is pretty nearly certain to meet the dictum "that local conditions vary so much that no general conclusion is possible." There is a tendency on the part of Ohio interurban managers to take refuge behind this statement, and while following the recommendations of the Ohio association as to interline business, and perhaps some other cases, the most of the roads will continue to charge local passengers for carrying baggage.

Questions that may or may not prove to be of importance are whether selling through tickets to points on connecting lines outside the state will bring the electric railways within the scope of the inter-state commerce law, which is understood to discourage discrimination, and whether carrying inter-state baggage free while making a charge for local baggage is in fact a discrimination.

THE STEAM ROAD AS A TROLLEY MANAGER.

One of the most significant developments of recent years in the electric railway field is the acquisition of certain trolley lines by steam railway companies operating in the same general territory. The important point in this movement is not so much the development of an entirely new class of business in the activities of the steam road as it is the tacit acknowledgment on the part of the older branch of railway service that the trolley road serves a purpose unique in its sphere and one which the steam locomotive can seldom, if ever, expect to usurp. Those who are acquainted with the working spirit and temper of the representative steam and electric railway managers of today know that in the inner circle the opinion is held that each type of railway has its own special field of usefulness, in which it is economically supreme under the present conditions of civilized life. In a word, the steam railroad's object is to derive profit from the movement of enormous train loads over relatively great distances at infrequent intervals, while the electric railway aims to have comparatively light loads over moderate distances at relatively short intervals. This is the crux of the difference between the two, which may be traced back to the motive power itself as the starting point. In the physical characteristics of the steam locomotive and the electric motor we find the parting of the ways in the division of traffic.

The responsibilities of a steam road which acquires control or ownership of an electric line or system in its territory deserve more than passing notice. Whatever may have been the cause which led to the extension of power—competition, present or prospective, or the desire to develop a harmonious and unified transportation scheme in the community—there is no doubt that new conditions and duties confront the steam railway management as soon as the control passes into its hands. There is consequently danger in some cases that the peculiar features of the street railway business may be overlooked in the attempt to apply steam railway methods too exclusively in the operation of the acquired property.

It is in the frequency and speed of the service rendered that the steam road is more likely to fall below the previous standards of operation. With their enormous necessary expenditures, steam railway officials are by training and experience so keenly on the lookout for every chance to reduce expenses that there is serious danger of the electric service deteriorating in their hands, especially if the sharp spur of acute competition disappears when the management takes up its new duties of the trolley business. The whole trend of operations on an electric road, from the power house coal pile to the car wheels, is so radically different from steam railway practice that it is good practice to turn the management of the acquired trolley lines over to an electric railway expert in preference to placing their detailed control in the hands of a steam railroad executive.

Even if the short intervals between cars are allowed by the new controllers of the property, the service may be rendered poor through a mistaken idea that fast running is not only needless—since there is no longer competition to worry about—but that it is too expensive a luxury for the company to sanction. A case in point is that of an electric cross country line, some 20 miles long, which has for some months been controlled by a large steam railroad system. Before the transfer in management occurred, the running time between the terminal points was 1 hour and 10 minutes, and the service compared favorably with the best interurban lines of the country. Today the schedule has been lengthened to 1 hour and 30 minutes, and on a recent trip over the line the motorman ran the car five or six miles without once throwing the motors into multiple. Power was shut off at the top of grades so slight as to be scarcely noticeable to the eye, and the larger hills of the undulating country were climbed with the controller in the series running point. The roadbed and track is one of the most expensive in the country, and no money was spared to build a substantial and adequate power house. There was no apparent reason why speeds as high as 40 miles an hour could not be attained, followed by extended coasting, which in the long run would enable a much faster schedule to be operated at a lower energy consumption per ton mile than the existing time called for. The old idea that because a locomotive consumes steam at a more rapid rate when the trottle is wide open, on account of the longer time full steam pressure is used without expansion, is probably the reason for the mistaken assumption that it is more economical to make long runs with the power of an electric car half on than to accelerate in limited time to higher speeds and coast.

It often lies within the power of an absorbing steam road to work numberless minor improvements in the transportation service of the community as a whole through the bringing together of the street car system and the trains into one comprehensive scheme of operation. Thus, the time tables of each road may be adjusted so that reasonably prompt connections may be obtained by both through and local passengers; the advantages of a common station, ticket office and baggage department may be availed of; the trolley lines may be operated, extended and advertised as feeders to the steam line; the street railway roadbed and track, particularly on private rights of way, may enjoy the advantages of maintenance along better lines; the rolling stock may in some cases receive better repairs through the wider facilities of the steam railroad repair shops; and then again, the cost of transporting coal and other supplies should be less in cases where the governing steam road handles business between coaling docks, lumber depots and other distributing centers. Accustomed as steam roads are to heavy maintenance expenses in connection with locomotives and other rolling stock, the relatively light upkeep charges upon the electric cars, power stations and other equipment should not be neglected. In striving to cut down power house operating expenses, the force of employes may easily be reduced below the number desirable to operate and maintain the installed machinery, and this is a point which the steam road needs to guard against, chiefly for its own interests in the long run.

When a steam railroad controls a number of different trolley systems it is strategically in a position to make such tests and experiments of a comparative nature as will best conduce toward the most economical operation of each component part of its electric system. This is an advantage already enjoyed by firms of engineers who manage industrial properties in different communities. There should be no special difficulty in collecting a great deal of valuable data from the simple operating records of the different lines, without going to the expense of tests specially planned and carried out.

Finally, the policy adopted by a controlling steam road with regard to the conduct of its tributary or component trolley systems is bound to be of great weight in giving a set to public opinion away from or toward the future prosperity of the steam road itself. If the service is poor, the cars ill kept, speeds low, intervals long and the schedules arranged without regard to the convenience of passengers, between the trolley and the steam cars, public opinion is certain to be unfavorable. On the other hand, if the service is good, the cars, speeds and schedules first class, the good will of the communities affected is sure to result. There is often discussion as to the wisdom of electric railway absorption by steam roads, without much realization of the simplicity of the fundamental proposition. If the service is as good or better than it was prior to the change in management, there would seem to be no reason for the public to regret the change, while if the service is made poorer thereby, the shifting of management may well be regretted. In the long run, duplication of service in the same territory is an economic waste, but as the spheres of electric and steam roads are often supplementary rather than antagonistic, it is reasonable to expect that there will ultimately be brought about co-operation rather than opposition in regions traversed by both services. An opportunity to gain a good name awaits the steam road which is absorbing trolley lines; the same opportunity also lies at hand at the door of the independent trolley line which is in a position to supplement the service of its older neighbor.

Single-Phase Car Equipment of the Indianapolis & Cincinnati Traction Company.

The line and power plant of the Indianapolis & Cincinnati Traction Co. were described in the "Review" for February, and we are now able to add further data concerning the car equipment. The present equipment consists of 10 passenger cars built by the St. Louis Car Co. These cars measure 55 ft. over all, and each is divided into three compartments, the first of which is 9 ft. 10 in. long, and is arranged for the accommodation of baggage, and provided with doors opening on each side. In front of this baggage

CAR WITH APPARATUS MOUNTED.

compartment and separated from it by a strong railing is the space allotted for the motorman. The middle compartment has a seating capacity for 16 people and is fitted up as a smoker. The main compartment occupies the other end of the car and has seating capacity for 38 people.

All the seats have reversible backs and are upholstered and covered with plush. Under normal conditions the cars will operate always in the same direction, though the equipment is such that they may be controlled from either end. At the rear of the car a vestibule is provided, with space for ingress and egress of passengers.

The cars are finely finished in mahogany. The windows are of plate glass, with art glass in the upper part and also in the ventilators. The toilet room is placed in the rear at the left side, so as

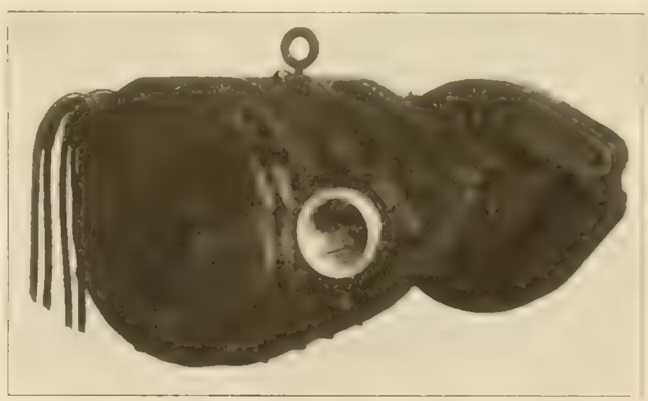
INTERIOR OF CAR.

not to obstruct the view of passengers entering the car at the right side. The cars are heated with the Peter Smith hot-water heaters, placed in the front compartment, and under direct charge of the motorman, with pipes running throughout the car. The framework is especially substantial, the floor and lower part being made of steel, with steel ribs running from the top. The roof is covered with sheet copper. The finish of the car inside and out is very handsome, and in every respect the work is fully equal to anything yet done for electric service. The trucks are of the M. C. B. type, with steel tired wheels, [illegible] 5 [illegible] journals. The [illegible]

Car Equipment.

As the cars of this line must be operated over the tracks of the city railway in Indianapolis, which are all supplied with direct current, it was necessary in the car equipment to make provision for operation on either direct or alternating current. Furthermore, as it was not considered advisable to use a high potential trolley within the limits of the town of Rushville, it became necessary to provide for the use of two alternating-current trolley voltages. The main portion of the trolley circuit will be fed with 3,300-volt, single-phase alternating current. The total arrangement therefore includes operation at 550 volts direct current within the city limits of Indianapolis, and 550 volts alternating current in Rushville, and 3,300 volts alternating current on the other sections of the line. Because of this complicated service it seemed advisable to pass by the attractive and economical features of control by induction regulators, and to adopt the rheostatic system on account of its simplicity and adaptability to both alternating and direct current operation.

The car equipment includes four No. 106-A alternating-current, commutator type, series wound railway motors, rated at 75 h. p. each; one main auto-transformer wound for primary potentials of 550, 1,650 and 3,300 volts, and for a secondary potential of approximately 250 volts; reversing switch; motor cut-out switch; commutator or change-over switch to throw the equipment from alternating current to direct current and vice versa; a complete unit switch system of multiple control, with two operating controllers arranged

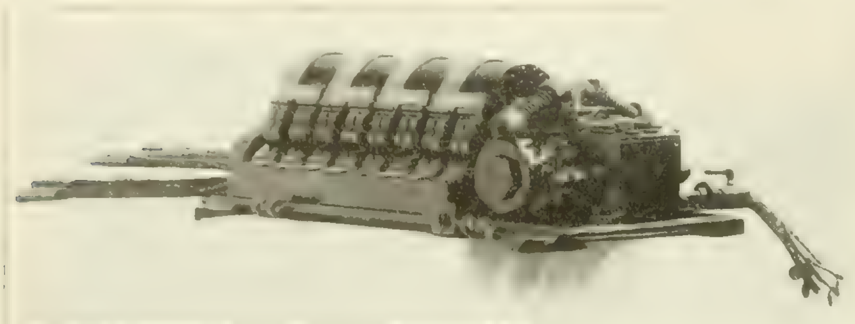


WESTINGHOUSE 75 H. P. SINGLE-PHASE RAILWAY [illegible]

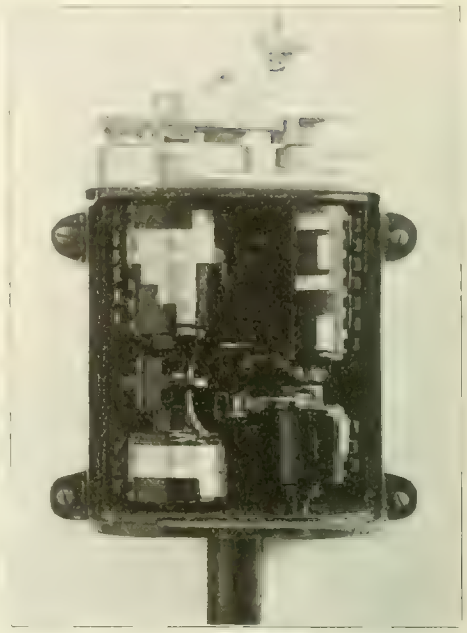
for the operation of the cars either singly or in trains; rheostats or current diverters for use on either alternating or direct-current circuits; air compressors direct connected to both an alternating-current and direct-current series wound motor; air reservoirs; two sets of storage batteries, consisting of seven cells each; complete Westinghouse air-brake equipment, with control valve on either platform; complete hand-brake equipment, with controlling lever on one platform; one wheel trolley for low potential service, and one bow type trolley for high potential service.

The diagram as shown illustrates the connections of apparatus forming the car equipment. It will be noted that the motors, which are wound for 250 volts, are connected four in series for direct current service, and four in parallel for alternating current service. The motors are geared for a maximum speed of 45 miles per hour for local service.

The frames of the motors are made of cast steel, surrounding a circular core built up of laminated punchings, which form four inwardly projecting poles. In addition to the main series coils, which are mounted direct upon the poles, auxiliary coils are provided which are threaded through partially closed slots in the pole faces. The circular casting is made in one piece and is closed by circular end pieces, which form supports for the armature bearings. The bearings are mounted in separate housings, a construction similar to that adopted as standard in the latest practice of the Westinghouse company in the construction of direct current railway motors. Lubrication is by oil and waste. The axle bearings are supported by heavy lugs which project from the motor frame. The armature is of the slotted drum type, with machine formed coils imbedded in open slots and held in place by retaining wedges. Though rated at 75 h. p. each, these motors are guaranteed to develop 100 h. p. at normal potential on either direct or alternating current without injurious sparking.



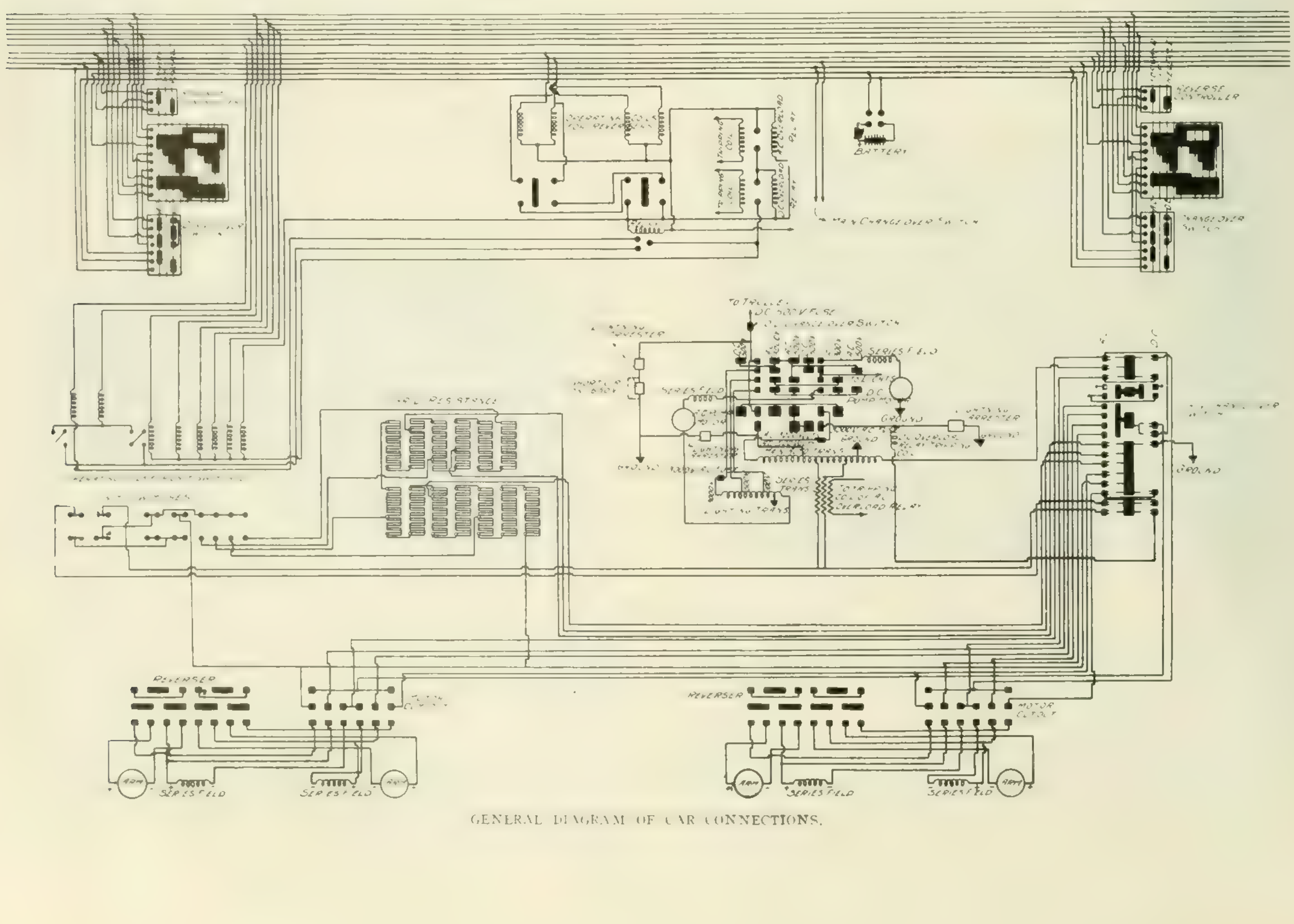
REVERSER.



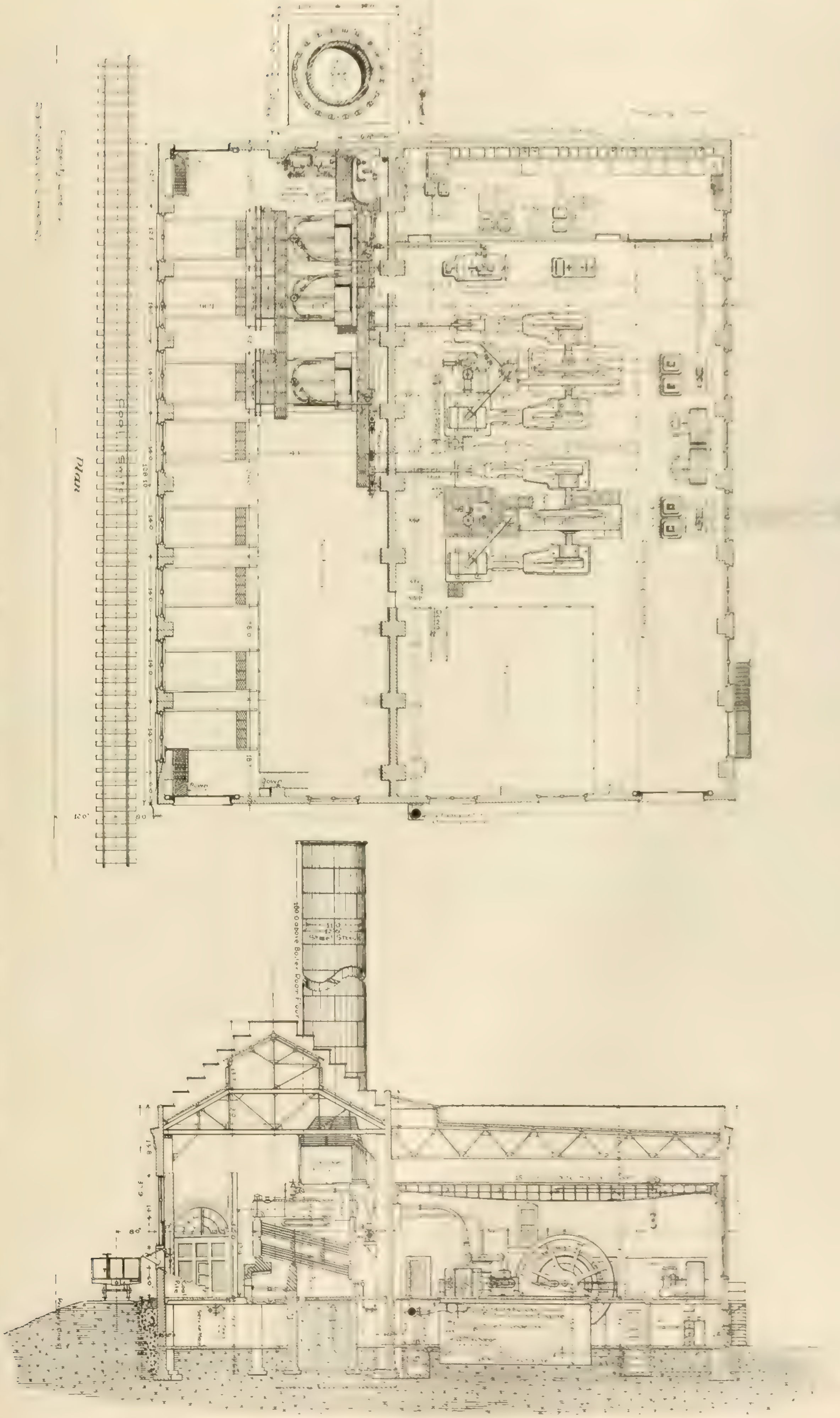
MASTER CONTROLLER.

The unit switch system of multiple control as adopted is the standard Westinghouse equipment modified to suit the double operation by alternating and direct current. The unit switches are arranged in groups, one of 8 and one of 4 units, which are mounted under the floor of the car. They are operated by compressed air, which in turn is controlled by magnet valves actuated by current from the storage batteries. The operating controllers are mounted one upon each platform, and are very small and compact.

The reverser, which is illustrated in one of the engravings, is of the reciprocating type, generally used with the Westinghouse system of multiple control.



GENERAL DIAGRAM OF CAR CONNECTIONS.



PLAN AND CROSS SECTION OF MAIN POWER HOUSE, INDIANAPOLIS & CINCINNATI TRACTION CO., RUSHVILLE, IND.

The main auto-transformer is of the shell form, air-cooled type. Before shipment it was subjected to a test of 10,000 volts between winding and iron, and was operated at double potential for 10 minutes. It is designed for operation at 25 cycles, a frequency which has been adopted as standard for single-phase railway service.

Outside of cities there is used a peculiar form of bow trolley designed for high potential alternating current circuits. The trolley is mounted upon a thoroughly insulated platform, and is raised, lowered and controlled by the motorman by means of compressed air. There is therefore no danger at any time of contact with live parts of the trolley. The bow carries a large, flat aluminum shoe, which makes contact with the under side of the trolley wire.

For low potential service, whether alternating or direct current, a modification of the "Union" standard trolley is provided, as the bow type could not be used in the city of Indianapolis.

A novel feature of the equipment of these cars was installed at the suggestion of Mr. A. A. Anderson, general superintendent of the road, and consists of a speaking tube connecting the motorman's position with the rear platform, so that the conductor and motorman may talk with each other at any time.

The entire electrical equipment of these cars was furnished by the Westinghouse Electric & Manufacturing Co., and installed under the supervision of Sargent & Lundy, of Chicago, the consulting engineers.

Courtesy.

In the January issue of "Trolley Talk," the interesting publication of the West Penn Railways Co., Connellsville, Pa., appears a sermon on "Courtesy," which we think well worth reprinting.

A SERMON.

TEXT:—A dispute arose between the passenger and the conductor and they began to upbraid each other; the conductor declared he would cast the wrathful passenger from the car and the passenger in his turn denouncing the conductor as a fool and a knave and prophesying his immediate discharge.

The text, my brethren, is taken from the volume of life and frequently we see the ruffled feelings, the loss of temper, the desire for revenge caused by a misunderstanding between conductor and passenger. This causes us to take as a subject—courtesy.

Courtesy on the part of the conductor and courtesy on the part of the passenger. The man who obtains a position as conductor rarely appreciates at the outset what demands will be made of him to exhibit patience, tact, courtesy and gentlemanly deportment in the discharge of his duties. No two passengers are just alike, no two of our patrons have just the same feelings and he needs to be an expert who could treat each one in the way he deserves, hence the only safe course for the conductor is treat all passengers with uniform courtesy; sometimes it's hard work, but in the end it pays big dividends, pays the employe, as popularity with the traveling public goes a long way towards keeping him off the "carpet," pays the passenger, as a scrap with a cranky conductor on the way to the office in the morning is a poor starting point for the day, while a pleasant "good morning" from a genial employe makes you feel good at once.

And it pays the employer. Conductors are traveling salesmen selling goods in 5-cent packages to thousands of people every day, and a discourteous salesman is a poor advertisement to any company.

Hence for all three parties courtesy on the part of the employe is a good investment.

Not long ago a certain West Penn conductor was transferred to another route. Shortly afterwards a prominent business man called at the office to ask if arrangements could be made to have the employe returned to his former run, giving as his reason that the man was so pleasant and attentive to his duties that the patrons would like to have him again on their line. That employe's courtesy cost him nothing and paid big dividends. One day about two years ago a quiet, unobtrusive man went up to a conductor who was turning the trolley, and said, "Does this car go to Leisenring?" The reply he got was, "Does—this—look—like—a—Leisenring—car?" The impolite conductor actually used seven words to answer the man and then gave him no information. To have given the desired information courteously would have taken not over three words. A sad lack of courtesy on the part of the conductor.

Now, about courtesy on the part of the passenger.

Sometimes the passenger fails to remember that the employe is human flesh and blood, the same as himself, and that he has feelings that are just as susceptible as those of the passenger.

The employes that man the West Penn cars are native born Americans and almost without exception are citizens of the towns and country adjacent to the lines. They have their homes and families among you, deal at your stores and in many ways form a part of the community. Their duties are many, and to collect all fares, remember where everyone wants off, throw all signals properly, keep the drunken man up in the corner from acting disorderly, pull the derailers, observe color of signals on passing cars, issue transfers, call the stops and a hundred other things all tend to make them a trifle impatient in manner at times.

A conductor was asked one day what he would like to have for a Christmas gift; he replied, "To be treated as a man by the traveling public."

One morning a lady came down Jenny Lind St., McKeesport, on her way to Pittsburg; she left her umbrella on the car. The motorman picked it up and recognized it as the one she held in her hand when boarding the car. He carried it in the cab with him, changing it from end to end of the car 30 times as the run was short and the heavy rain which had begun to fall made it too tempting to leave on the rear platform. In the evening the lady returned from the city and was tendered the umbrella by the motorman with the inquiry if it was hers, to which she replied, "Yes, it's a wonder I got it back." A simple "thank you" would have been appreciated by the big fellow in blue who had brought her safely down the hill.

Now, brethren, the Transportation Department of the West Penn has made a resolution that for the year 1905 its employes are going to treat the traveling public with greater courtesy than ever, and we want your help. Try a kindly word with them instead of a threat of report; if they don't do their part tell us, we want to know about it.

Los Angeles Pacific Railroad.

The greatly increased traffic which the Los Angeles-Pacific Railroad Co. is enjoying necessitates an increase in the capacity of its central power house at Vineyard and the installation of an additional sub-station in Los Angeles. To meet these demands the necessary machinery has been ordered from the Crocker-Wheeler Co., through the Abner Doble Co., of San Francisco. The contract includes one 1,200-kw., 3-phase, 50-cycle 2,300-volt engine-type generator built for a speed of 125 r. p. m.; one 300-kw. motor generator set; one 400-kw. motor generator set; three 400-kw. transformers; three 160-kw. transformers; three 120-kw. transformers, and one 60-kw. engine-type exciter. The 1,200-kw. alternator will be of the revolving field type and will be direct connected to a reciprocating steam engine. The motor generator sets will consist of 2,300-volt synchronous motors driving 600-volt direct current railway generators. The transformers will be the Crocker-Wheeler water-cooled oil insulated type, and will be built for 15,000 volts on the primary and 2,300 volts on the secondary.

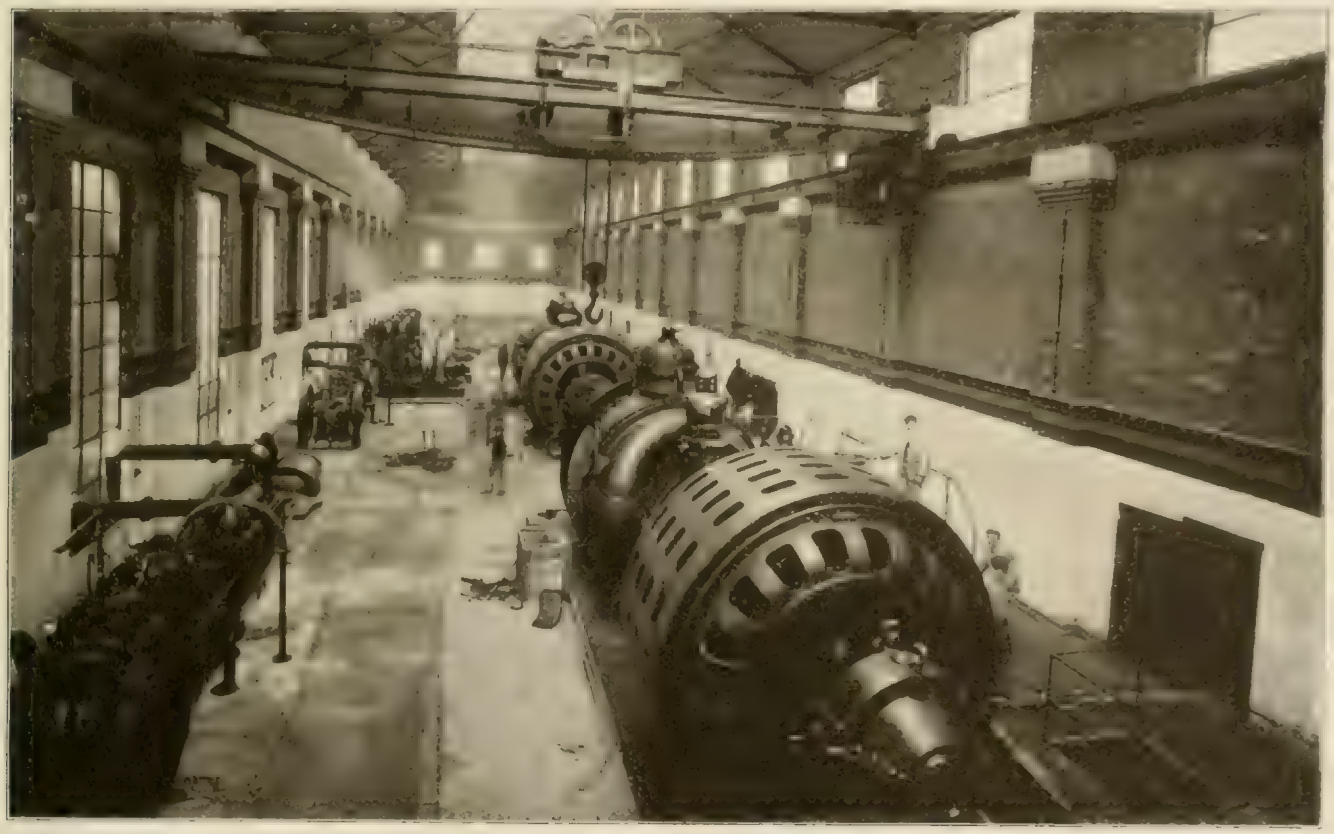
The Los Angeles-Pacific Railroad Co. is an electric system having nearly 200 miles of well built track. Its lines cover the territory south of the Santa Monica mountains and between Los Angeles and the ocean. About a year ago a new steam plant was installed at Vineyard, from which station 15,000-volt current is distributed to the sub-stations of the system.

New Work of Roberts & Abbott Co.

The Roberts & Abbott Co., Cleveland, O., has in hand the engineering for a number of the new and reconstruction propositions which have lately been started, due to the renewed activity in the interurban field. This company now is engineer for seven proposed roads which expect to commence construction this spring, and it is also preparing preliminary reports on several proposed interurban freight and passenger roads. One of the most important of the roads for which this company is engineer is the Washington, Baltimore & Annapolis Electric Ry. At the head of this road are Mr. George T. Bishop and Mr. John Sherwin, of Cleveland. It will be remembered that the Roberts & Abbott Co., had and still have charge of the engineering of the Northern Texas Traction Co. and the Muncie, Hartford & Ft. Wayne Railway Co., both of which roads have been very successful in their operation.

Metropolitan Railway of London.

The total length of the Metropolitan Railway lines is some 67 miles. Of this some 26 miles have been equipped electrically. The portion which has now been opened (the first electric train was run from Baker St. to Uxbridge Dec. 13, 1904) is that from Baker St. Station, which is in the Marylebone district in the northwestern part of London, to Harrow, and on to Uxbridge. The line from Harrow to Uxbridge is an entirely new line, that is it has been newly built and not converted from steam to electric traction like the rest of the system. The line which runs northward through Buckinghamshire from Harrow to Aylesbury and Verney Junction has not yet been equipped for electricity, and there is no immediate intention of superseding steam traction on this line. The eight miles of the company's track included in the northern portion of the inner Circle, which, of course, is underground, is now being equipped and will very soon be running. This, of course, is in conjunction



STEAM TURBINE SETS—METROPOLITAN RY.

with the District Railway's scheme for electric traction which is now being carried out, and power for which will be supplied from the power plant at Lots Road, Chelsea, which it will be remembered is a part of Mr. Yerkes' plan, and is being constructed by Mr. James R. Chapman.

The Metropolitan electric work has been carried out by its own workmen under the superintendence of Mr. A. C. Ellis, general manager, who has been assisted by Mr. Thomas Parker, the consulting electrical engineer, and Mr. C. Jones, chief electrical engineer. The permanent way has been under the direction of Mr. E. P. Seaton, the company's engineer, and the construction of rolling stock by Mr. A. Ingram, carriage and wagon superintendent.

There are two stations at Baker St., one on the Inner Circle, upon which district and Metropolitan trains run, and one the terminus of the Baker St., Harrow, Uxbridge and Verney Junction line. There is no physical connection, however, between these two stations, so that no passenger trains are run from one line to the other. The line, therefore, which has now been opened, is [illegible]

[illegible] gate St. and Aldgate, and it is intended to draw these trains, which are, of course, steam at present, by electric locomotives. Great Northern and Midland trains also run on a portion of the Circle lines from King's Cross, but do not run on the same track as that used by the Circle trains, so that they would not interfere in the least with the electric trains run by either the Metropolitan or the District Railway. A branch of the Metropolitan Railway runs from Aldgate to two separate stations at New Cross, this portion of the line being known as the East London railway, where connection is made with the main lines of the London, Brighton & South Coast Railway, and the South Eastern & Chatham Railway at their New Cross stations. These, of course, are steam lines at present, and no steps have been taken looking to electrical operation, though the change will eventually be made.

The Neasden Generating Station.

The Metropolitan Railway Co's. generating station is near its locomotive and engineering works at Neasden. There is plenty of room for extension, good facility for coaling, and the station is very centrally situated as regards the company's sphere of operation. An abundant supply of water for boiler feed and all other purposes has been found at a depth of over 400 ft., and two artesian wells have been sunk to tap it.

The main building of the power station is 327 ft. long by 101 ft. wide, and is one of the largest stations owned by a single railway company.

Boiler Room.

The main building is divided longitudinally into two parts, the [illegible]

[illegible] Babcock & Wilcox [illegible] ft. heating surface, fitted with Babcock superheaters and Roney mechanical stokers, which latter are driven through gearing by Westinghouse vertical enclosed engines. The boilers are each guaranteed to evaporate 20,000 lb. of water per hour, working at a pressure of 180 lb. per sq. in. and to superheat to 180° F.

Coal is received on a special siding, and delivered into a large hopper at the eastern end of the boiler house. From here it passes through crushers and thence is taken by a bucket conveyor to the storage [illegible]

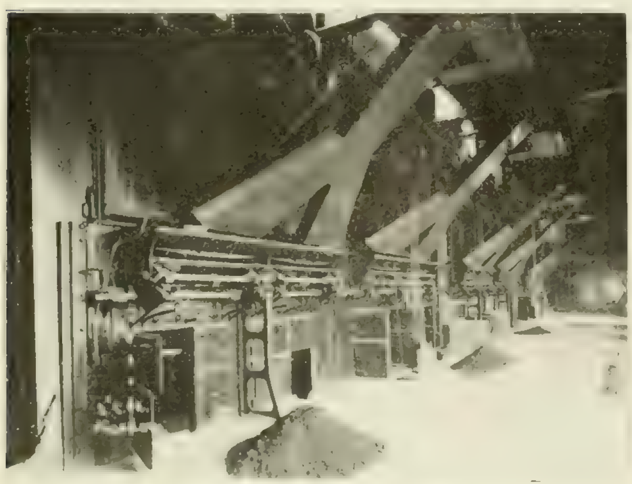
MAIN POWER HOUSE.

by gravity to the individual stoker hoppers, being automatically weighed en route by Avery machines. The same conveyor is also arranged to remove the ashes, which are discharged into a special bin.

The two economizers at present installed, the scrapers of which are driven by 3-phase motors, are of the well-known Green make, each having 1,760 tubes, 10 ft. long and 4 in. in diameter. These are in a chamber divided into two parts, each of which is provided with its own engine-driven induced draft fan. The chimney, which is 200 ft. high and 15 ft. in diameter, is approached by a flue 28 ft. wide, divided in two by a brick partition.

Engine Room

The portion of the engine room actually devoted to the generating machinery is 233 ft. 9 in. long, by 43 ft. 6 in. wide; at one end of the room is the space devoted to the switchboards, transformers and other auxiliary electrical apparatus.



BOILER EQUIPMENT

The generating apparatus at present consists of two 5,000 brake horse power Westinghouse steam turbines, coupled to 3,500-kw. three-phase Westinghouse alternators, and two more similar sets will soon be installed. The turbines are of the multiple expansion double flow type, with a guaranteed steam consumption of not more than 17 lb. at full load and $20\frac{1}{4}$ lb. at half load per kilowatt-hour; steam to be superheated to 180° F. and supplied at a pressure of 180 lb. per sq. in.

These machines represent the latest practice in every detail, particularly in the reduction in length that has been achieved by an increase in diameter. Despite the size, their freedom from vibration is reported as remarkable, as only the least tremor can be felt on applying the hand to the casing.

The bearings are of the spherical type, cast iron with babbitt

FINCHLEY ROAD SUB-STATION

metal linings. The flexible claw couplings for connecting the turbine rotor with that of the alternator are of forged steel and run in oil, and they are arranged to allow for any inexactitude in the alignment of the two shafts.

The operation of the valve gear is best understood by following the course of the steam through the turbine. Starting at the main stop valve, which is of the disk type and is operated from the platform by means of gearing, the steam flows through an emergency valve, strainer, and double seat poppet type governor valve, actuated by a centrifugal governor and steam relay, into the cylinder at the center. It then passes through a series of nozzles and impulse blades and expands down to approximately atmospheric pressure, after which the course is through a number of pressure blades on the Parsons principle to the condenser. The system of admitting steam

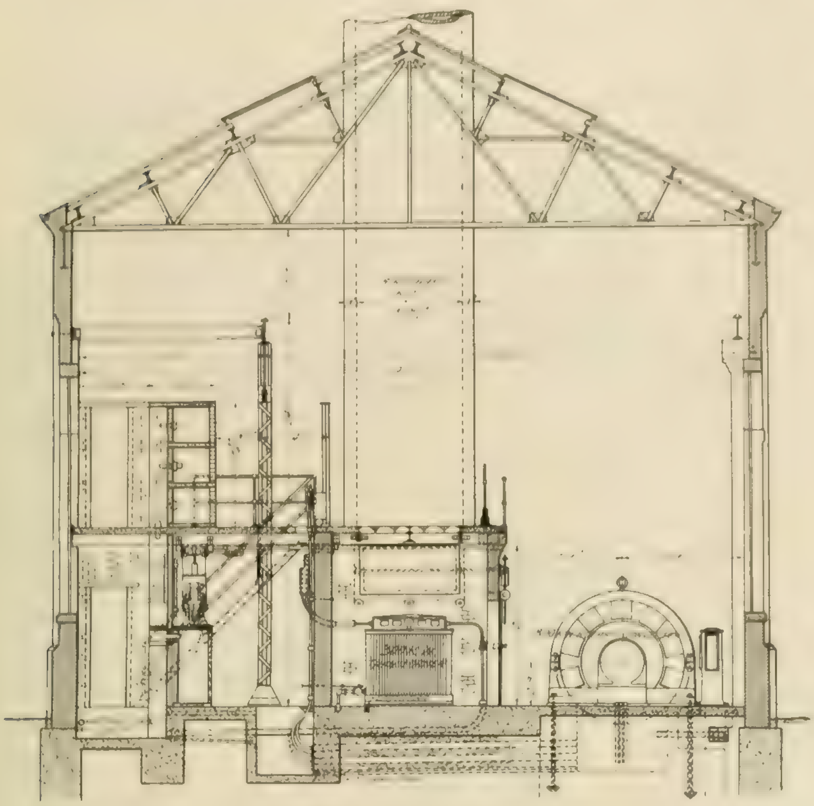
VIEW ABOVE ECONOMIZERS.

at the center with an equal flow each way, instead of at one end, keeps the shaft in perfect equilibrium and entirely does away with end thrust and therefore balance pistons. A thrust block is fitted at one end to allow of longitudinal adjustment of the rotating drum.

Lubrication of the turbine sets is effected from a central system which supplies oil under pressure to each bearing in separate pipes.

Generator.

The three-phase generators are mounted on a continuation of the turbine bed plate. The output per phase on a non-inductive load is 184 amperes at 11,000 volts, and the guaranteed efficiency is [illegible] per cent at full load, 95.5 per cent at three-quarters and [illegible] per cent at half load. The speed is 1,000 r. p. m., and as the rotating



SECTION OF SUB-STATION

field of the alternator has four poles, the frequency is 33⅓ cycles per second.

The exciting current is, as usual, led to the field coils by the aid of slip rings. It is derived from two exciter units, each of which consists of a Westinghouse single acting compound engine, running at a speed of 275 r. p. m., direct coupled to a 100 kw. 125 volt compound-wound generator. One such unit is sufficient to supply all the generators with exciting current at full load.

Auxiliary Apparatus.

Wherever possible, induction motors have been used for driving the auxiliary apparatus such as economizer scrapers, coal and ash [illegible]

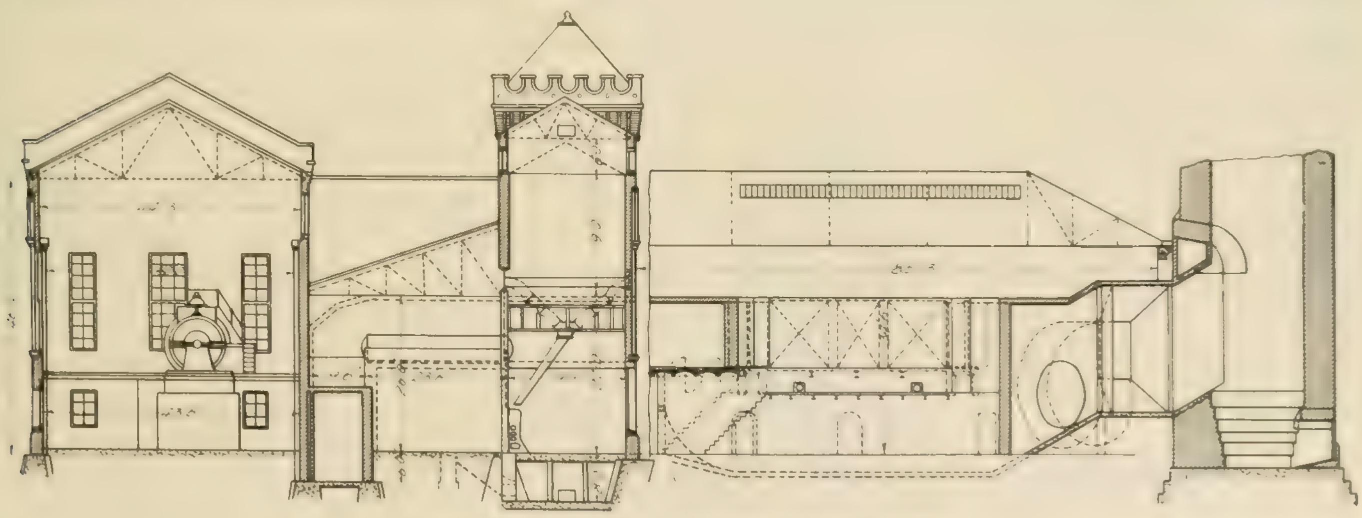
[illegible] works, according to the designs of the Alberger Condenser Co. [illegible] generating unit, and they are separately capable of dealing [illegible] load, and 110,000 lb. per hour at maximum overload for a period of one hour. At normal load, a vacuum of 27 in. is attained, and the overload reduces this only by one inch. A steam-driven rotative dry vacuum pump is provided with each condenser, and its engine when working at full load develops 55 h. p. with a steam consumption of 1,375 lb. per hour.

In addition to the auxiliary apparatus mentioned there are installed: Three 18-in. centrifugal, Guynne, cold-water circulating pumps, each driven by a Westinghouse compound engine; three 16-in. Worthington hot-water circulating pumps; two surface heaters, each containing 1,000 sq. ft. of heating surface; one Alberger surface condenser of 700 sq. ft. cooling area for condensing the exhaust steam from the exciter engines and the 100-kw. auxiliary generating set; two Cole, Marchent & Morley grease extractors; two tandem compound Weir steam feed pumps; six cooling towers erected by Donat & Co., each capable of cooling 400,000 gallons of water per hour; two 20-ton overhead electric traveling cranes; one Harris patent feed water softener, capable of effectively dealing with 13,000 gallons of cold water per hour.

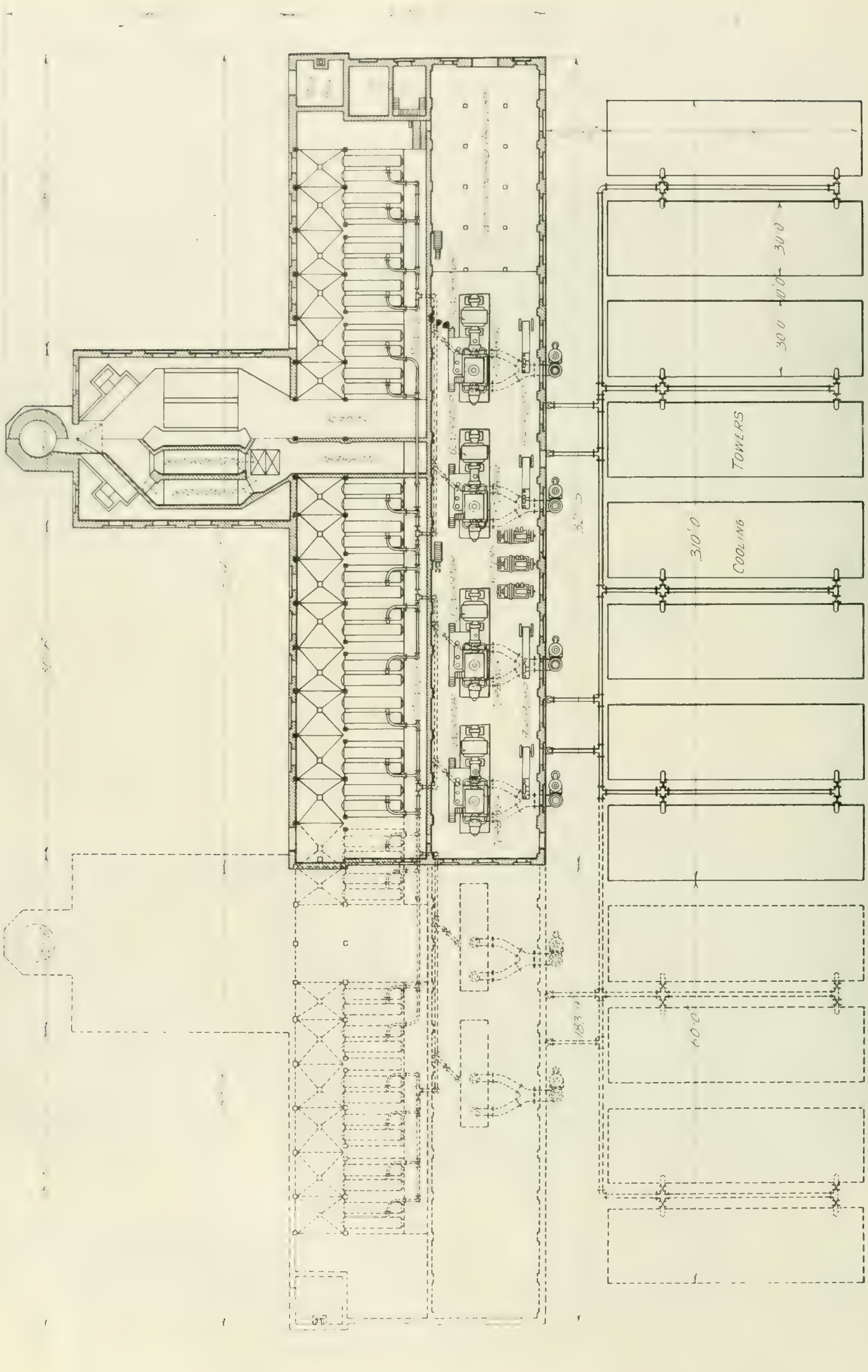
Switchboards.

There are two sets of main bus-bars, to either of which the generators may be connected by the aid of two switches in series; the switch next to the machine is a simple main circuit oil break switch, and the other between this and the bus-bars is the selector switch for connecting the generator to either set of bus-bars. In addition, isolating switches are provided and placed, electrically, right on the bus-bars to allow for safe inspection or repair of the controlling apparatus. By closing both of the selector switches it is possible to operate with both sets of bus-bars in parallel.

The same arrangement is made in the feeder circuits which may be connected to either or both sets of bars. On the separate rheostat or control board there is a duplicate set of direct current bus-bars from which the exciting current is taken through two, main, double-pole, single-throw, quick-break, switches to the generator field. These two switches are electrically operated, and may be used either singly or in parallel. In connection with them the usual



SECTION OF POWER HOUSE, SHOWING ECONOMIZER HOUSE

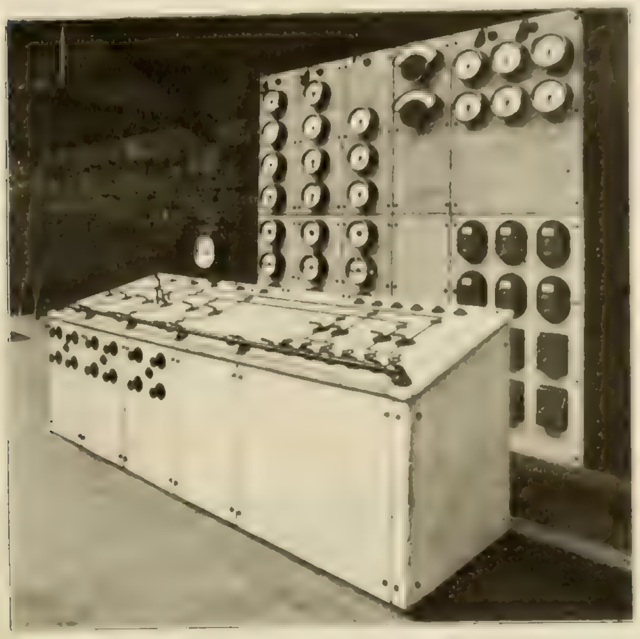


PLAN OF POWER HOUSE—METROPOLITAN RAILWAY.

discharge resistance is provided, and a field ammeter and an electrically operated regulating resistance complete the equipment for each generator exciting circuit.

As the potential of the current controlled by the switchboard is 11,000 volts, fireproof construction, safety and convenience of working were the leading considerations in their design, and all these conditions are amply met by most efficient means.

The bus-bars and other conductors are supported on heavy porcelain insulators, and where a difference of potential exists, are



INSTRUMENT AND CONTROL BOARD

separated by means of fireproof and insulating walls. All conductors are placed so as to offer the least risk to the switchboard attendants, but at the same time they are arranged to be readily accessible if necessary, and fully in sight. In the lower gallery the 11,000-volt generator and feeder main circuit oil switches are placed; and in the gallery above them, the selector switches previously referred to.

The top gallery contains the main alternating current bus-bars, and the various instrument and control boards. The latter is of the now very general desk type with an inclined top. On this is fixed the remote control apparatus for operating the main alternator, feeder, and field switches, and the electrically operated resistances and turbine governors.

On top of the desk is drawn a diagram of the connections, showing the generators, bus-bars and switches, and thus the attendant has always before him a clear representation of the conditions under which the station is working; this is a very commendable feature, and one that might be adopted with advantage in all stations of any considerable size. All the boards are of white marble.

Sub-Stations.

At the present time the sub-stations are not all completed, but ultimately there will be nine, which will come separately into use as occasion requires. They will be situated as follows:

Ruislip—Two 800-kw. rotaries with transformers, etc.
Harrow—Two 800-kw. rotaries with transformers, etc.
Finchley Rd.—Three 800-kw. rotaries with transformers, etc.
Gloucester Rd.—Three 800-kw. rotaries with transformers, etc.
Baker St.—Three 1,200-kw. rotaries with transformers, etc.

When extensions become necessary, Baker St., Finchley Rd., Harrow, and Ruislip will each be allotted another rotary converter of similar size to those they now contain.

From the power station, four cables run to Harrow, two of which continue to Ruislip. In the other direction, five run to Finchley Road, where one ends and another is tapped off, continuing its course with the remaining three to Baker St., where they terminate. From Baker St. eight cables run to the other four sub-stations of Gloucester Road, Bouverie St., Euston Road and Moorgate St., two feeders to each; thus, Baker St. when finished will be [illegible] Metropolitan Inner Circle traffic.

As regards the transmission and distribution of power, the system [illegible] volt, three-phase current is conducted to the sub-stations by three-core armored cables, and there transformed down and changed to [illegible] self-cooling type.

[illegible] drawings. The rotaries occupy the ground floor, and in some cases a railway siding is brought right into the building in order to facilitate the erection and replacement of machinery. The switchboards, oil switches, and transformer chambers take up by far the greatest space. Each transformer is placed centrally in a separate well-ventilated chamber with its low tension side facing the door, and a large air shaft common to all the chambers provides for a through draft. In the ceiling of the chambers, which is the floor of the upper gallery, large iron manholes are inserted to allow of the transformers being withdrawn if necessary, a hand power traveling crane being in most cases provided for this and other similar purposes.

On the ground floor behind the transformer chambers is a passage containing the high tension oil-break switches, and at the back of this are the cable ducts through which the 11,000-volt feeders enter the building and the track feeders leave it. The lightning arresters are situated here on the end of each cable in separate brick partitions.

All the high tension switches are hand-operated through gearing by means of levers placed close to the edge of the upper gallery, and in the case of those used in the rotary circuits are provided with

[illegible]

time limit relays, while automatic reverse current relays are installed with the feeder switches.

Electrical tripping arrangements are placed both on the switchboard panels on the gallery and the main levers.

The high tension bus-bars of thin copper strip are contained in brick chambers situated directly over the oil switches. They are

[illegible] effective [illegible] and access is obtained to them through iron doors, which when closed render them inaccessible.

The low tension and operating switchgear is contained on several marble panels placed well in front of the bus-bar chambers in the upper gallery.

The lighting of each substation is effected from a separate small transformer tapped direct off the feeders, and in addition an efficient gas supply is laid on to cope with the remote possibility of entire failure of the current.

Rolling Stock.

The new rolling stock of the Metropolitan Railway is all of the corridor type with longitudinal and transverse seats. The cars are 52½ ft. long, and are mounted on two pressed steel, four-wheel, bogie trucks; the weight is approximately 87,000 lb. Each motor car, of which there are two in a train of six coaches, is equipped with four 150-h. p. ironclad British Westinghouse railway motors, one for each axle of the truck.

The collecting gear carried on the motor cars is shown separately. The working parts are effectively shunted by flexible copper connections. This gear is installed on both sides of the motor cars, as the current rail is not always on the one side, and a similar arrangement is fixed to a beam in the center of the truck for making contact with the return rail.

The Westinghouse quick acting brake is fitted to all the trains, and works automatically in conjunction with the unit switch arrangement.

Both the power and lighting wiring of the cars is carried out with great precaution against fire. The method is illustrated in one of the engravings which shows some of the cables laid in asbestos grooves, filled in with a fireproof composition and covered with sheet asbestos.

The interiors of the superior class non-smoking cars are upholstered in art green moquette, and the smoking cars are similar in all respects except that the upholstery is in green leather. All the second-class cars have buffalo hide covered seats, and only differ from the first-class in that the decorations are less elaborate. Sliding doors are fitted at the ends of the cars, and patent swing gates are placed on the platforms.

All the rolling stock has been built at Birmingham and Manchester by the Metropolitan Amalgamated Railway Carriage & Wagon Co., Ltd., under the immediate supervision of the railway company's carriage and wagon superintendent, and the entire electrical equipment has been designed and installed by the British Westinghouse Co.

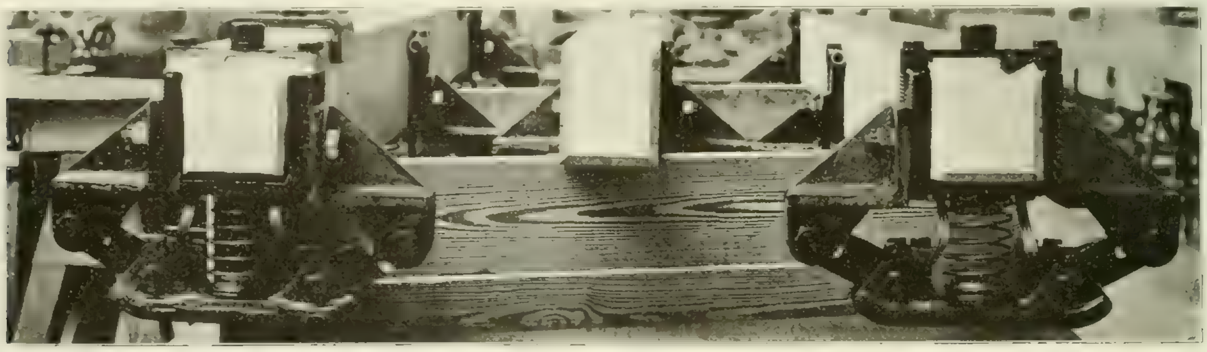
Train Control.

All the electric trains on the Metropolitan railway will be operated with the Westinghouse unit switch system of multiple unit control. This apparatus consists essentially of two parts, the turret controller carried under the body of the motor car and the master controller placed in the motorman's cab. Grouped around the center of the turret controller are 15-unit switches or circuit-breakers, each of which is operated by a separate pneumatic cylinder working against a powerful spring. The latter tends to open the switch, which can only remain closed so long as the air pressure is in the cylinder. The magnetic blow-out arrangement consists only of one coil that affects all the switches alike.

The air cylinders, placed in a circle above the switches, are controlled by magnetically operated needle valves, which when open allow compressed air to pass from the central chamber where it is stored to the cylinder, closing the switch attached to it.

The master controller is small and compact. It operates the needle air valves of the turret controller by aid of a 14-volt current taken from a small storage battery on the car. It has five notches for both forward and backward running in addition to the "off" or neutral point. The movement of the controller handle to the first step sets the emergency brake valve; the second sets the reverser—a piece of apparatus for controlling the direction in which the car is run—and puts on the main supply current; the third, or shunting notch, connects the motors in series with all resistance in; the fourth brings the automatic accelerator into play, which closes the switches of the turret controller in their right order unless checked by what is termed the limit switch; and the fifth, opening all the pneumatic switches that have been closed and simultaneously throwing in others, connects the motors in the first parallel stage with resistance in circuit.

An overload and no-voltage return relay is in electrical connection with the actuating magnet of one of the pneumatic cylinders of the turret controller which operates the main circuit breaker. To prevent damage from a resumption of supply after any interruption such as a break in the third rail or persistent bad contact in the collecting shoes, the no-voltage part of this device returns the controller to a position in which some considerable amount of resistance is in circuit, allowing it to be gradually and automatically cut out when the current comes on again. Sudden interruptions and resumption of supply such as occur when the collectors pass over points or crossings do not affect the relay, it being arranged to work too slowly for this.



COLLECTING GEAR ON MOTOR CARS.

Three of the most important points in the control equipment of these cars that have been found to be useful are as follows: The possibility has been recognized that through accident or sudden illness the motorman may leave hold of the controller handle, in which case, especially under the latter circumstance, grave consequences may ensue. This is provided for by means of a strong spring action, which when the handle is released returns it to the neutral position, interrupting in passing the circuit of an electromaget attached to the air brake. This opens a valve in the main pipe of the system, allowing the air to escape and the brakes to be immediately applied over the full length of the train. In ordinary reversing of the train this arrangement does not operate provided the handle is passed quickly over the neutral point.

The second safeguard is that which prevents any harm being done to the motors if the operator moves the controller handle rapidly over to the full parallel position. In such a case, the speed of working of the turret controller does not increase, and the various connections passing from first series to full parallel are made automatically at the right place. This reduction of the human element to a very low value results not only in greater safety and comfort to passengers, but in considerable economy in power consumption amounting to as much as 10 or 15 per cent over that obtained by ordinary hand operated methods.

The third provision is a system of interlocking between the control equipment and the power brakes, whereby the controllers throughout the entire train are opened automatically when the brakes are applied, no matter in what position the motorman may have or continue to hold the master switch handle.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO

The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1894 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from January, 1894, to January, 1897, Vol. II from January, 1897, to July, 1899, Vol. III from July, 1899, to April, 1901, Vol. IV from April, 1901, to April, 1903. Vol. V [illegible]. Price: Bound in sheep: four volumes, $10.00, single volume, $3.00. Bound in buckram, four volumes, [illegible], single volume, $2.00.

STATUTE OF LIMITATIONS RUNS AGAINST CONTRACT TO PAY ANNUAL LICENSE FEE.

Mayor and Aldermen of Jersey City vs. Jersey City & Bergen Railroad Co. (N. J. Sup.), 59 Atl. Rep. 15. Nov. [illegible], 1904.

The construction of its railroad by the defendant under the municipal consent that was required by statute and that was given by the plaintiff upon condition that the defendant would pay to the plaintiff an annual license fee for each car run by the defendant on its road, the supreme court of Jersey City holds, constituted an obligation resting in contract to pay such fees, to the enforcement of which obligation by legal action the statute of limitations may be pleaded.

DUTY OF MARCHERS.

Rideout vs. Winnebago Traction Co. (Wis.), 101 N. W. Rep. 672. Dec. 13, 1904.

This action was brought to recover damages for the alleged wrongful killing of a marcher who was parading with others on the street. True, the supreme court of Wisconsin says, the car had the right of way and it was the duty of the marchers to step aside so as not to interfere with its passage or speed. True, it was the duty of the marchers, as is ordinarily the case, to use their senses reasonably, to enable them to do that before the car came dangerously near them, and yet no excuse is seen for an assertion of a superior right in the company by consciously running its car into the parade at a speed of 22 feet per second.

PERMITTING ELECTRICITY TO BE CONDUCTED THROUGH WIRES WHEN NOT REQUIRED IN TIME OF STRIKE.

Cleary vs. St. Louis Transit Co. (Mo. App.), 83 S. W. Rep. 1029. Nov. 29, 1904.

The plaintiff's horse was killed by coming into contact with a trolley wire, charged with electricity, that was down upon a public thoroughfare. The St. Louis court of appeals says that the prevalence of a general strike, suspending the operation of the defendant's cars, and the lawlessness attending such situations, so far from excusing or justifying the perilous condition of the wire, rather aggravated it, and lent force to the charge of negligence in permitting the electric power to be conducted through the wire at a period when, from the suspension of the system, and the continued cessation of its cars, such motive power had not been for a long period, and was not then, required to propel them.

ORDINANCES MERELY EXPRESSIVE OF RULES OF LAW AS TO CARE TO BE USED TO PREVENT INJURY NOT ADMISSIBLE IN EVIDENCE.

Christy vs. Des Moines City Railway Co. (Ia.), 102 N. W. Rep. 194. Jan. 18, 1905.

The following ordinances were excluded from evidence in this personal injury case, on objection by the defendant, because merely expressive of rules of law independent of such regulations: "(6) Conductors and drivers employed by said company shall use reasonable care and diligence to prevent injury to persons, and on the appearance of danger to any one on or near the track the car shall be stopped, when by so doing such danger can be averted. (7) All proper care shall be used by conductors and drivers to prevent injury to teams, carriages, wagons, and other vehicles." The supreme court of [illegible] It says that in the use of the streets the company was bound to exercise reasonable care, and [illegible] must be stopped regardless of what the city council may think about the matter.

CARE REQUIRED OF STREET RAILWAY COMPANIES AS COMMON CARRIERS OF PASSENGERS—PRESUMPTIONS AND BURDEN OF PROOF IN PERSONAL INJURY CASES.

Lincoln Traction Co. vs. Webb (Neb.), 102 N. W. Rep., 258. **Jan. 18.** 1905.

Street railway companies, the supreme court of Nebraska holds, are common carriers of passengers, and are liable as other common carriers upon common-law principles. They are required to exercise the utmost skill, diligence, and foresight, consistent with the business in which they are engaged, for the safety of their passengers, and they are liable for the slightest negligence.

In an action for damages for an injury received while being transported by such common carrier, proof of mere injury, without more, does not raise the presumption of negligence sufficient to impose on the company the burden to prove due care on its part. In such cases the burden is on the plaintiff to prove that he was a passenger, was injured, the extent of his injuries, the accident from which the injury resulted, and circumstances of such a character as to impute negligence.

But where the negligence is proved, or where, from the nature of the accident, which was the proximate cause of the injury, negligence is presumed, the carrier is then required to show that it was in no wise at fault, or that the plaintiff was guilty of some negligent act which contributed to the injury complained of. In such a case it is error to instruct the jury, in substance, that it is only necessary for plaintiff to prove that he was a passenger and was injured, and that the burden of proof is then upon the defendant to show by a preponderance of the evidence that it was not guilty of the negligent act complained of.

CASE WHERE ONE COMPANY SHOULD NOT BE ENJOINED FROM INTERFERING BY PHYSICAL FORCE TO PREVENT THE RUNNING UPON ITS TRACKS OF ALLEGED IMPROPER CARS BY ANOTHER COMPANY.

Schenectady Railway Co. vs. United Traction Co. (N. Y. Sup.), 91 N. Y. Supp., 651. Jan. 4, 1905.

This was an action to enjoin the defendant from preventing the operation of the plaintiff's cars over its tracks in certain streets. The contract between the companies provided that, "until another type of car may be agreed upon between the parties hereto the railway company may operate cars forty-eight feet over all, with four motor equipments, air brake and track brake equipments, etc., said cars to weigh not to exceed twenty-five tons when loaded." The defendant did not seek to enforce a forfeiture of the contract or to prevent or interfere with the running of cars so long as the latter were within the express terms of the contract, and there was no question raised as to whether it unreasonably refused to assent to the use of larger cars. Under these circumstances, the third appellate division of the supreme court of New York holds that the plaintiff could not, upon its complaint, obtain the injunctive relief demanded. It says that the plaintiff's rights under the contract were

[illegible] gard of the test as a par-ticular car as to affect the determination of the court in the consideration of the rights of the parties as between themselves, or that required it to sustain an injunction pending the determination of the action. Assuming, for the purpose of this decision, that the defendant could waive the provisions of the contract, or become estopped from asserting the same, the plaintiff could not, without alleging in its complaint that the larger type of car had been agreed upon by the parties, or that the plaintiff had waived the terms and limitations of said contract, or become estopped from asserting the same, present to the court the facts upon which it claimed such modification of the agreement, waiver, or estoppel.

EFFECT OF RULE RESTRICTING SPEED FOR PASSING ENGINE HOUSES.

McKernan vs. Detroit Citizens' Street Railway Co. (Mich.), 101 N. W. Rep. 812. Dec. 22, 1904.

A rule of the company provided that motormen, when passing by engine houses, must not go faster than four miles an hour. The trial judge construed this rule as imposing no obligation upon a motorman to approach an engine house at a reduced rate of speed, being of the opinion that the four-mile limit was fixed for the period of time when the car was actually passing the 42 feet in front of the engine house. But the supreme court of Michigan thinks such a construction rendered the rule wholly ineffectual to accomplish any good. It says that the real purpose of this rule was evidently to challenge the attention of the company's employes to the necessity of approaching the engine house with the car under control, and fixing a speed of four miles an hour as a safe limit. The existence of this rule did not add to the company's obligations to the public. If, however, knowledge of this rule was possessed by the plaintiff, a fireman who was injured, this might have a distinct bearing upon the question of his contributory negligence.

EXTENT TO WHICH A PASSENGER MAY RESIST WRONGFUL EJECTION FROM CAR.

Breen vs. St. Louis Transit Co. (Mo. App.), 83 S. W. Rep. 998. Nov. 29, 1904.

The Illinois cases, and some from other states, holding that a passenger should retire from the car when ordered to do so by the conductor, notwithstanding the fact that he is rightfully on the car and has a right to remain until his destination is reached, the St Louis court of appeals says seems to it to require an unreasonable submission to wrong, and are not in consonance with the universal rule of law applicable to every condition in life, to wit, that every one has the right to defend his person, his property, and his legal rights, within reasonable bounds, when an unlawful attempt is made to deprive him of any one of them. But to maintain his right to remain upon a street car or railroad train after he has paid or tendered his fare, a passenger has no right to fight the conductor to prevent being ejected, for the reason that a fight would disturb the innocent passengers aboard the car; but he does have the right to so far resist ejection as to make it manifest that he is being put off by compulsion and against his will, and this is all that is meant by the expression, "He may manfully assert his rights, and make all lawful efforts to maintain them;" not that he may fight the conductor, or in any other manner disturb the peace of other passengers. To offer violence which would lead to a disturbance of the peace, to prevent his ejection from the car, would be to resort to unlawful means in the defense of his right to stay on the car.

INSTRUCTION AS TO CARE REQUIRED IN CROWDED STREETS THAT ENCROACHED TOO MUCH UPON PROVINCE OF JURY.

Indianapolis Street Railway Co. vs. Taylor (Ind.), 72 N. E. Rep., 1045. Jan. 3, 1905.

The trial court instructed the jury in this case that "greater care is required in populous cities and crowded streets than in sparsely settled districts and streets or highways upon which there are few travelers." The supreme court of Indiana holds that this was error under the practice of that state. It says that while, as a matter demonstrated by common experience, it may be true that greater care in the operation of street cars is necessary to avoid accidents in populous cities or crowded streets or highways than is necessary in "sparsely settled districts or on streets or highways where there are few travelers," nevertheless such a question, so far as involved in the case at bar, was a matter of fact to be decided by the jury, and not a matter of law to be announced by the court from the bench. Of course, it says, it was within the province of the court to have directed the minds of the jurors to any particular evidence in the case applicable to the question of ordinary care to be considered by them along with all of the other evidence upon the same point in determining whether the company, at the time of the accident, was exercising such care in the operation of its car; but it was not the right of the court to advise the jurors, as it in effect did, what weight or value they should attach to any such evidence.

LIABILITY FOR OBSTRUCTION OF STREET WITH VIADUCT.

Camden Interstate Railway Co. vs. Smiley (Ky.), 84 S. W. Rep.. 523. Jan. 20, 1905. "Not to be officially reported."

In this case a viaduct some 10 or 12 feet high was built along the central part of a street, leaving only the space of 21 feet between the line of certain abutting property and the base upon which the viaduct rested, and, after deducting the sidewalk of 10 feet, only about 11 feet for teams to drive on. The purpose of the viaduct was to raise the company's track so as to get up to a bridge over a river. It rested on trestlework. Bents were placed 18 feet apart. the bents resting on concrete pedestals 2 feet square. The owner of the abutting property referred to first sought to enjoin the erection of the structure without the payment first of a just compensation therefor, on the ground that the ingress and egress to and from her property would be materially affected. After the injunction which had been granted by the clerk had been dissolved, she amended her petition, charging that the viaduct was a permanent obstruction in the street, unreasonably destroying ingress to and egress from her property, and damaging it in a certain sum, for which she prayed judgment. The court of appeals of Kentucky holds that she was manifestly entitled to damages if the statements of her petition were true, and, although she was not entitled to enjoin the construction of the viaduct, the court. in furtherance of justice, should not have left her remediless, and refused to allow her to amend her petition and ask the relief to which the facts she stated entitled her. While the proof was conflicting, there was sufficient evidence of the obstruction of the ingress to and egress from the property to justify the submission of the case to the jury.

ASSAULT BY CONDUCTOR AFTER PASSENGER HAS VOLUNTARILY LEFT CAR.

Reilly vs. New York City Railway Co. (N. Y. Sup.), 91 N. Y. Supp.. 319. Dec. 23, 1904.

A passenger whose destination was Fifty-Second street claimed to have given the conductor a $1 bill requesting him to take out the fare for herself and daughter, but, failing to get back her change, she got off at Fiftieth street, where the conductor went into a small office. There she complained to the starter, who, after the conductor had resumed his trip without satisfying her demand, told her to wait until he returned. Then she received her change, and, when she turned to go, was apparently struck by the conductor. Assuming her testimony to be true, the appellate term of the supreme court of New York holds that the facts showed an unjustifiable assault for which the company could not be held liable. It says that it has been held that no matter what the motive is which incites the servant of the carrier to commit an unlawful or improper act toward the passenger, the carrier is liable for the act and its legitimate and natural consequences. The relation of carrier and passenger must, however, continue to exist. There is a plain distinction between a railroad company running a train of cars, from which a passenger alights at some point on his journey, and enters a room for the purpose of obtaining refreshments or to await the further continuance of the train, and is there assaulted and injured by an employe of the company, and a street car company, running only one car at a time, and whose passengers must continue thereon until the point of their destination is reached, and who, therefore, unless by transfer asked

for and given, relinquish the right of further transportation as soon as they leave the car. That a passenger on a street car who voluntarily leaves it at any point before he arrives at his first intended destination, does so without any existing right to be taken up and carried forward unless he again pays a fare and again resumes the relation of passenger and carrier, except one who is entitled to or receives a transfer, is a fact of common knowledge, and one of which the court may take judicial notice. It [illegible] that the plaintiff could not still be regarded as a passenger.

CARE REQUIRED OF STREET RAILWAY COMPANY—DUTY AS TO FURNISHING APPLIANCES AND KEEPING THEM IN REPAIR—SLIGHTEST NEGLIGENCE GROSS NEGLIGENCE—FREQUENT BREAKING OF TROLLEY WIRE—PASSENGER LEAPING FROM CAR.

Mannon vs. Camden Interstate Railway Co. (W. Va.), 49 S. E. Rep. 450. Dec. 20, 1904.

A street railway company, the supreme court of appeals of West Virginia holds, is in duty bound to the public, from which it enjoys its franchise and fares, to exercise the utmost diligence possible to secure the safe transportation of its passengers, of all ages, character, disposition, and information. To this end it must furnish appliances of the most approved construction, and keep them in perfect repair, so far as human skill and foresight can provide. It must at all times exercise the highest degree of vigilance in superintending the appliances used by it, so that they may be kept in the best possible condition, for it is using the most dangerous of all propelling agents, and to neglect its duties in this respect is to trifle with human life, and render its negligence criminal in its nature. The slightest negligence on the part of the railway company is gross negligence.

The frequent breaking of a trolley wire at or near a given point is evidence to justify a jury in finding such a company negligent in discharging the duties it owes to the public and its passengers. The evidence in the present case from which a jury would have the right to find negligence was the smallness of the wire, its use, wear and tear, and exposure to the elements for 10 years, its frequent breaking near the same place, its patchwork condition and the rotten character of the line poles, all tending to show want of that degree of care that the law requires. The fact that the new patch out of old wire broke tended to show that the wire used was for some reason weaker than the old wire which had been breaking previously.

Whether a passenger acted with ordinary prudence in leaping from a car in motion, or from a rash apprehension of danger which did not exist, under circumstances of age, time, place, experience, and other facts, about which reasonable men might differ as a justification for such conduct, is a question of fact for a jury, and not a question of law for the court. It is not necessary that the danger actually exists, but that the plaintiff has been placed by the negligence of the defendant in a position which has to him the appearance of imminent danger threatened, and forces him to momentarily act for the preservation of his safety and life.

INJURY TO CONDUCTOR TEMPORARILY LAID OFF BECAUSE OF ILLNESS AND RIDING FREE—COMPANY NOT LIABLE FOR ACTS OF CONDUCTORS ON ACCOUNT OF THEIR SUPERINTENDENCE.

McLaughlin vs. Interurban Street Railway Co. (N. Y. Sup.), 91 N. Y. Supp., 883. Jan. 27, 1905.

A conductor who has been laid off a few days because of illness, but who had just received a physician's certificate stating that he would be able to resume his duties on the following day, was seriously injured while riding on the front platform of a horse car by being thrown off from the driver suddenly loosening the brake. He was riding free because he was wearing the uniform of a conductor, and was regarded as being in the company's employment, and was riding on the front platform because the conductor of the car required him to do so. Conceding that he was free from negligence which contributed to his accident, and that the act of the driver in suddenly releasing the brake constituted negligence, the second appellate division of the supreme court of New York says that it is of the opinion that he could not maintain an action for damages, under the employers' liability act, because the negligence [illegible]

The provision of the employers' liability act extends the liability of [illegible] gence of a co-employe only where the negligent person is "in the [illegible] tendent with the authority or consent of such employer." It is true that, in a general sense, the duties both of a car conductor and a car driver require the exercise of superintending to the extent that intelligent watchfulness is essential to the careful performance of their work; but the superintendence referred to in the statute is something more than this, and is intended to relate to that class of servants who are generally known as "superintendents," and whose sole or principal duty is to oversee the work of others.

JURISDICTION OF FEDERAL COURTS [illegible] TION PROCEEDINGS.

Madisonville Traction Co. vs. Saint Bernard Mining Co. (U. S.), 25 S. C. Rep., 251. Jan. 16, 1905.

The traction company, a Kentucky corporation, having by its charter authority to construct an electric railroad, filed its application in the county court of Hopkins county, Ky., to condemn for its use certain lands belonging to the mining company, a Delaware corporation engaged in mining coal. The application was made under the Kentucky statutes relating to the condemnation of lands. Process having issued, the mining company, before any action was taken upon the report, filed its petition and bond for the removal of the case into the circuit court of the United States, alleging, among other things, that the value of the matter in dispute, exclusive of interest and costs, exceeded $2,000. The petition for removal distinctly alleged, as the ground of removal, that the two companies were corporations of different states. Subsequently the present original suit in equity was instituted in the federal court by the mining company against the traction company. The relief asked was that the traction company be restrained and enjoined from further prosecuting the case in the county court, or taking any further steps therein.

The supreme court of the United States says the fundamental question here was whether the case, brought in the county court, was a removable one. If it was, then the decree of the circuit court, restraining the traction company from taking further steps in the local court after the removal of the case to the federal court, was right; but if the case was not a removable one, then the decree was erroneous. The rule is now settled that, under the judiciary act of 1887, 1888, a suit cannot be removed from a state court unless it could have been brought originally in the circuit court of the United States. Why could not the proceeding instituted in the county court have been brought originally in the federal court? The proceeding in the county court was a suit or controversy within the meaning both of the constitution and of the judiciary act.

Speaking generally, it is for the state, primarily and exclusively, to declare for what local public purposes private property within its limits may be taken upon compensation to the owner, as well as to prescribe a mode in which it may be condemned and taken. But the state may not prescribe any mode of taking private property for a public purpose, and of ascertaining the compensation to be made therefor, which would exclude from the jurisdiction of the circuit court of the United States a condemnation proceeding which, in its essential features, is a suit involving a controversy between citizens of different states.

Now, it is true that the circuit court could not have the property in question condemned for local public purposes if the state had not previously, by statute, authorized its condemnation. After the removal of a case of condemnation from a state court, the federal court would proceed under the sanction of state legislation. It would enforce the state law, unless that law authorized the appropriation of private property for purposes that were not really of a public

nature. So far as authority to take the property for local public purposes was concerned, the circuit court could not enforce any other than the state law. It would respect the sovereign power of the state to define the legitimate public purposes for which private property may be taken, upon compensation to the owner being made or secured. But, at the same time, it could enforce, as of course it must, the authority of the supreme law of the land, which expressly extends the judicial power of the United States to all suits involving controversies between citizens of different states, and which also, by statute, give the circuit courts of the United States, without qualification, jurisdiction of such controversies. A state cannot, by any statutory provisions, withdraw from the cognizance of the federal courts a suit or judicial proceeding in which there is such a controversy. Otherwise the purpose of the constitution in extending the judicial power of the United States to controversies between citizens of different states would thereby be defeated. If the judiciary act of congress admitted of the case in the county court being brought within the original cognizance of the circuit court, that was an end of the matter, although it be a case of the appropriation of private property to public uses under the authority of the state. Under any other view a state, by its own tribunals, could deprive citizens of other states of their property by condemnation, without giving them an opportunity to protect themselves, in a national court, against local prejudice and influence.

In the present case the commissioners reported the damages to be only $100; whereas, the owner alleged that the amount awarded was grossly inadequate, practically confiscatory. That question, as well as the question whether the statute authorized the traction company to take the property, the Delaware corporation was constitutionally entitled, as between it and the Kentucky corporation, by reasons of the diverse citizenship of the parties, to have determined upon their merits in a court of the United States, in which, presumably, it would be protected against local prejudice or influence. The circuit court, recognizing the right of the traction company to appropriate the land in question, if necessary for its purposes, could do all that was required by the Kentucky statute, and meet fully the ends of justice. Besides, a court always looks to substance, and not to mere forms. Mere forms are not of vital consequence in cases of condemnation.

In short, the supreme court holds that, as the proceeding in the county court was a suit involving a controversy between corporate citizens of different states, it was one of which the circuit court of the United States could have taken original cognizance, under the judiciary act, and it was, therefore, a removable case. And being a removable case, it was to be regarded as having been removed upon the filing of the petition and accompanying bond for removal; in which event, it was competent for the circuit court, having thus acquired jurisdiction of the subject-matter, and of the parties, to enjoin the traction company from proceeding further in the state court.

INJURY FROM THIRD RAIL TO ONE ENTERING RIGHTFULLY UPON PREMISES—RISKS ASSUMED—WARNING REQUIRED.

Anderson vs. Seattle-Tacoma Interurban Railway Co. (Wash), 78 Pac. Rep., 1013. Dec. 28, 1904.

The evidence in this case showed that the plaintiff had bought a round-trip ticket for passage from Seattle to Tacoma and return. He had made the trip from Seattle to Tacoma in the afternoon, and, after spending some time in Tacoma, at about six o'clock in the evening, he attempted to get upon a car for the return trip to Seattle. He approached it from the left side, and just as it was starting he stepped upon the front step. The front door upon that side was closed, and he said he thought they were going to open it and let him in, but they did not do so. Upon reaching the first station out of Tacoma, the motorman opened the door and told him he must get off the car. He stepped with one foot onto the station platform, and the car immediately started. He then jumped back upon the car step, and the car was again stopped, when he was forced to get off. When he was told he must get off, he said: "I have got a ticket to go to Seattle. Give me time to get around on the other side and get on the car." But no time was given, and the car immediately moved away. Being thus left, and believing that his business required his return home that night, he immediately started back toward Tacoma for the purpose of trying to get a boat for Seattle. By this time darkness had come on, and, after he had proceeded about a mile to a point where the roadbed was upon a quite steep embankment elevated some five or six feet, seeing a bridge a short distance ahead, he tried to get off the roadbed and down the embankment, and in his efforts to descend he reached his hand and took hold of one of the rails and received a terrible shock This accident occurred on the first Sunday after the road was opened for travel, and he testified that he did not know of the existence of the electrically charged rail, though there was a notice posted at the station calling attenion to this dangerous rail.

The supreme court of Washington states that it could not be said that the plaintiff's presence upon the company's premises was initiated by trespass. He had by contract and for a consideration first entered upon the premises, and had been carried as a passenger from Seattle to Tacoma. The same contract called for his transportation from Tacoma to Seattle, and he therefore not only had a right to be upon the premises, but was there by the invitation and consent of the company. The conduct of its agents and employes in forcing him to leave the car was unexplainable in the light of the evidence in the record. Certainly the demand for speed in modern travel does not call for such zeal on the part of the employes of a railway company that time shall not be given a passenger to get aboard when he has already paid his money in the usual manner for his transportation.

Being thus left upon the premises, under all these circumstances, did he have no rights greater than those of an ordinary trespasser when he moved along the track? It was true he was not invited upon the premises as a pedestrian, but he was invited to come for business purposes, and the court believes, under all the conditions, that he did not become a trespasser in the really tortious sense of that term, even though some elements of technical trespass may have been present. He was in any event entitled to the reasonable protection from injury which one human being owes to another when placed in like situation. The company's agents must have known that from common experience the thing he was most apt to do was to take the track back to Tacoma. They should therefore have seen that he was advised of the danger of such a course because of the unusual and imperceivable danger to an uninformed traveler. Doubtless he was required to take the risk of all ordinary dangers attending a pedestrian upon a railway track, such as contact with moving trains, falling through bridges, and other usual dangers. But since he came upon the company's premises rightfully, and did not come as a willful trespasser, the court thinks he was not required to take the risk of such an unusual and hidden danger as this third rail, the character of which was unknown to him, and the powerful, death-dealing force of which was entirely concealed.

If modern transportation methods involve the use of such concealed, unprotected, dangerous, and deadly devices in places where persons of common experience may be expected to come in contact with them, the court believes those who use them should not escape liability unless they exercise such a degree of care to warn and protect those who are injured as the circumstances and surroundings reasonably require. Whether such care is exercised in a given case becomes a question of fact for the jury. In a case of this kind the conditions are out of the ordinary, and call for care commensurate therewith. To the uninformed the danger in this rail was as completely hidden as is the danger in the case of a spring gun. While the absence of criminal intent might remove this case from the domain of crime, yet resultant damage from neglect to sufficiently guard and warn against what was in itself an entirely concealed death trap was in effect the same as that visited by the spring gun, and was certainly ground for recovery of damages. Whether such neglect existed in this case was for the jury to say, and the same was also true as to whether the plaintiff was guilty of contributory negligence.

Again, the court says that, for reasons already stated, it thinks, that as the plaintiff was not a trespasser in the beginning, he did not become a real trespasser at all, but was on the company's premises by inducement for business purposes, and, being left as he was under the peculiar circumstances, he was not required to measure with exactness any given number of square feet of its right of way which he might occupy, and at the same time feel secure from hidden and unusual dangers, unless he had been warned of the danger.

Piping and Power Station Systems. V.*

By William L. Morris, M. E.

Condensers and Heaters.

Before taking up any of the other systems for the station in question we will next consider the requirements for a condensing plant having an artesian well and using cooling towers and a surface condenser. The most difficult feature to contend with in connection with using cooled water is that arising from the use of oil in engine cylinders. A surface condensing plant retains all the solids and the objectional matter contained in the water because the vaporization due to cooling the water carries away only the pure water vapor. There is an opportunity for much study in regard to a system and apparatus to be used in such a condensing plant. The elevated jet type of condenser in which the circulating water is not used for boiler feeding is shown in Fig. 23. Artesian well water ordinarily contains large quantities of lime and magnesia, making it necessary

1. Cost of pulling and deep well pump, motor, housing, etc.
2. Cost of chemical treating plant, housing, pump, etc.
3. Cost of cooling tower, fans and motors, pump and motor and building for the tower installation.
4. Cost of vacuum exhaust heater, by-passes, etc

The additional operating expenses would be:

1. Raising deep well water to its basin
2. Raising water to chemical tanks.
3. Raising water to top of cooling tower.
4. Power to operate cooling fans.
5. Cost of chemicals for treating.
6. Increased labor to operate and maintain additional apparatus.

The arrangement shown in Fig. 23 may be simplified by using a surface instead of a jet condenser and omitting the use of the chemical treating plant. This will necessitate the installation of an extra

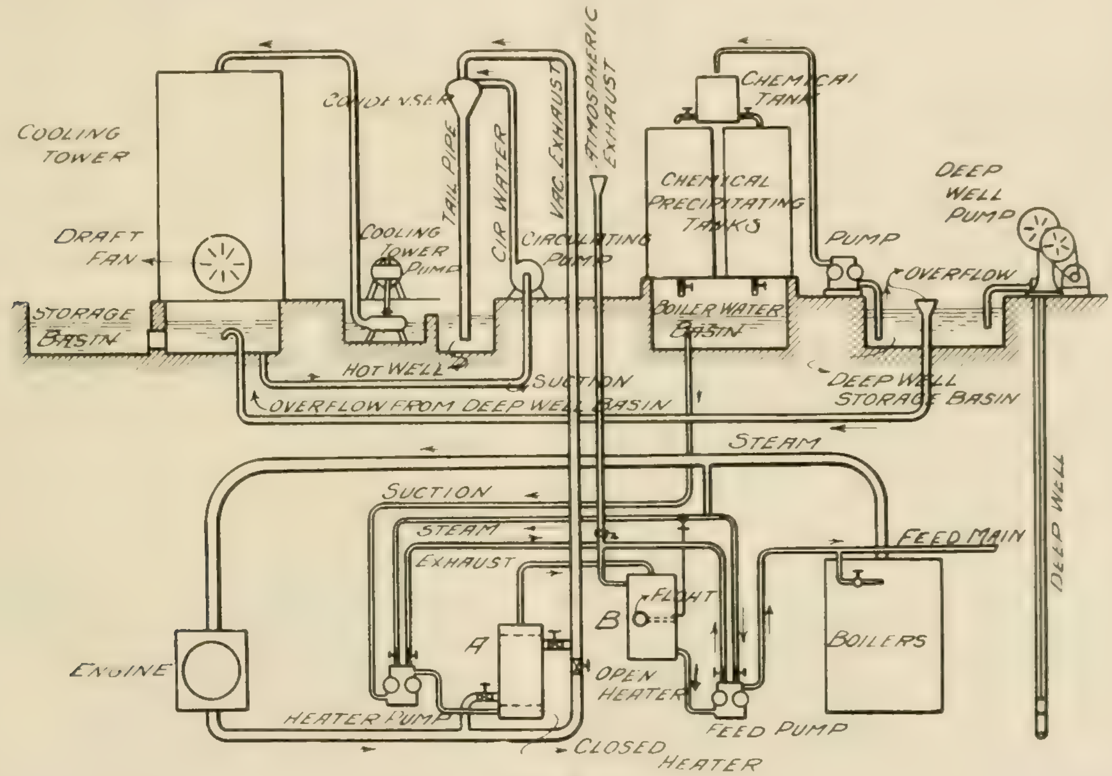


FIG. 23.

to remove these before feeding this water to the boilers. The amount of water in the form of vapor which would be lost while being cooled would be replaced chiefly by condensation added in the condenser and still more water would be added through a line from the deep well basin to the circulating pump. The loss in circulating water is greater than that required for the boilers so the feed which requires the least addition will be treated. By treating the boiler feed direct from the well all difficulties from cylinder oil, etc., are avoided.

To retain the heat which would ordinarily be saved by using hotwell water a vacuum exhaust heater A and an open atmospheric exhaust heater B for additional heating would be used. Since the feed water temperature would be as low with this system as with any other condensing arrangement the using of economizers, though not shown in Fig. 23, should be considered. The system here shown is practical but very expensive both to install and operate. The additional expense of installation of the system shown in Fig. 23 would be:

large grease extractor in the exhaust main and a large filter bed in the heater. Fig. 24 shows such a system laid out so that repairs may be easily made. It will be noticed that the large water basin may be completely shut off by closing valves A, B and C, thus allowing water to raise in the cooling tower basin and flow back into the cold water basin. During the time when the cold water basin is used as a supply for the condensers, the house service including the drinking and cooling water would be taken from the city water connection. During regular service the deep well pump would discharge into the cold water basin and the overflow from here would run into the cooling tower basin. The air traps at the water discharges of the cooling towers are not shown with the diagrams because no attempt is being made to show detail in connections. Note will also be taken that the heater and heater suction may be shut off and the wet vacuum pumps have another connection through which to discharge condensation to the pump suction other than by way of the heater. Any portion of the piping shown or any device may be shut off from service and one condenser still be run.

[illegible] from one machine to another, for instance if No. 1 condenser, circulating pump and wet vacuum pump be running and either of the pumps necessitates shutting down, it is then possible to put No. 2 machine into operation serving No. 1 condenser, and not shut down the No. 1 machine until No. 2 is in operation and supplying No. 1 condenser. When one condenser is out of service the other can be readily run and two circulating pumps used on it. This system enables perfect operation even though there be a circulating pump of one unit, and a condenser of the other unit out of service.

In a piping system there should be no machine piped direct to another without cross connections, so that the shutting down of one would require the shutting down of the other. There should be two separate sources of supply and two ways of discharge, with one machine on either end and the cross connections so arranged that either or both machines could use either supply or discharge. This is absolutely essential because it allows for repairing the pipe line or machines. The system shown in Fig. 24 is about the most satisfactory arrangement which can be laid out for an artesian well, cooling tower and condensing apparatus. The boilers would be fed with condensed steam and only that water lost by leakage at the joints, exhaust drips, etc., would need to be replaced. In a surface condensing plant the steam for the feed pumps would be somewhat differently arranged than in a jet condensing plant. The method of supplying water to the heater and steam pumps would be the same for a jet condenser plant as for a non-condensing station. This detail will be taken up later.

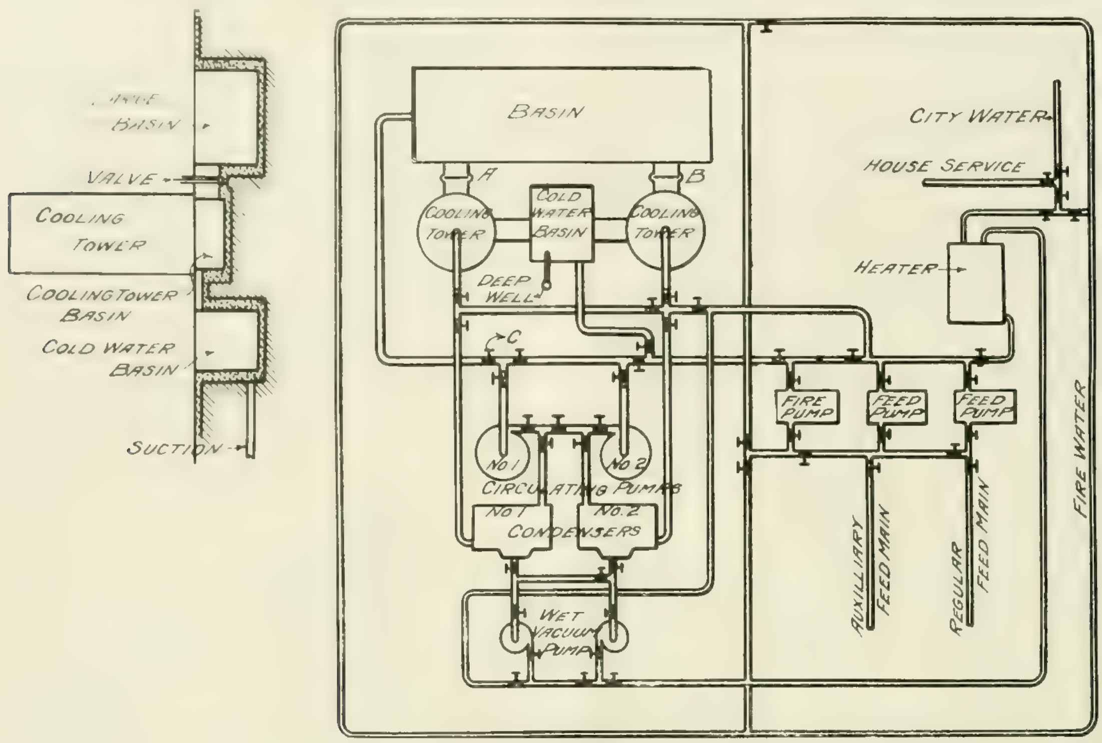


FIG. 24

In the heater and pump arrangement for a surface condensing plant as in Fig. 25, the condensed steam from the condenser is free to be discharged into the heater and the speed of the pump is governed by the water level in the heater. The only hand control is a valve in the make-up water line. This line replaces the water which has been lost by leakage, drips, etc., and would be quite a steady, invariable quantity requiring but little attention when slight variations in the relative water level of two boilers may be controlled by the boiler feed valves. If during the day the fireman observes that the total water in all boilers is becoming low or high he slightly adjusts the make-up water valve. The advantage of this style of governing is that regulation is required for almost constant demand caused by leakage, drips, etc. It is not practical with this style of condenser to leave the pump control to a fireman when he has no control of the incoming condensation. If so, it is fair to presume that fully one-third of the return condensation would go to the sewer. The object in using a surface condenser is to be able to save all the condensation for the boilers, thus using very little new water. This can be accomplished only by connecting the float valve to the pump steam

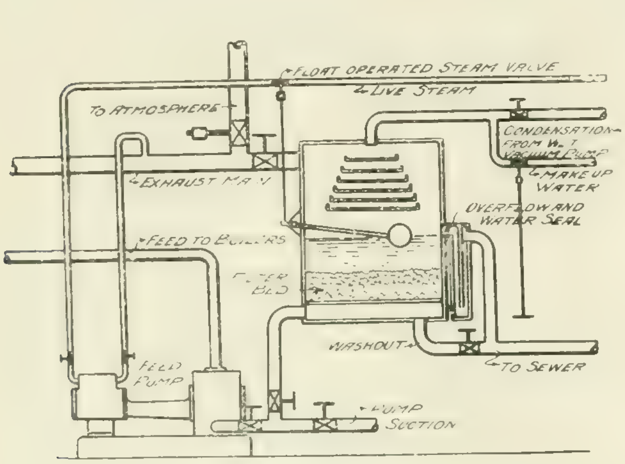


FIG. 25.

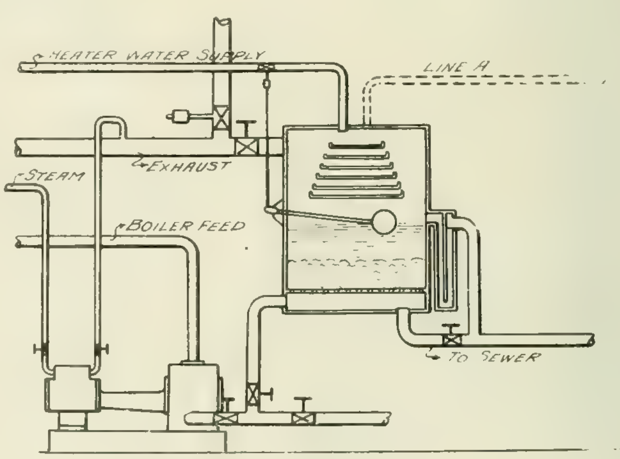


FIG. 26.

connection, and if it is desired at any time to skim off the top of the heater water this can readily be done by shutting steam off the pump for a minute or so.

The heater manufacturer will possibly oppose this style of piping, claiming that it is not the regular method. For all other applications their method as shown by Fig. 26 is correct but for surface condenser it is radically wrong. The absurd claim is sometimes made that when a heavy load comes on the boilers would evaporate water to a low water level and it should be possible for the fireman to speed up the pump in order to increase the water in the boiler.

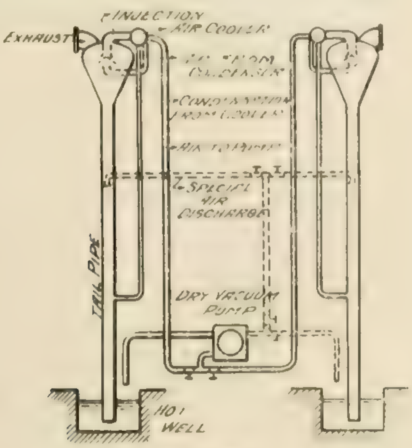


FIG. 27

The velocity of steam in pipe lines should not be taken at less than 1,000 ft. per minute and with this speed it would take about 5 seconds for steam to leave the boiler, reach the condenser, and be condensed ready to deliver back to the heater. The fireman would not have time to even see the change in the boiler water level by the time the feed pumps were under control of the changed condition.

The system shown in Fig. 25 is not suitable for a non-condensing or for a jet condenser plant, but it is desirable for the returns of a heating system which is also a surface condenser. In Fig. 26 is shown the regular method of heater connections using a float control valve in the water supply line. Line A is the discharge from the steam traps, etc., which must be left open at all times. This would also be the discharge from the wet vacuum pump in case Fig. 26

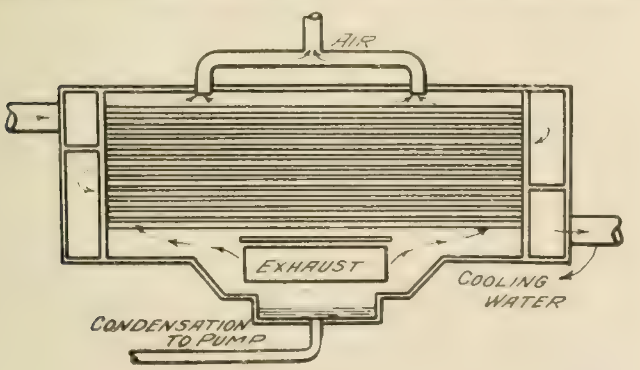


FIG. 28.

were used for a surface condenser system. The line A should deliver to the heater but a small portion of the feed water because the boilers and the pump should never be run slower than is necessary to remove the feed water from the heater. For the station in question since we are using jet condensers, we will use the system shown in Fig. 26, that is the line A will be the discharge from the heater pumps and the float operated valve will be on a branch from the house service line. The float operated valve will be out of service for the greater part of time during regular operation of the heater pumps, because these pumps will deliver to the heater the same amount of water as the feed pumps would take away. In case the heater pumps are not being used, the heater supply would be controlled wholly by the float operated valve.

Referring to Figs. 22, 23 and 24 it will be noted that the dry vacuum pumps are not shown. The dry vacuum system would be the same for either style of condenser but if a surface condenser [illegible] operation. A surface condenser accumulates air until the vacuum is [illegible] being mingled with the air. An elevated jet condenser will ordi- [illegible] vacuum pump, in fact the syphon type elevated jet condenser is in- [illegible] the valves placed as closely as possible to the pump in order that the number of joints and fittings between the shut-off valves and the pump may be reduced. To make repairs between the valves and pump necessitates shutting down the pump but any other repairs can [illegible]

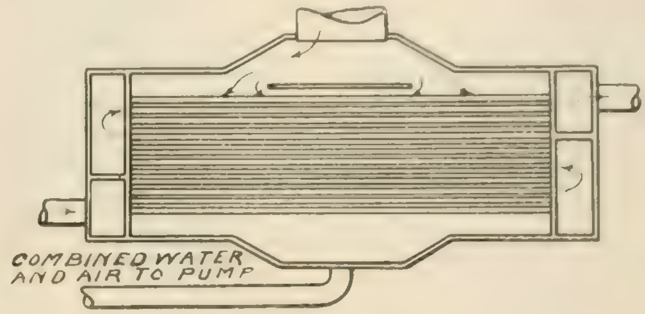


FIG. 29

The air cooler drains back into the tail pipe or hot well, the injection water passing through the cooler on its way to the condenser. The air pump is shown discharging over the hot well but may discharge over a sewer catch basin as there is no appreciable vapor. Another method is to discharge the air into the tail-pipe shown in the dotted lines. The advantage of this arrangement is that air showing, say 26 in. vacuum, is taken from the condenser bowl and discharged into the tail-pipe where it would show but 20 in. of vacuum, thus instead of compressing 7 cu. ft. to 1 cu. ft. as would be the case if exhausting to atmospheric pressure, it is necessary to compress but 2½ cu. ft. to 1 cu. ft. This arrangement would not permit raising the vacuum on the condenser and the atmospheric vent would require being used until the vacuum is on the condenser and the water flowing through the injector shaped air discharge in

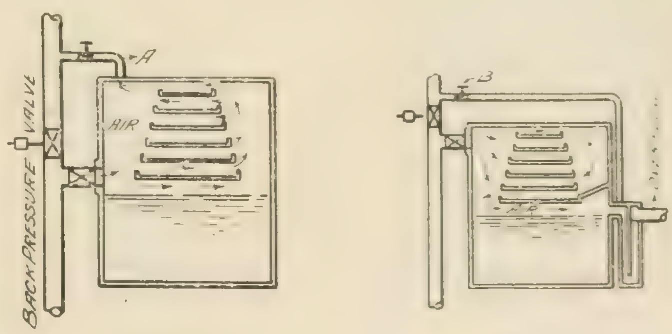


FIG. 30.

the tail-pipe. The air cooler shown is used on jet condensers only, the surface condensers admit the cooling water to the condensing tubes in contact with the outgoing air. In addition to cooling the air it is also necessary to cool the air cylinders of the dry vacuum pump, otherwise the high temperature due to compression will prevent proper lubrication.

Different methods are used for removing the air from surface condensers. Fig. 28 shows the Alberger counter current system. The exhaust steam enters beneath the cooling tubes and the air is withdrawn from the top of the condenser. The condensation makes its last pass over the hottest tubes and therefore through highest temperature in the condenser. The air which is removed from the upper portion of the condenser by the action of an air pump is in contact with the tubes which contain the cold incoming circulating water. Evidently the air must be in a continual state of unrest due to the counter current action. The weight of saturated air at the tempera-

[illegible] If it were not for the exhaust steam entering the lower part of the condenser and being deflected over the entire base it would be possible for air to settle to the base of the condenser, but instead it can drop only into the current of incoming steam and therefore be constantly carried upward. Air cannot remain in pockets at the upper portion of the shell because it is heavier than steam and will therefore drop and be caught in the steam current.

The fact that this type of condensers has shown itself to be very

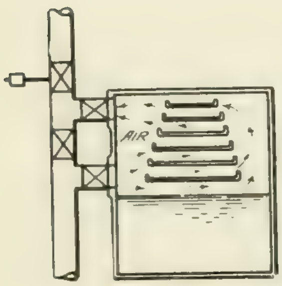


FIG. 32.

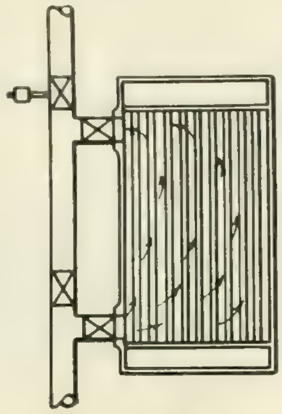


FIG. 33.

effective is sufficient proof of the merits of this most unusual method for removing air from a condensing chamber.

A more usual type of condenser is shown in Fig. 29, the exhaust enters the top and together with air passes towards the bottom of the condenser, the air dropping to the base of the condenser and "flowing" away with the condensation. It is not the intention here to give the "selling points" of different types of apparatus but these two styles of condensers differ so greatly in their system for removing air that they have been described. In fact, the elevated jet type of condensers are also made in these two styles. The Weiss condenser is of the counter current type, the steam entering below the water spray and flowing upward retarding instead of accelerating the fall of the injector water after leaving the spray pan. The air is taken from the upper portion of the chamber instead of the lower

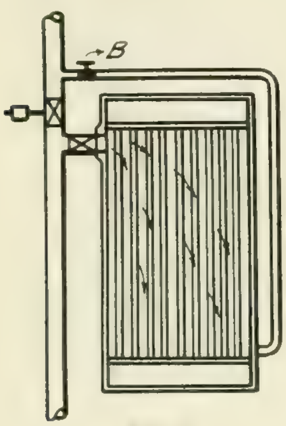


FIG. 34.

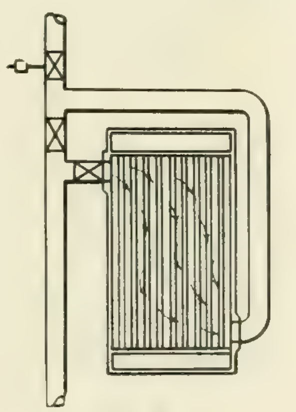


FIG. 35.

as the steam entering the lower portion prevents the air from precipitating. This method of removing air must be more effective for both jet and surface type condenser judging by the excellent results obtained from them.

In removing air from either an open or closed exhaust heater it must be remembered that the air should be led off at the water line and not at the top of the steam chamber. In cases where all the steam from a non-condensing plant passes through the heater, air will be removed by the rapid flow of the steam, provided the openings in the heater are properly arranged. Fig. 30 shows an ordinary heater connection which is radically wrong, the small air vent A being wrongly placed so that the flow through the side and top connection is very slight; in fact, too slight to carry out air by the velocity flow through the heater. The correct method is shown in Fig. 31 which may appear wrong until more fully considered. The exhaust enters the top and causing no eddy currents will drop to the water line and if the valve B is open will pass away to a point of lower pressure.

Heaters can also be styled direct and counter current, the same as jet or surface condensers, or open spray or closed tube type of heater. Figures 32 and 33 show the counter current type, the air being constantly in a state of unrest and due to the large volume of surplus exhaust passing to the atmosphere the air will drop into the current of the steam and be carried out of the heater. This type of connection would show better efficiency than Fig. 35 because as in counter current surface condensers air would not be carried to a point where it would remain stagnant and thus insulate any heat conducting surface. The heaters shown in Fig. 31 and 34 are specially suited for use in condensing plants where the amount of exhaust steam supplied the heater is too slight to cause enough upward flow to carry air with it. The valve B shown in Fig. 31 and Fig. 34 should be of a globe or gate type and not a back pressure valve as it is very necessary to prevent a vacuum on the heater unless the apparatus is specially arranged to stand such pressure.

(To be continued.)

British Columbia Electric Railway Co. Absorbs The Vancouver & Lulu Island Ry. Property.

Arrangements have been completed whereby the British Columbia Electric Railway Co., Ltd., will take over the business and property of the branch of the Canadian Pacific railway known as the Vancouver & Lulu Island Ry. The British Columbia company will soon commence work in converting the line into an electric system, and it is expected that the line will be ready for operation by July 1st. A sub-station will be erected at a point about midway between Steveston and Vancouver, and plans for the structure are being prepared by Dalton & Eveleigh. The building will be similar to the present sub-station at Burnaby, slightly larger and the machinery installed of greater capacity. It is also stated that the plans of the company include the use of electric locomotives for handling freight on various parts of the line. Plans for the schedule between Vancouver and Steveston include an hourly service during the summer months and bi-hourly service during the winter, with freight service at as frequent intervals as the business may justify.

Australian Tramway Systems.

Although the introduction of electric traction into Australia is of comparatively recent date, yet its development has been very rapid, as may be learned by noting a list of some of the present Australian tramways and the amount of traffic which they are handling. In Sydney the trolley system is owned by the state, and has 125 miles of track. An interesting description was printed in the "Review," Oct. 20, 1903, page 823. This road carried 130,405,402 passengers during 1903. The Melbourne system is owned by a municipal trust. This road has 48 miles of track and is operated by cable. The number of passengers carried during the year was 47,564,942. There are also several suburban lines near Melbourne on which are operated horse cars. An English company owns the 28 miles which make up the tramway system in Brisbane. There is a horse car line in Adelaide, which is owned by a private company. Electric lines owned by private companies are now in operation at Perth, Kalgoorlies municipalities, Roebourne, Cossack, and in several other cities roads are in process of construction. An extended description of the Kalgoorlie tramways was published in the "Review," Sept. 20, 1903, page 754.

Sixth Annual Convention of the American Railway Engineering and Maintenance of Way Association.

Announcement has been made that the Sixth Annual Convention of the American Railway Engineering and Maintenance of Way Association will be held March 21, 22 and 23, 1905, at 9:30 o'clock a. m., at the Auditorium Hotel, Chicago, Ill. The second session each day will be held at 2:30 o'clock p. m.

The Louisville (Ky.) Railway Relief Association gave its annual banquet February 16th at Liederkranz Hall, Mr. J. T. Funk, superintendent of the railway company, presiding.

Tramway Overhead Equipment Materials.*

BY H. M. SAYERS, M. I. M. E.

This audience is well aware of the general purposes to be fulfilled by a satisfactory overhead equipment, but to make an orderly study it is necessary to commence by a brief analysis of the mechanical and electrical conditions which must be satisfied in order that the structure may serve its purpose with the maximum economy and efficiency. The necessity of studying appearance should not be a serious addition to the primary engineering necessities, for the appropriate use of materials and obvious adaptation of means to ends satisfies the æsthetic as well as the practical sense and, where incongruity with architectural and natural beauties is the danger, unobtrusiveness will probably give better results than any elaborate attempts at ornament.

The first mechanical condition to be satisfied is evidently that of safe and stable support. The trolley wire has to resist, in addition to the stresses on a suspended wire, the repeated upward thrust of the trolley pole and the friction of the trolley wheel. The attachments are exposed to reversed stresses of the nature of blows in both vertical and horizontal directions, and the wires being necessarily carried at a distance of several feet from the poles any unbalanced longitudinal stress produces considerable couples upon the supporting structure. The second mechanical condition is that imposed by the function of the trolley wire as a suspended guide or rail for the trolley wheel to run on. This condition resolves itself into a necessity to follow the general lines of the rail-track in plan—with some maximum permissible lateral deviation, and some maximum permissible change of horizontal direction at points of support. The permissible limits in both directions depend upon factors outside the overhead structure, some of them being the type of trolley boom and wheel, the size and speed of the cars, the radii of the curves, and the lay-out of junctions or other special work.

The effects of wind and snow are of relatively small importance as regards trolley wires, but must be given full weight in the erection of guard wires. The electrical conditions to be met affect the mechanical structure in so far as they prescribe the size and weight of the trolley wire, the necessity for efficient insulation being constant.

Time will not permit of more than quite general references to questions of design and erection of the line, excepting as they may affect the choice of materials and design of parts. I therefore take the different items of material in an order which is intended to be logical and consequent.

The trolley wire comes first, its support and proper position being the principal object of the whole work. The stresses on all the supporting structure are evidently functions of the size and weight of the wire used, and to keep down the size, weight, number, and expense of supports the wire should be chosen as small as will serve the designed purpose.

It is easy to show that there is no electrical necessity for using any wire larger than No. 0 S. W. G. (.324 in. diameter), where the trolley wire is fed as usual from underground feeders at half-mile intervals, unless the traffic is extremely heavy. But on suburban or interurban lines carrying an infrequent service it may be necessary to avoid the expense of underground feeders, and to employ heavier trolley wires, or preferably overhead feeders. Heavy traffic, especially over curves of short radius, may also afford a reason for the use of larger wire in order to increase the life, and remove the risk of breakage on account of heavy mechanical wear.

The most economical size of trolley wire to employ in any particular case is thus mainly a question of its life as a mechanical wearing part, the cost of renewal and the loss by scrapping having to be put against the capital expenditure. But it must not be forgotten that a heavier wire involves heavier poles and other supports, the cost of which must be properly brought into the account. The conditions are too complex, and at present too little determined by experience, to admit of the formulation of any general rule, but it is probable that where the conditions are very severe it is better to employ one of the harder bronze alloys than a copper wire of larger size.

One reason for this is that the wearing qualities of hard-drawn copper wire are not directly proportional to its weight, the hardness diminishing from circumference to center. This is well shown by the fact that the postoffice specification for such sizes as Nos. 12 and 14 call for a breaking strain of 62,720 lb. per sq. in., whilst the 000 trolley wire specification is equal to 49,280 lb., over 20 per cent less. The effective thickness of the hard skin varies with the details of the manufacturing process, and very little seems to be known about the subject by users; but, from the behavior of trolley wire under long wear, it seems probable that the hardness diminishes gradually and, up to such sizes as No. 0, a considerable thickness is appreciably hardened. It is also possible that the rolling of the trolley wheel has a further hardening effect but, where the wheel rubs or grinds hard abrasion removes the hard exterior and the softer metal inside is soon reached. On these facts it is clear that a material that is hard right through should be preferred. Very little experience with these bronze wires has been made public and, as some are brittle and some pit badly under arcing, they should not be extensively adopted without trial. They are all of higher electrical resistance than copper and, therefore, require feeding at shorter intervals if the traffic is heavy. The mechanical and electrical qualities required in trolley wire are well known, easily verified by test, and readily complied with by a considerable number of makers. Very high tensile strength should be regarded with suspicion as probably indicative of brittleness, and bending and falling weight tests should be made in such cases.

The next point in order after the size of the wire is its position in relation to the track; the choice lies between side and central wires. There is sometimes a conflict here between the claims of good working, and the supposed interests of appearance, but the prejudice against span wire construction is happily dying out, and it is unnecessary to enter into any elaborate argument before this audience to show why and how the center wire gives the best working. Assuming that center wiring is adopted the approximate position of the wire is given at once by the center lines of the tracks, as shown on the permanent way plans, or as actually laid. There are sometimes material differences between track plans and execution, and it is often wasted labor to plan out overhead work in full detail from construction plans. It is far better to let the permanent way construction get a good long start of the overhead, then pole positions can be laid out from the actual track centers, and the overhead work can be carried through continuously, and with the certainty of correct position. As overhead work does not take more than a fifth of the time required for track construction, there need be no difficulty in arranging for practically simultaneous completion of the two. Although exact positions cannot be taken from permanent way plans, the number and size of poles and the general arrangements can be got out sufficiently well to order all necessary materials in good time. The maximum distance apart of supports is settled by the Board of Trade regulations at 120 ft.; on straight lengths there is no reason for diminishing this, and it is therefore taken as the standard. But at curves, junctions, and termini the positions of poles have to be carefully considered, and so arranged as to take the longitudinal pulls of the straight lengths or tangents as directly as possible, to hold the trolley wire closely and firmly to the required curves, and to hold "special work" to its correct place. There is often but a limited choice for pole positions, especially at junctions where streets cross, and in all such cases an accurate large scale survey should be made, the trolley wire and special work laid down on it, and the best arrangement of span and pull-off wires will suit the possible pole positions worked out. The labor of drawing several alternatives will be well repaid by the workmanlike and satisfying appearance of the completed work, and by the absence of working troubles.

One essential point at these places is to anchor the straight lengths as directly as possible to a heavy pole. If such a pole can be placed at the intersection of the tangents it can take both anchor wires. The ends of the curves should also be anchored in the usual way. This anchoring is very important, because it makes the straight lengths and the curve-work mutually independent, the span wires are not distressfully pulled out of line, and the pull-off wires intended to shape the curve have not to take indefinite components of the pull of the straight lengths. Most important of all, if any accident happens to the overhead work on either the curve or one of the straight lengths its effects will be stopped by the anchoring. Anchoring is also necessary at section insulators, and it is advisable to anchor every quarter of a mile, even on a perfectly straight line, in order to localize the effect of a trolley wire breaking. Termini,

*Read before the Tramways and Light Railways Association, Jan. 13, 1905.

curves, and junctions are the keystones of the whole structure and, when the pole positions at these places have been worked out, the tangents between have only to be divided up into equal lengths of as near as 120 ft. as circumstances permit, but never exceeding that distance. Side poles with brackets can rarely be used to carry wires central to the track as the bracket arms would be unduly long; the choice lies between span wires and central poles. Where there is room central poles have certain advantages, especially that of neat or even ornamental appearance, and their cost is somewhat less than that of span-wire construction. But as the clearway between the tracks has to be from 2 ft. to 2 ft. 6 in. wider to give the regulation clearance between cars and standards, the total cost to the tramway undertaking is rather increased than diminished. They also have to be lighted sometimes at the tramway expense. To other traffic in a busy thoroughfare central poles are a nuisance and a danger but, where streets of magnificent width relatively to the traffic on them exist, the disadvantages may be inappreciable. On even slight curves center poles are insufficient, as there is no means of "pulling-off" the outside wire, and, if side poles are added for that purpose, they look very odd.

Feeding points have also to be reckoned with in laying out pole positions. The best way of cutting up the work into half-mile sections will depend upon many local conditions, but one constant consideration is to arrange that a fault on any section shall have a minimum effect upon the whole service and, consequently, sections frequently terminate at junctions. Section insulators should be kept out of the junction special work and, where this is complex or important, it is best to insulate it on all sides and feed it separately. Section insulators should not be put on curves, or on steep gradients.

If the central wire has been decided upon, span-wire construction will be the prevailing type, excepting where central poles may be possible and preferred.

It is just possible in some cases to carry a central wire from a side pole and bracket arm. In the case of a double line these will be required on each side of the street, and it is hard to see what is gained in appearance by the substitution of two sets of bracket arms for one set of span wires. The bracket arms are much more conspicuous and the construction more expensive. Span-wire poles will be set out in pairs opposite each other on straight work, but on curves more and stronger poles are needed on the outside, or convex side, of the road than on the concave side, the pull of the trolley-wire being centripetal. Bracket arm poles should always be on the outside or convex side of the road.

Having arrived at the pole positions the next point to determine is the strength of pole to be used in each. Generally speaking, three grades of strength will suffice. The Engineering Standards Committee has recently issued a standard specification for tubular tramway poles in which the three strengths are classed as light, medium, and heavy, and the strength defined by the loads needed to produce a temporary deflection of 6 in. and a permanent set not exceeding ½ in. under conditions fairly representing the working loads. The temporary deflection load may be regarded as the maximum safe working load, and the permanent set load as marking the commencement of danger by deformation. The loads are as follows:

Class of Pole.	Load for temporary deflection of 6 in.	Load for permanent set not exceeding ½ in.
Light	750 lb.	1,000 lb.
Medium	1,250 lb.	1,750 lb.
Heavy	2,000 lb.	2,500 lb.

The light poles will naturally be chosen for straight line work, the medium serve for pull-offs on moderate curves and, for feeder poles, and the heavy for anchor poles and for carrying heavy special or curve work which involves resistance to the direct longitudinal pull of trolley wires. Occasionally heavier poles than the standard "heavy" class may be needed, but these occasions are rare, and may often be avoided by dividing the load between two "heavy" poles. The choice as between sectional and taper poles is mainly one of taste and price. That the appearance of a pole of uniform taper is better than that of a pole built of three parallel sections is a general opinion. At present, for equivalent mechanical tests, taper poles to standard dimensions are dearer than sectional poles, and somewhat heavier. The absence of the swaged joints is put forward as a mechanical advantage, but it is very rarely found in practice that a sectional pole fails at the joints. If taper poles are used it is desirable to have them solid rolled, as a lapweld the whole length of the pole may prove a line of weakness. Solid rolled tube is an improvement in sectional poles, but there is not a great risk of poor welds in these comparatively short lengths, and if the joints are set at 120° in plan, as they should be, the pole as a whole will show no line of weakness.

Wooden poles have been very little used in this country, but are somewhat extensively employed in the United States and some Continental countries. They will rarely be tolerated in town work here. Wooden poles should be chosen to give the same temporary deflection as would be called for in steel poles. As this depends upon stiffness, it will generally be found that very thick timber is necessary and the poles will have a stumpy and heavy appearance. The first cost will generally be lower than for steel poles, but the ultimate economy is somewhat doubtful and should be considered with full knowledge of the special conditions, especially the probable life of the wooden pole in the local soil and climate. In any case the poles should be creosoted to the Post Office specification, and they should not be set in concrete.

Lattice poles can be purchased, and are sometimes used on the Continent. They are said to be cheaper than tubular poles of equal strength, but are very ugly, and it is probable that the painting necessary to preserve them from rapid corrosion in this climate will neutralize the initial saving.

The type, positions, and sizes of poles being settled, the intermediate supports between poles and wire claim attention. The choice lies between span wire and bracket arms, but it is frequently necessary to use both constructions in different parts of a tramway net work. If the central wire has been chosen span-wire work will generally predominate, but there are many exceptions, especially on systems which are mainly composed of single lines with turnouts. Where bracket arms are employed it will be wise to use the short span-wire arrangement generally known as the "bowstring." The older construction, in which the hanger is clamped directly to the bracket arm, is probably obsolete. The rigidity of the attachment is a serious evil, imposing upon the hangers and the trolley boom a considerable blow, detrimental to every part, especially to the insulation of the hanger and clamp. It may further be said that it is not possible to provide a satisfactory permanent insulating sleeve for the clamp in this climate, all materials tried, so far, failing in a comparatively short time. The "bowstrong" suspension is an improvement, but it is still far more rigid than the span wire and, therefore, results in greater wear of wire and trolley wheels, and in deterioration of insulators, besides leading to de-wiring at speeds much lower than can be run with safety on span-wire work

This detrimental effect of rigid or semi-rigid attachments is sometimes overlooked, or the true cause is not recognized, although it is simple enough. The trolley wheel of a moving car presses the trolley wire upwards with a force which usually equals or exceeds half the weight of the span of wire.. At the centre of a span it will therefore lift the wire considerably, possibly to the height of the points of support; from the centre onwards it is, however, depressed with increasing rapidity as the stiffness of the wire comes into play, and will be below the level of the ear some distance before it arrives there. It therefore meets the rigid ear while rising rapidly, and delivers a blow the force of which is the product of the effective mass of the whole boom and head, and the square of its upward velocity. At some speed the rebound will take the wheel flanges clear of the ear and, if there is any side pressure, dewiring results. The noise and the flash invariably seen on the passage of trolley wheels under bracket-supported hangers demonstrate the correctness of this explanation. After passing the ear the wheel at first descends, but soon commences to rise again up to about the middle of the next span. Its path is therefore a wave-like one with a high crest in the middle of each span and a small steep one at each ear. Besides the effect of the blow upon the ear, the insulating materials, and the trolley wheel and the boom, the wire is worn by arcing and damaged by bending. It is therefore not extraordinary that failures of insulators and breakages of wire at ears are more common on bracket than on span-wire work. If bracket-arm construction is used, the bowstring should be made as long as practicable in order to get the maximum flexibility.

The flexibility of a span-wire construction greatly reduces the blow upon the ears, as the span wire also rises to the trolley pressure, and the car more readily aligns itself with the wire but, at high speed, the effect is quite perceptible and, for railway speeds,

the longitudinal suspending wire carrying the trolley wire by hangers at short distances and so approximating to a system with a constant vertical rigidity from point to point is essential.

Span, bowstring, and pull-off wire are generally of galvanized steel, but in many towns this material has but a short life on account of atmospheric pollution and, in such cases, phosphor or silicon-bronze wire should be used. This applies equally to guard wires and their supports; whichever is used the metal parts of the suspension fittings should be of similar metal. There is no means of preventing galvanic corrosion where dissimilar metals are in contact, and such contact should be avoided. The use of iron insulated bolts screwed into brass ears is almost universal, and frequent trouble results at this point. Gun-metal bolts would be better, but there is some difficulty in getting them made.

The size of span wire should not be less than 7/14 S.W.G. There seems no reason for using larger wire, but such use is quite common even up to the monstrosity of 19/12. This wire should have a breaking point equal to from 35 to 40 tons per sq. in. after stranding; the galvanizing should be carefully examined and tested in the manner prescribed by the Post Office. Galvanizing that is originally defective, or that cracks and peels off in erecting, is useless, the wire will rust through at the unprotected points in a brief period.

To secure the wire at the poles it should be laid around a horse-collar thimble of size proportioned to the size of strand, and properly bound with galvanized charcoal wire—not twisted up. Better than the thimble is a shackle or reel of porcelain with a central hole to take the strap bolt. Porcelain is a far better, more durable, and cheaper insulator than any of the compounds used in turnbuckles, globe strains, etc. There is no need to provide any tension adjustment at the ends of span wires—insulated turnbuckles, Brooklyn strains, etc., are quite unnecessary, and represent wasted money. With a dynamometer on the drawvice, or by the measurement of the sag from the ground, span wires can be put up with the greatest uniformity, and the certainty that the trolley wires will be carried at their correct level. This level can be checked, if desired, by loading the span wires at the correct points with weights representing the working load, but this only needs to be done once for each width of street.

Bracket arms are generally made of 2-in. steel steam pipe either screwed or expanded into a socket on the pole clamp. These arms are often much too long for safety. A 2-in. tube 12 ft. 6 in. long, fixed as a cantilever, and loaded with the weight of a span of trolley wire and the suspension fittings, is very near its breaking point. Longer arms are therefore entirely dependent upon tie-rods. The longer the arm the less efficient the tie-rod, owing to the more acute angle between the two members. As generally made, tie-rods are pulled up by a nut so that their effective strength is the resistance of the threads to shear. Bracket arms 18 ft. to 20 ft. in length are therefore extremely unsafe, having practically no margin of safety. It is better to use eye-ended tie-rods and dispense with nuts, and no real difficulty arises in erection if the clamps are fixed at measured distances, so that the brackets and tie-rods make the correct calculated angle; but if adjustment is necessary it is best provided by a long, solid, right-and-left threaded sleeve fitting the two parts of the rod like a rigging screw. Struts are usually inapplicable, but if the scrollwork can be made to give some support so much the better. Bracket arm pole clamps should be of substantial length, and a good fit on the pole by internal fitting rings at top and bottom. The bolts should fit through long bored sockets in the planes of the fitting rings, and be kept close in to the poles. The socket receiving the arm should be of ample length, and well thickened out to the body of the clamp. In fact, in designing bracket arms and their fittings, the stresses and strains should be calculated out as for a loaded cantilever, ignoring the tie-rod, but adding 50 per cent to the dead weight to allow for the rolling load and its hammering effects. Then the tie-rod and its fastenings should be designed to carry the same load safely. Malleable cast iron is the best material for pole and bracket arm clamps and bowstring brackets. These last are often too short to give proper clearance, and are spaced too close on the bracket to give the elasticity so desirable. They should be pinned or otherwise secured so that they will not slide along the arm. Porcelain shackles should be used as the secondary insulation of bowstrings.

On straight work the "straight line" hanger is the best insulated fitting, but on curves and wherever there is a probability of lateral pressure on the wire the pull-off pattern must be used. The caps of these should be [illegible] soft leather washer should be placed between the head of the insulated bolt and the cap. The insulating material on the bolts is far from perfect. The compounds are trade "secrets," but very slight investigation shows that shellac is the insulating and consolidating element in nearly all. Mica, asbestos, and other mineral substances add some toughness to the mass, but its mechanical qualities are generally poor. Whilst new the insulating qualities are very good, but in a short time the atmosphere deposits dirt on the exposed surface, and sooner or later in damp weather a trifling leakage of current chars the surface and breakdown speedily follows. This should not happen if the secondary insulation remains good and, if porcelain is used, such breakdowns are very rare, because a porcelain surface does not char with a small creeping leak, it dries up and the leakage ceases. A somewhat tough vulcanite has been introduced. Vulcanite has had extensive trials in telegraph practice and obtained a bad reputation. Tramway conditions are less favorable to its permanence. This matter is a really serious one, and the insulated bolt is probably the most unsatisfactory item of the whole overhead equipment. The cure may be found in redesigning the arrangement in such a way as to remove the insulator itself from so trying a position, but there are obvious difficulties. The usual practice of keeping the two trolley wires for up and down directions separately insulated and separately fed is highly advantageous. But at junctions this becomes very difficult. Insulated crossings are a variety best avoided and, as above stated, the best course is to feed junction-work separately; the next best thing is to feed it through one wire only of one of the junctioning lines, and to insulate the junction from all the other wires. In bowstring suspensions care should be taken to provide ample clearance above the cap of the hanger. Sometimes only a small fraction of an inch is left between the cap and the bracket arm tube, with the result that at every passage of a trolley wheel the hanger strikes the arm, damage soon resulting.

The soldered ear is the best form of attachment for the trolley wire. Many patterns of mechanical ear have been devised and tried, but it is hard to see how any mechanical clip can give equal security without adding to the effective diameter of the wire on the arc in contact with the wheel. The use of wire of figure 8, or grooved section, makes the mechanical ear satisfactory, but such wire is at once more expensive and more troublesome to erect, so that the balance of advantage remains with the soldered ear. The metal used for ears should be tough bronze or gun-metal, and careful inspection after machining is necessary to eliminate defective pieces, as the castings are somewhat apt to show blow-holes and other weak places. The groove to receive the trolley wire should be milled to a hundredth of an inch larger diameter than the wire, and should come to a sharp edge. It is doubtful whether the small lugs, which it is usual to provide at the ends of the ears for hammering over the wire, serve any useful purpose. They sometimes hold up a wire that has not been properly soldered until traffic commences. Fifteen inches is the minimum length of ear for straight work; the tendency is to increase the length up to as much as 24 in., but the advantage seems doubtful. On curves longer ears are necessary, and by bending them to a proper radius the change of direction of the trolley wheel is much smoothed. Unfortunately curved ears tend to pull into angular shape with use. There seems no good reason why they should not be cast curved with lateral webs to impart stiffness. It would not be necessary to use many different radii, as the varying radii of the track curves should be met by the use of a larger or smaller number of pull-offs, with a standard deviation at each. Splicing ears should not be needed in building a new line, but are necessary for repair work. They are rarely well designed, the wire ends having to be bent too sharply, and some patterns are provided with foolish little steel-set screws, that invariably set fast and break off. Anchor ears should be provided with stout eyes of rounded section, to which the anchor wire can be secured without bending to a dangerously small radius.

Section insulators present a combination of difficulties, and in selecting a pattern both mechanical and electrical considerations must be studied. The pull of the wires has necessarily to be transmitted through insulating material, and it ought to be so trans-

mitted as a straight path without any binding or twisting component. This is inconsistent with the necessity for allowing a straight level path for the trolley wheel. Hence the best designs are but compromises, and the worst may be guaranteed to break down within a few months. The terminating arrangements for the wire ends need the same easy curvature as in splicing ears. It is better to dispense with set screws for securing either the feeder cable or the trolley wires and to have tinned sockets or grooves into which they can be soldered. The air-gap pattern is probably better than that with a gap stick, but there should be two distinct air gaps, and an insulated running piece between them, to prevent an arc being drawn in the event of an earth on one wire. Gap sticks of lignum vitæ have been found to wear smoothly and give a regular life. Section insulators are very heavy and saving of weight is a merit to be fully credited. Easy and rapid replacement is another virtue which will be appreciated when the line is at work. The sweating of the connections is not inimical to this because, knowing that it has to be done, the fire-pot and bit will be ready, but a rusted-in set-screw cannot be calculated for.

Junction special work fittings also require careful selection. For central wires and rigid trolley heads the frog makes a satisfactory facing point, provided that it is properly set, with reference to the track points, and the lengths of the cars and trolley booms. Even with swivelling trolley heads frogs will work fairly well if the wire is approximately central but, for side wires, switches with movable tongues should always be used in the facing direction. Frogs will work on side wires in the trailing direction, but must have deep cheeks and grooves to take the wheel flanges, as there is a considerable centrifugal force tending to de-wiring and automatic or spring switches are preferable. Crossings are apt to give more trouble than frogs or switches. The greatest care should be taken to get them of the correct angle to suit the track crossing, but as the angle is also affected by the lengths of car and trolley boom, the junction should be drawn to scale, a template of the car and trolley boom fitted to it in successive positions to ascertain the best angle and position for the crossing. Even with a central wire there must be a lateral pressure on the trolley wheel taking the junction curve, so that guidance by the flanges across the gap is necessary. A swivelling trolley head adds largely to trouble at crossing by its liability to turn while crossing the gap, and this liability is aggravated by any considerable side reach. At junctions on single lines it is best to use only a single trolley wire and thus avoid the use of crossings, especially if swivelling heads and side wires are used. It involves the use of three automatic switches, but these give much less trouble than one crossing. All these fittings should be so designed that the trolley wires need not be cut when fixing them, and so that they can be securely held by pull-off and span wires to their positions.

Feeding arrangements are usually classed with the overhead equipment, the feeder work terminating with the thimbles entering the bus-bar terminals. As regards the feeder pillars the best advice is to make them as big as will be tolerated. Even at this they are pretty sure to be awkwardly cramped. Opinions and practice are divided between cylindrical and rectangular shapes. Perhaps it is largely a matter of taste. The cylindrical pattern gives the largest amount of useful space for the area covered and for the weight of the casting, and has the practical advantage that when opened the panel is somewhat more accessible. On the other hand the fitting of the curved doors is not so good a job as with the flat-sided pillar, and when the doors are closed there is less clearance between them and the live parts. Provision should be made for ventilating the pillars without permitting the entrance of rain or snow; the bottoms should be filled in over the concrete with a thick layer of pitch or bitumen, and all leading in pipes stoppered. The safest kind of panel is a cast-iron frame into which are cemented procelain insulators carrying the live metal-work, the frame being itself carried from the sides of the pillar by oil insulators. It should be easily removed for replacement by a new panel. All the cable connections should be made on one side of the panel, the switch fittings being on the other.

Plain quick break switches are frequently used and answer most purposes but, where a number of feeder pillars are fed by one cable feeder, the use of switch fuses, such as the Bates' pattern, will sometimes isolate a faulty length of trolley wire and avoid the stoppage of all the sections served by the feeder. As these switch fuses are not dearer than quick break knife switches, and have no troubles of their own, they should be chosen, although in most cases the feeder circuit breaker will outstrip the fuse.

All cable ends should be terminated with corrugated procelain stoppers suitably sealing the dielectric. A kicking coil and lightning arrester are necessary to protect the underground cables. Three or four kinds of arresters are in use, and there is not much to choose between them. I think the Garton is perhaps the best. They all get blown to pieces occasionally, either by a lightning discharge, or the short set up by it. Telephone fittings are generally included in feeder pillars. They should not be fixed on the switch panel, but quite separately, and surrounded by an earthed metallic frame to protect them from leakage. The same treatment is best for the pilot wire terminals that may be provided. Telephones do not thrive in feeder pillars, and there is rarely any room for them. The provision of a socket box into which the cords of a portable set may be plugged is therefore the best arrangement. If fixed telephones are thought essential they should be placed in separate pillars, or in boxes secured to the poles.

The side-feed cables from the feeder pillars to the trolley wires are often troublesome, the trying conditions and their importance are such as to warrant careful design and erection. In many cases small holes are drilled through the pole underground and above the span wire or bracket attachments, and the unfortunate cables threaded through these holes with the slight protection of a wooden or fibre bush. It is impossible to tell how sharply they may be bent, or how much they may have been strained in the process, but experience shows that they are frequently damaged and have in consequence but a short life. Their replacement, in case of need, is a particularly tedious and exasperating job. The following has been found a good method of dealing with this matter. An oval hole about 3 in. by 5 in. is cut in one side of the pole about a foot below the ground level, and a special quarter bend of 3-in. pipe passed into the pole and bolted through a flange which fits its perphery. This 3-in. pipe finishes in the base of the feeder pillar with a bell mouth providing a duct of ample diameter and easy curvature of the four cables. The pole is fitted with a special finial made in two parts.

The lower part fits easily into the top of the pole supported by a narrow flange resting on the pole end and expanding upwards and outwards to form the ornamental base collar of the finial. The portion inside the pole carries four screwed glands provided with rubber gaskets, and bored to pass the cable. Screwing up the glands secures the cables by compressing the rubber packing rings. Four holes are cored out in two opposite pairs, through the bottom of the flared out part, through which the cables descend outside the pole. This fitting is wired by passing the four cable lengths through the glands and then, by an easy and regular curve, through the holes in the wide part. A hauling wire having been threaded down the pole and into the section pillar, the long ends are drawn through the pole and the fitting rests on its place. The upper part of the finial is merely a cover shaped to match the other pole finials, and secured by two tap bolts. The outside cables are secured to the pole by a suitable clamp and then taken by an easy curve to the span wire or bracket. This arrangement is safe for the cables and, in case of need, their replacement is a very simple and speedy operation. It is almost essential to use India rubber insulated cable, as the dielectric must be waterproof and flexible. The Board of Trade calls for metallic sheathing, but objects to lead in this position. Flexible metallic tubing has been found very suitable. It adds little to the diameter and weight; it is very flexible up to a certain point, and then refuses to bend further, which is a safeguard to the cable. The metal sheathing of the cable should not touch the trolley span or bowstring wire, and should therefore be cut well back. On span-wire work it is best to carry the feeder cables on a separate span wire above the trolley wires. This should be insulated in the usual way, and the sheathing cut back from it. The cable ends then dip down very conveniently to the section insulators, and there is a long surface of cable covering free in air, over which very little leakage can occur. The cable terminals here should be made with corrugated porcelain stoppers as a further precaution. On bracket arms the cables should be secured by special collars fitted with ebonite bushes, and arranged to give the longest possible leakage path.

Guard-wiring is a necessary evil in this country, as tramway undertakers can neither compel the owners of overhead wires to make alterations to them, or even present the erection of new

wire over an existing trolley line. Galvanized steel wire, No. 8 standard gage, satisfies the requirements. Solid wire is better than stranded, having a longer life. The same wire may be used for guard wire spans. Guard wires should be run over the span wires and secured to them by binding wire sweated at the ends of the lappings. In some atmospheres it is necessary to use bronze instead of steel wire. On bracket arm work, a span wire from the pole to a standard clamped to the end of the bracket makes the best job, but a neat and good-looking arrangement is hard to find. Secure erection is often neglected for the sake of light or ornamental appearance, with sad results.

Telephone and pilot wires are sometimes run on tramway poles, hard-drawn copper is the best material. Good telegraph practice should be followed in the design and attachment of the insulators, but a somewhat freer use of shackles is sometimes desirable. These wires are sometimes carried on the trolley or guard-wire span wires, but it is difficult to make a good job of this. No. 12 wire is usually large enough, smaller sizes are too weak. They should be carried at such levels and positions that they cannot be blown across the trolley wires if broken in a gale. The speaking on these telephone lines would be improved if they were rotated after the manner of Post Office trunk lines. They generally suffer much from trolley wire induction.

Overhead feeders have sometimes to be provided for. They have to be carried from suspender wires and to be covered, best done by hard cotton or hemp braiding saturated with waterproof preservative compound. These conductors should be shackled off at every pole. If they are large it will be necessary to increase the size and stiffness of the poles used. As regards appearance such feeders are very objectionable, and they complicate the overhead engineering considerably, especially at feeder poles. But the saving of underground work is ofttimes an important economy, and a perfectly good job can be made.

Time and space limit this discussion to matters of material. Much might be said on erection, but I have probably said quite enough for one time. There must be now a good deal of information available as to the normal life of various items of overhead equipment under various conditions of traffic and atmosphere; and also as to the nature and frequency of breakdowns. Mr. McElroy last year made a laudable attempt to collect some of this information, and I am considerably indebted to the paper which he prepared for the last conference of the Municipal Tramways Association. This, however, is only a beginning, and only partial because, for some reason not easy to understand, no information was given to Mr. McElroy by any tramway company's officials. It is by the collation and discussion of information from all sources that advance may be expected, and every little helps, so the continuation of Mr. McElroy's good start is highly desirable.

The cost of overhead work seems to vary a good deal more than it should. Some authorities put it at £1,500 to £2,000 per mile of route, but I don't know how so much can be properly spent. Thoroughly good span-wire work for either double or single lines can be erected for £1,200 per route mile, with fair profit to the contractor. Bracket arm work, for single lines, where a single line of poles is generally sufficient, can be done for £1,000 per route mile, or even less under specially favorable conditions. These rates include average amounts of guard wiring and proportion of junctions, but very heavy and complex junctions, car-shed fan-work, and similar special requirements will involve some additional expense. A great deal of money can be spent on elaborate scroll-work and fancy painting, especially if a little goldleaf is thought necessary to harmonize with the surroundings; but these are matters of taste rather than engineering, and those who like to pay for them will doubtless continue to do so.

In some towns there certainly is the excuse that the overhead structure is the only thing visible in the streets that bears the slightest trace of design or grace, of which the most should, therefore, be made.

It is stated that since the Lake Shore Electric Railway Co. has secured control of the Lorain (O.) street railway system, it will abolish the 3-cent fare that has long been enjoyed by the Lorain people, and hereafter the fare in the city will be 5 cents, and the fare to Elyria will be 10 cents instead of 9 cents. Workmen employed at the steel plant were given a special rate of 6 cents to Elyria from the plant, but this will also be done away with.

A Solid Porlelain Sign Letter for Street Railway Parks.

The accompanying [illegible] great value to the man who wishes at attractive electrical sign. These letters are made of solid white glazed porcelain, fitted with standard Edison [illegible] lighting circuit. They can be readily attached to wooden or wire backs. These porcelain letters are concave and of such form that they will reflect the light in parallel rays, enabling one to read the sign at a great distance and at any angle. The letters are designed so that they will give the best effect with the smallest amount of

SHOWING EFFECT OF [illegible]

current consumption, reducing the number of lamps and the candle-power of each, so that a saving of 50 per cent in operating expenses is secured, at the same time producing a bright, sharply defined letter. These letters are made of vitrified porcelain, with a permanent and beautiful glaze. No paint is used on these letters, because such letters have to be painted several times a year, as heat softens the paint, allowing soot and dirt to stick to it.

The lamps used in these porcelain letters are especially designed so that the light is all radiated from below the face of the letter. This prevents the diffusion of light from one letter to another, and does away with the blurring effect.

SPECIMEN PORCELAIN SIGN LETTER.

Other advantages of this letter are that the sockets are imbedded in solid porcelain, thus eliminating chance of short-circuits; they are not affected by heat, cold, dampness or weather conditions of any kind; they will not rust or warp and can be easily installed by an electrician and can be moved and remounted easily.

W. N. Matthews & Bro., 371 Carleton Bldg., St. Louis, the sales agents for these letters, are to be congratulated upon obtaining such a remarkably good letter and should meet with success in selling them to street railway companies for their parks and amusement places.

The contract for the engineering work on the Washington, Baltimore & Annapolis Electric Railway Co.'s line has been awarded to the Roberts & Abbott Co., Cleveland, O., by the Bishop-Sherwin syndicate, which recently purchased the property. Plans and specifications for the electrical equipment of the road are now being prepared.

February Meeting of the Ohio Interurban Railway Association.

[illegible]

Mr. E. C. Spring called the meeting to order at 10:30 o'clock, and announced the report of the executive committee. One of the recommendations of the committee was that the president make visits to the various portions of the state where the membership in the association was not as large as it should be and endeavor to enlist the companies not now represented in the work of the association.

The dates and places of the meetings for the next four months were announced, as follows: March 23d, Cincinnati; April 27th, Springfield; May 25th, Cleveland; June 22d, City Point.

Standing committees were announced as follows:

Subjects: F. J. J. Sloat, Hamilton; H. C. Lang, Cleveland; J. W. Brown, Connellsville, Pa.

Transportation: J. H. Merrill, Lima; F. W. Coen, Cleveland; F. W. Adams, Fostoria; T. Stebbings, Columbus.

Legislature: Dr. J. E. Lowes, Dayton; Warren Bicknell, Cleveland; C. H. Bosler, Dayton.

Arrangements: The president, the secretary and the treasurer.

Publicity: G. S. Davis, Cleveland; E. B. Grimes, Dayton; J. R Harrigan, Newark; Daniel Royse, Chicago, Ill.

The chair then announced that the Western Ohio Railway Co., the Ft. Wayne, Van Wert & Lima Traction Co. and the Lima Electric Railway & Light Co. extended the courtesy of free transportation on their respective lines to the members of the association.

Mr. F. J. Green reported on behalf of the committee on baggage the following recommendations:

1. That on interline tickets 150 lb. of baggage be checked free upon presentation of an interline ticket and that the ticket be stamped "Baggage Checked."

2. That a charge of 25 cents per 100 lb. be made for baggage in excess of 150 lb.

3. That the brass shell card check case be adopted, with white card checks for baggage checked free and colored card checks for excess baggage.

4. That a uniform waybill for baggage be adopted.

As a form for the use of conductors for reporting baggage carried the committee recommended a card 3⅛x5½ in. in size, which was ruled to show the following information:

Conductor's Report of Baggage.

Date, initial, number, received, time, delivered, time and final destination.

As a form for the waybill the committee submitted one showing the following information:

Report of Baggage......Train No.......Date......1905.

Initial, number, received, time, delivered, time, final destination, description of baggage, received by baggage master.......

After some discussion the report was adopted.

Mr. C. D. Emmons, general manager Ft. Wayne & Wabash Valley Traction Co., Ft. Wayne, Ind., was called upon to speak concerning the plans of the Indiana roads to adopt an interchangeable mileage or coupon book, and stated that it was the opinion of the committee of the Indiana Electric Railway Association having this matter in charge that the discount of 16 2-3 per cent on interchangeable books was too great in view of the low rates of fare (1¼ to 1½ cents per mile) which obtained in that state, and that he understood the committee favors a discount of 10 per cent. He recommended that there be a conference between the committees of the two associations before the Indiana meeting on March 9th.

On motion the transportation committee was directed to take this matter up with the committee of the Indiana association.

Dr. H. B. Rockwell, of Cleveland, was then introduced and explained to the association his plans for a mutual accident and claim adjusting bureau to be conducted along the same lines as the Railway Pool which had administered the claim departments for a number of Massachusetts electric railway companies. (A very interesting statement as to the plans on which the railway pool was operated under the management of Dr. Rockwell will be found in the "Review" for August, 1903, page 455, and an exposition by Dr. Rockwell of his plans for mutual accident insurance was published in the "Review" for September, 1904, page 590.)

Dr. Rockwell briefly outlined the plan of the proposed Railway Adjusting Bureau as follows:

1. There will be a common fund, out of which losses will be paid, thus preventing unusual burdens being cast upon the company suffering the consequences of a serious accident. It is proposed that the companies pay quarterly in advance into the treasury of the bureau sums equal to 3½ per cent of the estimated gross earnings. Experience in Massachusetts indicates that about 2 per cent of the gross receipts will be sufficient to pay all claims, but it is desired to accumulate rapidly a working capital of from $20,000 to $50,000, and hence the assessment is fixed at 3½ per cent. From the common fund are to be paid not only claims for personal injury, but also property losses, except any injury to the property of the railway company, legal expenses in fighting contested claims, claims arising from ejectment of passengers, etc.

2. The bureau will be administered by an expert under the direction of an executive committee composed of the officials of the earliest companies to become members. The head of the bureau will have for his assistants competent men who are experts in this line of work, and thus the members of the bureau will have their claim business handled by professional adjusters, instead of leaving it to their own officials, who are perhaps only called upon to negotiate with one or two claims a year and are therefore inexperienced. Dr. Rockwell cited a number of instances in which lack of diplomacy and inexperience on the part of some official had cost the company a great deal of money. Claims that could have been settled for $100 were contested, resulting in verdicts of from $1,000 to $3,000.

3. A special feature will be made of inspection, so that the operation of the properties of all members can be brought to a satisfactory standing.

4. The funds of the bureau not required for the adjustment of claims will be distributed to the members in the way of dividends, the distribution being in the same proportion as the net profits from each member of the bureau bears to the aggregate new profits, any member whose losses equal or exceed its assessment not being entitled to share in the dividends. In this way the greatest financial burden is placed upon the company having the greatest losses and members are encouraged to improve operating methods with a view to making losses as small as possible.

Dr. Rockwell stated two Ohio companies had already signed the contract and that seven others had promised to do so. The contract is to become effective when the members joining show an aggregate of gross receipts in 1904 equal to $3,000,000.

Afternoon Session.

At the afternoon session the subject for discussion was "The Use and Abuse of Car Equipment." Mr. G. H. Kelsay, master mechanic of the Western Ohio Railway Co., opened the discussion with a paper in which he discussed some of the principal abuses to which car equipment was subjected and the result of tests made between Piqua and Lima. Mr. Kelsay's paper was as follows:

Use and Abuse of Car Equipment.

BY G. H. KELSAY, MASTER MECHANIC WESTERN OHIO RY., LIMA, O.

The all-day operation of railway motors is one extremely varied in its requirements as imposed upon the motor, as they vary from conditions of rolling or coasting, when the motor is practically inert, to the extreme conditions of rapidly accelerating a heavy car, when the motor is handling currents several times as heavy as normal all-day rating.

The work a railway motor will perform is limited by its mechanical strength, its commutation and its heating. Its mechanical strength is governed by the chemical and physical properties of the material and the relative sizes of the various parts that go to make up the mechanical details of the machine. All mechanical structures, no matter for what purpose they are designed, are built with a factor of safety. A bridge when built would require six times its normal load to break it down; so with railway motors. The design must be amply strong.

Take the condition, which is one that sometimes occurs, that a motorman is called on to protect himself, car and passengers from a

collision with some object, that he acts quickly and sometimes without reason. He sets his brake and at the same time reverses his car, and possibly, if his circuit breaker will not stay in, he in addition holds it in. This in turn will possibly open the power house breakers. The stresses exerted in a motor under these conditions may be extremely severe.

The common failure of a gear bolt, its parts passing between the pinion and the gear, produces very heavy mechanical stresses on a motor.

The sketch Fig. 1 illustrates a case of mechanical failure in a motor that came under my observation. Here is a 50 to 60-h. p. motor with a 3¼-in. shaft. The end of the shaft was reduced to 2½ in. to receive a pinion. With the size of pinion used there was no excuse in having the shaft reduced at all, any more than the taper to make a fit with the pinion. As a result of that small neck in the shaft many shafts were bent and broken, and not necessarily by abuse to the equipment. The trouble was corrected by substituting a shaft not reduced so much at this point and having ½ in. more stock. See Fig. 2.

A railway motor as a machine is possibly subjected to conditions in operation as far above normal rating as any class of machines made. So it is thoroughly important that details should be carefully designed and that the motor when put in operation receive extreme care in maintenance. The cost of inspection of the most thorough nature is money well invested. Inspection of gears, pinions, bearings, brushholders and all bolts in and about the motor equipment should be made each week, when cars are subjected to hard service.

FIG. 1

FIG. 2

A motor may be designed to commutate its normal rated current without appreciable sparking and heat. But with a lack of careful brush inspection and adjustment, excessive currents due to various causes that come up in every-day service, more or less sparking will occur, accompanied by flashing, and a dirty machine results in damaging commutator, brush holder and motor winding.

Great stress should be laid on careful inspection of brushes and brush holders and on maintaining a smooth and even commutator. It is foolish economy to operate a commutator that has developed flat spots, on the theory that machining cuts off a useful lot of copper. Flat spots once started develop at an accelerating rate.

A very great proportion of our motor trouble is due to copper and carbon dust accumulating on all parts of the interior of the motor. The accumulation is augmented by rough commutators and poor brush and brush holder adjustment. The operation of double end equipped cars makes the question of commutation a much more serious one, as it is quite impossible to get a contact the full width of the brush if the motor is operated in both directions.

The third limitation to the work a railway motor will perform is due to its heating. The heating of a motor comes from six sources:

1. The I^2R loss of fields.
2. The I^2R loss of armature.
3. The I^2R loss of eddy currents.
4. Hystresis or "magnetic friction."
5. Friction of bearings and commutators.
6. Friction of the air.

A motor when started into a day's service has a temperature the same as that of the surrounding air, but its temperature will begin to rise, due to the six causes indicated, and continue to increase until the difference of temperature between itself and the air is so great that the rate of radiation from the motor is equivalent to the rate of generation of heat in the motor.

The final temperature, then, at which a machine will run depends on the magnitude of the losses, and they in turn depend on the mean current and voltage on which the machine is forced to operate. The rating of machines is given in this way. As an example, the Westinghouse No. 76: Commutator capacity with 75° C. rise by the thermometer, 60 amperes at 300 volts, or 55 amperes at 400 volts.

The two losses in armature and field winding are equivalent to the resistance of the motor times the square of the current in the motor. The resistance in the motor is slightly variable and becomes a little greater as the motor gets warmer.

The iron losses vary as the 1.6 power of the magnetization, which in turn depends on the speed of the motors and the voltage. If it were possible to operate motors without their heating, the question of rewinding armature and fields would be a small one. A temperature of 150° C. is the point at which cotton insulation begins to char.

The continued operation of machines at high temperature weakens the insulation to such a point that its insulating qualities and dielectric strength is weakened. The armature is much more susceptible to break down from any electrical disturbance. An accumulation of copper and carbon dust over the armature winding undoubtedly aids materially in breaking down the armature. A possible solution for a portion of this trouble may be in the use of "Deltabeston" insulated wire, for which great claims are made by the D. & W. Fuse Co.

Mr. Kelsay exhibited charts showing the voltage, current, energy and speed curves for a run of the special car "Theodore" between Piqua and Lima, and from Lima to Wapakoneta. The "Theodore" weighs about 46 tons and is equipped with two 150-h. p. (Westinghouse C.) motors.

The test car was run between two limited cars from Piqua to Lima, and on the return from Lima to Wapakoneta as the second section of a limited, so that the variation in line pressure from 650 volts to 350 volts was not due to the operation of the test car only.

The average current taken by the "Theodore" from Piqua to Lima was 134 amperes, the maximum being 460 amperes on a 4¼ per cent grade 1,800 ft. long. The average speed was 28½ miles per hour, and the energy consumption 2.86 kw. h. per mile.

For the section from Wapakoneta to Lima the figures were: Current, 112.5 amperes; potential, 535.4 volts; energy per car-mile, 2.57 kw. h.

For the return from Lima to Wapakoneta the figures were: Current, 151 amperes; potential, 482 volts; energy per car-mile, 3.02 kw. h.; speed, 25.2 miles per hour.

The cars in regular limited service, which weigh 30 tons and are equipped with four 50-h. p., require 2.23 kw. h. per car-mile on the Piqua-Lima run. These cars have the K-14 controller with 13 points. The "Theodore" has the L-3 controller with 15 points.

Mr. William E. Rolston, chief engineer Dayton & Troy Electric Railway Co., expressed the belief that most of the difficulty experienced in handling car equipment was due to the fact that the average motorman is not familiar with the motors and does not understand their construction and capacity. Some tests made on the special car "Francis" show that with fast feeding a maximum of 420 amperes was required, while with slow controller feeding a maximum of only 320 amperes was reached, the car making the schedule equally as well and with far less heating of the motors. He favored the use of automatic control, believing that a saving of from 25 to 35 per cent in current consumption could be made by using automatic control.

Mr. Rolston, in discussing the causes of car failures, stated that on his road the greatest number of burn-outs occurred at points on the line where the voltage was low.

He believed that on many roads the instruction of motormen was not carried on in a manner to get satisfactory results. While classes for instruction of motormen were a good thing, the work of instruction could be done better on the front end of a car. He presented some figures as to the energy consumption on the run between Dayton and Delphos. The special car "Harriet," weighing about 34 tons and equipped with four Westinghouse 76 75-h. p. motors, requiring 2.8 kw. h. per car-mile. The special car "Francis," weighing 45 tons and equipped with two 150 h. p. motors, requires 3.2 kw. h. per car-mile. On the company's limited cars the average energy per car-mile was 2.2 kw. h. At low voltage, that is, less than 350 volts when in series, which would mean a drop to 250 volts when in parallel, means a slow speed, greater current consumption, and hence greater heating and more frequent burn-outs of motors. At high voltage, that is, 650 volts, flash-overs were more frequent, but he believed that flash-overs were due rather to faulty commutators than to the high voltage. Some motor failures were due to the lightning arresters not being of sufficient capacity, that is, the lightning arrester would care for the discharge up to its

capacity and [illegible] the motors.

Mr. A. M. Frazee, master mechanic of the Columbus, Buckeye Lake & Newark Traction Co., stated that during the three years his road had been in operation the number of armatures lost by burnouts was not more than six, and the number of fields burned out was not more than nine. During this time the company had had considerable trouble with breakage of gear bolts in the split gears used. Three shafts had been broken and 25 bent, and in 18 cases where the shaft was bent it had been necessary to rewind the armature. Mr. Frazee gave some interesting figures on the cost of oil, saying that some of the armature bearings had run from 150,000 to 160,000 miles with less than 1-32-in. lowering of the armature shaft. The cost of lubrication was 29 cents per 1,000 miles, "Viscosity" car oil being used. The company had been using steel tired wheels, but had not yet worn out any of them. It has secured from 30,000 to 50,000 miles between turnings of the tires, and as the 2½-in. tires used would bear three turnings, the life of the tire was placed at 130,000 to 140,000 miles. The company found it necessary to replace a number of tires which had worn sharp in service. These were on the gear end of the shaft. Mr. Frazee suggested that those using steel tired wheels with Gibson rings would find it a great saving of time and labor if it were specified that the outer rings be bored with flush holes and button head rivets with the heads on the outside be used for holding the rings together. When it became necessary to retire a wheel the heads of the rivets could be quickly knocked off and the rivets driven out easily, whereas if the usual practice of countersinking the holes in both rings and using counter sunk rivets is followed, the counter sunk heads have to be drilled out at a great loss of time.

Mr. A. A. Hilton, of the Griffin Wheel Co., spoke on the present status of steel tired wheels, and said that no conclusive data were now obtainable, as the use of steel tired wheels in electric railway service was too recent. He spoke of the practice of the Boston Elevated in substituting grinding for turning and dressing its wheels. Operating conditions on the Boston Elevated had made it necessary to turn the tires each month; now the tires were ground twice every month. He believed that the present trend was toward the use of steel tired wheels for interurban roads.

Mr. Warren Bicknell, of the Lake Shore Electric Railway Co., described the policy of his road with regard to the instruction of motormen. They were broken in by a motorman on a car, and were then turned over to the master mechanic, who would spend two or three hours showing the candidate about the shop explaining the equipment to him. The candidate then spent a week in the shop on his own time, the foremen having instructions to help him to an understanding of the motors and their use, showing him special attention. If a motorman is unable to get his car over the road, and investigation shows that it is due to some trivial trouble with the equipment, the man is sent to the shops on his own time for further instruction. The men are in hearty sympathy with this method of discipline.

Mr. Bicknell believed that a great deal of trouble with car equipment was due to causes other than the motormen. As an example of the effect of low voltage he detailed the experience of his company about a year ago, when a power house designed for the operation of 60 miles of the road with cars equipped with two 75-h. p. motors each, was called upon to operate 100 miles of road with cars equipped with four 75-h. p. motors each. The power equipment was inadequate, and whereas the plant had been designed for 150 lb. boiler pressure, it was impossible to keep the steam pressure above 100 lb. and it often dropped as low as 75 lb. This meant slow speed for engines, reduced voltage at the alternators, inefficient operation of rotaries and low voltage on the line. While these conditions obtained for the months of December, 1903, and January, February and March, 1904, the cost of maintaining car equipment, comprising the items included in accounts 7, 8, 9, 10, 21 and 22, was in excess of 5 cents per car-mile. Under normal conditions, that is, with a line pressure of 625 volts at the bus bars, the maintenance charges were 2.8 cents per car-mile. This excess appeared almost entirely in the maintenance of motor equipment and in the maintenance of misceallaneous equipment of cars.

Mr. Bicknell described the trolley wheel designed by Mr. F. Heckler, master mechanic of the Lake Shore Electric Railway Co., which is designed so that the hub may be charged with enough Dixon graphite grease to last the entire life of the wheel, which is about 3,000 miles on the average. By using this design no attention need be paid to the lubrication of the wheel.

Mr. H. A. Bundy, master mechanic of the Lima Electric Railway & Light Co., emphasized the need of proper instruction and discipline for motormen, and advocated giving the master mechanic direct supervision of motormen, with authority to hire, discharge and administer discipline. To educate a man to operate the equipment carefully saves the car and makes easy work for the mechanic.

When the meeting adjourned a party was taken to Wapakoneta and St. Marys for an inspection of the shops and power house of the Western Ohio Railway Co., returning to Lima about eight o'clock, where Mr. C. N. Wilcoxon, of the Western Ohio Railway Co., entertained the party at supper.

New Plant of the Railway Electric Equipment Co.

The Electric Railway Equipment Co., Cincinnati, O., to meet the need for more room for manufacturing and better arranged facilities for shipping, has secured a large five-story building in what is known as West End, Cincinnati, into which it will move the entire force and equipment formerly in its two separate factories on East Front St. The new building into which the company is now moving is located at the intersection of West Eighth St. and the Cincinnati, Hamilton & Dayton R. R. The new building extends the entire length of the block, and will give an abundance of room for manufacturing purposes, and because of its location on the railroad will give the best facilities for receiving and shipping freight. In this plant the Electric Railway Equipment Co. will manufacture its well-known line of railway supplies, which comprises brackets, trolley ears, trolley wheels, bushings, hangers, bearings and all kinds of overhead line material.

This company operates separate factories for manufacturing steel poles for railway and city lighting systems. These factories are located at Pittsburg and Reading, Pa. The location of the Reading factory being within 90 miles of the coast makes the handling of foreign shipments very convenient. The foreign business of this company in poles and electric equipment supplies is quite extensive. Orders are now in process of shipment to several points in South America, Mexico and Japan.

Compressed Air in the East Boston Tunnel.

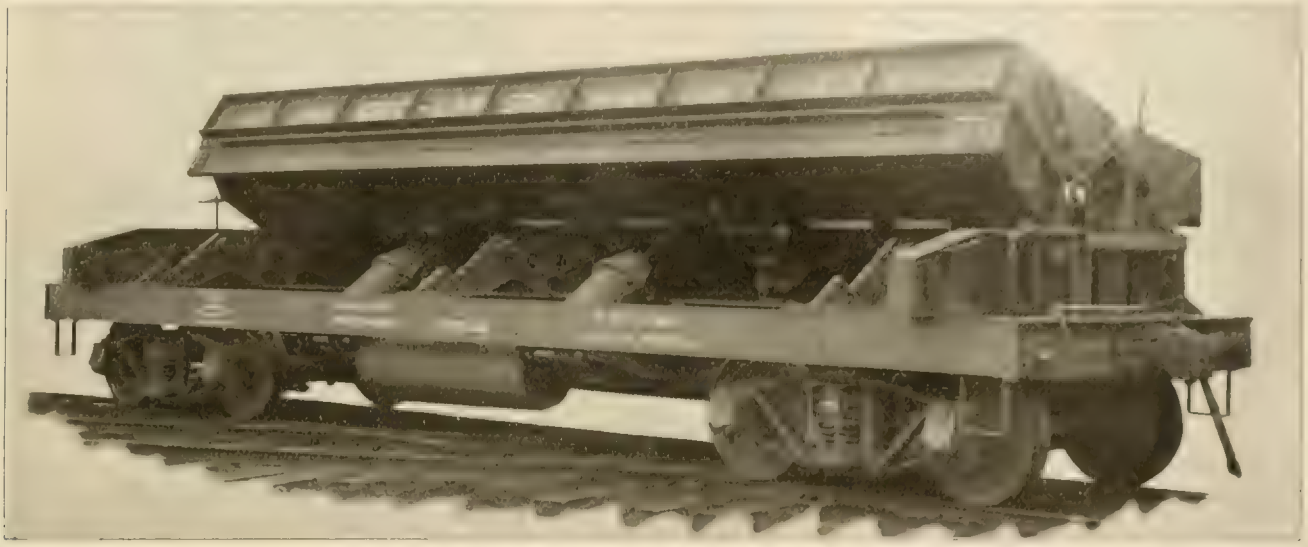
It is interesting to review the details of the methods employed in the construction of the East Boston tunnel, of the Boston subway system, because of the successful completion of this enterprise after five years of steady work. The total length of the tunnel is 7,500 ft., of which two-thirds was built by sub-surface tunneling methods, the remaining portion being open cut. The sub-surface bore was driven by two shields, and almost the entire bore was made under an air pressure of from 18 to 27 lb. Three air locks were used with each heading, one for the entrance and exit of the men, the other two as outlets for the excavated material. The entire bore of the tunnel is lined with concrete, reinforced where necessary by steel bars, the side walls having been built in advance of the shields.

Compressed air for the sub-surface work was furnished by two compressing plants, in which were seven Ingersoll-Sergeant machines, four low-pressure, straight-line, single-stage "Class A" compressors furnishing air for the working chambers of the shields, and three high-pressure, straight-line, two-stage "Class AC" compressors delivering air at 120 lb. pressure for operating the 16 jacks, each of 75-tons capacity, by which each shield was pushed forward. High pressure air was also used for driving the auxiliary apparatus, and a portion of it was discharged direct to the headings for ventilation. The volume of free air delivered to the headings averaged about 20 cu. ft. per min. for each workman. During the construction period of five years very few accidents happened to either the men or machinery.

The Sterling, Dixon & Eastern Electric Railway Co., Sterling, Ill., has purchased an equipment for the installation of a private telephone system along the entire line, to be used for dispatching and general purposes.

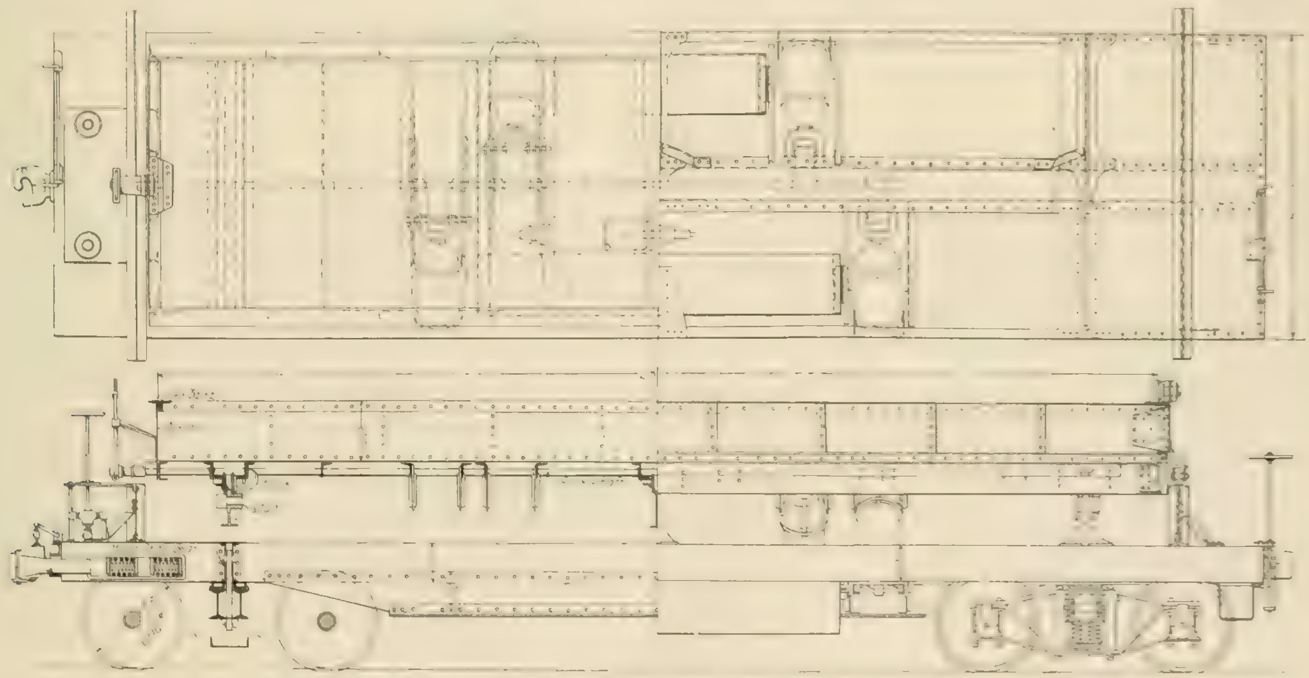
The King-Lawson Dump Car.

The King-Lawson dump car, which is built by the Middletown Car Works, of Middletown, Pa., has recently been designed by Mr. George I. King and Mr. Thomas Lawson. The principles followed in the construction of this car are those of the original Lawson car, the body of which consists of two boxes, each one-half the width of the car and extending the full length. The older type of car dumped its load on both sides of the track, while the new car



THE KING-LAWSON DUMP CAR.

dumps the whole load on one side. The principal features of this car are the underframe, the box, the operating mechanism and a rock shaft which operates interlocking arms governing the movement of the body.



THE KING-LAWSON DUMP CAR—PLAN AND SIDE ELEVATION.

The underframe is of the usual type, with the addition of transverse members, that serve as tracks to carry the box. The two end tracks upon which run the rollers which support the hinged sides of the box are made of plates and angles, and the three tracks upon which bear the grooved steel rollers supporting the box and the load are made of steel castings. These tracks are level for a space upon the top, inclining at an angle of 35 degrees with the horizontal at points 18 in. from the center line. Thus, when the box is pushed sidewise, this inclination allows it to tilt, the movement of which is [illegible] frame and [illegible] point where the inclination begins. A casting upon the box underframe, [illegible] regulates the [illegible]. The [illegible] pivots located [illegible] the box end. The end [illegible] and have rollers which run along the end track attached to the car underframe.

Interlocking rock arms attached to the square rock shaft which runs the length of the box just beneath its floor control the direction in which the box may be moved. A lever provided with a ratchet and quadrant which is notched for three positions operates the shaft. In the center position the rock arms are held in contact with the crosshead pins belonging to the cylinders on both sides of the car, thus locking the box in its level position. By moving the lever to the right, the left-hand rock arms are disengaged and those on the right are placed in full contact with the crossheads of the right-hand cylinder, and the box is prepared to dump on the left side. This is [illegible] cylinders.

The cylinders, which are hinged to the underframe at their lower

ends and are free to swing, are equipped with coiled springs inside to take up the shock when the box is dumped. Guide slots in plates secured to the box underframe direct the movement of the cross-heads, while the crossheads of the idle cylinders, when disengaged

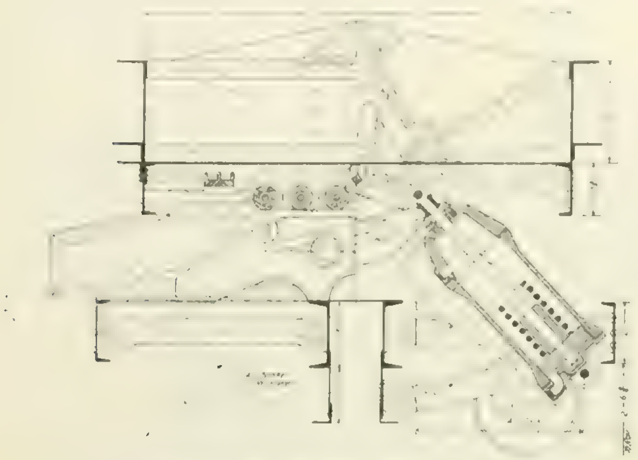
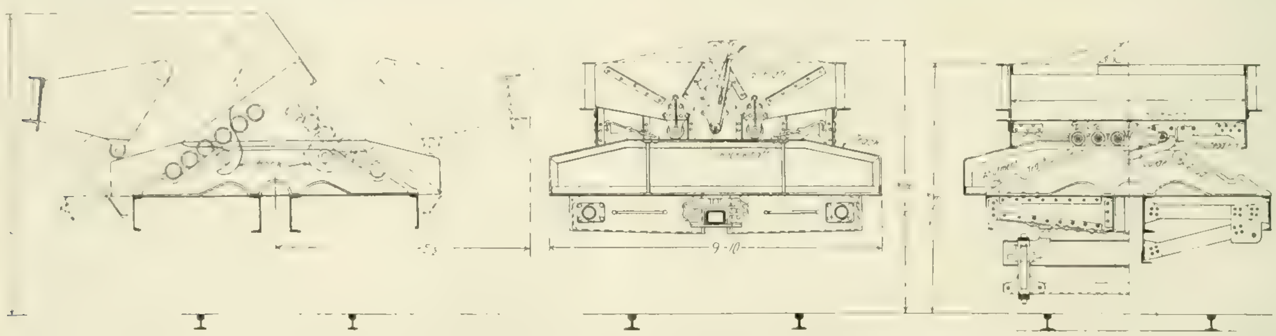


DIAGRAM OF OPERATIVE DETAILS.

by the interlocking rock arm, slide freely through their guides as the box is crowded over. It should be noted that while the dumping action is assisted by gravity, it does not depend upon that force The hooks, as previously stated, engage the studs upon the track castings and arrest the horizontal side movement, at which point



THE KING-LAWSON DUMP CAR—VARIOUS POSITIONS.

all of the force exerted by the cylinders is converted into an overturning movement. One of the most noticeable features of this car is its ability to dump the load away from the track and outside the clearance limit of rolling stock. In the recent operations of this car 60,000 lb. of pig iron and car-wheel scrap was dumped in 30 seconds, and a load of 50,000 lb. of water-soaked clay was dumped in 15 seconds.

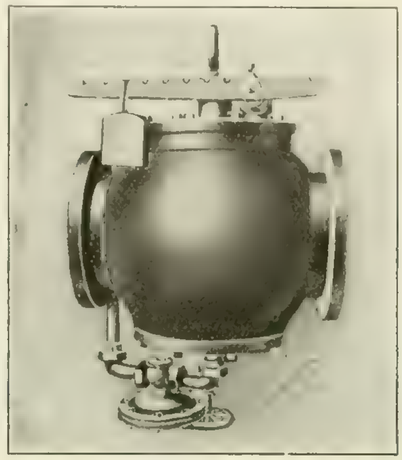
Orders for Wheeler Seats.

The Heywood Brothers & Wakefield Co., of Wakefield, Mass., has recently been awarded the contract for the seats to be used in the sample car which the Boston Elevated Ry. is constructing for use in the tunnel connecting Boston proper with East Boston. This car is of fire proof construction throughout and the woodwork of the seats will be treated so as to make it uninflammable. The seats will be of the well known Wheeler type and will have slat cushions and backs, with the Wakefield patented grip-handle. There will be 14 reversible seats and 4 non-reversible seats, all placed transversely.

The Heywood Brothers & Wakefield Co. has also been awarded the contract for seats for the 300 cars which the Brooklyn Rapid Transit Co. has ordered for its elevated and surface lines. These seats will be of the Wheeler type, upholstered in rattan and are made to measurements particularly suited to the requirements of the railroad company. The number of seats required for the 300 cars is 7,800, and the railroad company requires delivery within sixty days.

The Davis Turbine Relief Valve.

Realizing the desirability of a valve designed to automatically change from vacuum conditions to pressure, or from pressure con-



DAVIS TURBINE RELIEF VALVE.

ditions to vacuum, as it does away with the necessity of two valves and the extra amount of piping that is often necessary to arrange for running an engine condensing at one time and non-condensing or under back pressure at another time, the G. M. Davis Regulator Co., 144 Milwaukee Ave., Chicago, has placed upon the market a combination of an atmospheric relief valve and a noiseless back pressure valve, known as the Davis turbine valve, and which is illustrated herewith. A feature of special note embodied in this valve is the differential semi-balanced disk, the upper or main disk being of the full area of the inlet pipe and seats on steam metal and babbitt surfaces, while the lower or semi-balanced disk has no positive seat, but operates in a large dash pot and is made tight with bronze expansion rings. The diaphragm attachment and accompanying connections provide for the automatic features of the valve, by which device, in connection with the differential seats, the inventor claims to be able to hold a back pressure up to 20 lb. or a vacuum of 29 in. without changing or adjusting any part of the valve. The company has made many installations of this valve, which is made in sizes ranging from 6 to 24 inches, and report very satisfactory results. Many of the installations of the Davis valves have been made in connection with the Curtis turbine by the General Electric Co.

Trial postal cars will be placed by the Government on all the lines of the Northern Ohio Traction Co. and the Canton-Akron Railway Co. between Cleveland, Akron, Ravenna, Kent, Barberton and Canton. Special cars have been built for the purpose to carry passengers as well as mail.

The street railways of Athens, Greece, comprise a total of 20 km., half operated by steam and half by horse power. The name of the company is Societe de Tramways d' Athenes et Environs, with a capital of 2,200,000 francs. The officers are: General manager, Mr. Delmouly; secretary, Th. Thermides; treasurer, Mr. A. Demetriou.

Ingersoll's Luna Park, Cleveland.

Ingersoll's Luna Park, the new amusement resort at Cleveland, O., is rapidly nearing completion. Mr. Frederick Ingersoll, the Pittsburg amusement man, is at the head of the enterprise and the park is being built under his personal direction. The park is located in the aristocratic eastern environs of the city, within 25 minutes' ride by trolley from the Public Square. It occupies a tract of [illegible] acres, and the natural scenery of the locality is unsurpassed in northern Ohio. Mr. Ingersoll is expending approximately [illegible]

PANORAMIC VIEW OF LUNA PARK, CLEVELAND.
Shoot the Chutes, Concert Band Stand, Night and Morning, Arcadia, Trip to Rockaway Office, Shooting the [illegible] Alphonse and Photograph Gallery.

on his Cleveland park, with the avowed purpose of making it the most elaborate and complete amusement and recreation place on the lakes.

The street car lines terminate at Woodland Hills Av. and Ingersoll Road, the western frontage of the park, and cars enter the property on a loop, with the unloading station directly in front of the main entrance of the amusement park proper. This portion of the park comprises about nine acres. The design is on compact lines to attain beauty and utility. Styles and ideas of all periods have been used by the designer to produce gorgeous and dazzling effects in architecture, sculpture and painting. The architectural patterns are of all styles from the Corinthian, Byzantine, Moorish, Japanese, Arabic and Gothic to the French and Italian Renaissance.

The buildings are laid out on the border line of a mall and oval middle ground, with an artificial lagoon, concert band plaza and broad promenade ways. Balconies and boxes are ingeniously studded in the building fronts to afford comfortable places of observation.

The eastern portion of the park tract is a wooded knoll which hides a deep ravine of great scenic beauty. Beyond the ravine is a gently sloping valley, which is a part of the picnic grounds. The picnic park will be beautified by landscape gardeners with flowers and [illegible] will be illuminated by electric lights hidden beneath the plants. Cement walks will be [illegible]

A great shelter house is being constructed in the grove. It will be equipped with ranges and kitchen utensils and have a capacity for 5,000 picnic diners. An old Dutch house with large verandas will be built for a rest lodge. Small buildings of novel design will be constructed in various places about the woods and valley for picnic parties.

The [illegible] structure, 150 ft. long over all, of Ionic architecture. A great crescent curves over the main entrance in honor of Luna. Four lofty Egyptian towers complete the majestic picture. This building is elaborately decorated in white and gold, and more than 10,000 electric lights are used for illumination.

To the right of the main entrance is the Japanese exposition. The buildings in this section are pure Japanese in architecture, a native designer having assisted in planning them. The delicate tints and novel color decorations of Japanese artists are used in both exterior and interior decorations. A group of Japanese girls will preside over the tea garden in the exposition.

REVERSE SIDE OF MAIN ENTRANCE.
Japanese Section on the Left, Restaurant Building, Temple of Fortune, Candy Booth, [illegible]

The casino is the largest building in the group; it is of the Moorish type and 75 x 300 ft. It [illegible] by suites of parlors and retiring rooms, and is essentially a woman's building, with day nursery, baby cab livery and a corps of maids. The scenic river has a novel front, an old Dutch mill with great overshot wheel to propel the boats on the voyage through scenes of many lands. The Ingersoll figure eight roller coaster, which has proved one of the greatest of park attractions, is the largest of its kind ever constructed, having nearly one-half mile of trackage. Next is the carrousel building, a picturesque structure.

Mr. Ingersoll has introduced an entirely new attraction in "A

Trip to Rockaway." This is a marine voyage, with storms and rolling seas, fair weather and sunny skies. "Morning and Night" is another new show from the Ingersoll workshop, and has many novel electrical, mechanical and scenic effects. The "Shoot-the-Chutes" tower is 135 ft. in height, with an incline extending 350 ft. to the lagoon. "Arcadia" is another new show, built up principally upon mirror illusions. The offices, emergency hospital and rest rooms

[illegible] BUILDING AND SCENIC RIVER.

occupy the building adjoining "Arcadia." "Edisonia" is an exposition of phonographic and mutoscopic novelties. "Shooting-the Shoes" is a unique diversion; this is built up in the form of a great shoe. The "Caves of Capri" has winds from all directions and musical stalagmites and stalactites. There are also a great circle swing, candy butcher shops, old taffy shop, the "Scenetorium," "Scenic Theater," and a number of buildings for concessions.

The Cafe Neapolitan has a grand salon dining room and a roof garden which overlooks the entire city.

Mr. Ingersoll will present complete circus performances and con-

ROLLER COASTER AND CAROUSSEL BUILDING.

cert band organizations in weekly engagements during the season. These will be attractions.

The Cleveland park, which it is intended to open May 11th, will make the 34th amusement resort in the Ingersoll circuit. Mr. Ingersoll is rapidly acquiring a predominate hold on the summer amusement business, because of his diversified interests, which includes the building of roller coasters and other amusement devices, the building and operation of parks, and the production and booking of vaudeville and circus acts and concert bands.

It is reported that creeping of the third-rail is causing trouble on the lines of the Puget Sound Electric Ry. A peculiar feature of this trouble is that the rail tends to move in but one direction throughout the entire line which is single track and has no severe grades. Experiments are now being made with a view to finding a satisfactory method of anchoring the rail.

The Latest Design of the "Automotoneer."

No fact in the connection with the operation of electric railways is better appreciated than that the improper handling of the car controller means a very serious waste of current. The use of current involves the heating of the car motors and waste of current means needless and usually excessive heating of motors, which results in excessive repair bills. The use and abuse of car equipment was the subject of discussion at the February meeting of the Ohio Interurban Railway Association, and the opinion was there given by a number of master mechanics, who had made a very careful

FIG. 1.

study of this question, that from 25 to 35 per cent could be saved in current consumption by the application of automatic control. It is probably safe to say that in the long run repair bills would be proportionate to the heating of the motors, and therefore that the repairs would vary as some function of the current used, and from such data there might be estimated the corresponding saving in maintenance which the 25 or 35 per cent reduction in current consumption would effect. An apparatus to give automatic control that could be applied successfully and economically to the controllers in general use has for several years been the subject of study and experimentation on the part of the Garton-Daniels Co., of Keokuk, Ia., its device, the "Automotoneer," being known to all of our readers.

In 1902 the design of automotoneer that had given most promise of success was of a form to be placed within the controller, and

FIG. 2.

this was illustrated in the "Daily Street Railway Review" for Oct. 8, 1902, page 631. Tests to determine what could be accomplished in practice by the automotoneer were made by Messrs. D. C. & W. B. Jackson on the lines of the Madison (Wis.) Traction Co., and published in the "Daily Street Railway Review" for Sept. 3, 1903, page 600. The result of the Madison tests may be summarized as follows: With a fairly careful motorman the device effected a saving of 7½ per cent in energy consumption. The maximum current was reduced from 160 amperes to 119 amperes.

Since the date of the tests reported more extensive experiments in

actual service indicate that a design of automotoneer that would be self-contained and could be placed outside of the controller offers a number of advantages. It is this new style of this device which forms the subject of this article. As shown in Fig. 1, the automotoneer is a simple piece of apparatus which slips over the shaft of the controller, displacing the pointer collar on the top, but otherwise leaving the controller intact. This is comprised of two principal parts. One part is stationary (shown in Fig. 2) and is bolted to the top of the controller; the second part (shown in two styles in Figs. 3 and 4) revolves concentrically in the first in obedience to

FIG. 3

the movement of the controller handle, and in effect may be said to form a part of the controller handle.

The automotoneer is made principally of malleable iron, properly case-hardened on all wearing surfaces. The stationary portion is in the form of a short hollow cylinder, open end up, the lower end being closed except for a hole in the center through which the controller spindle passes. A zigzag channel is cast in the inside face of the barrel of the cylinder, which may be seen in Fig. 2. The part of the automotoneer which revolves with the controller handle carries a pawl or dog, which may be seen in Figs. 3 and 4. This plays in the zigzag channel described in such a way that the pawl is pushed upward and engages a catch or tooth of the stationary portion each time the controller is moved one running point toward

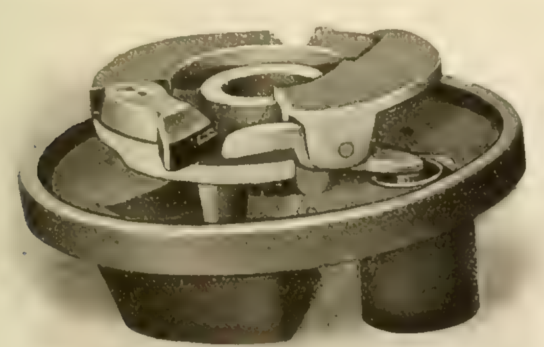


FIG. 4.

the "on" position. It is then impossible to pass this point until the pawl has disengaged the tooth by dropping downward.

The automotoneer is made in two forms, known as style G and style G-A. In the one the rapidity of the disengagement is fixed; in the other is provided an adjustable dash pot whereby the rapidity with which this disengagement occurs may be varied after the automotoneer has left the shop. Fig. 3 shows the style G of the automotoneer and Fig. 4 the style G-A. As will readily be appreciated from the illustrations, both types are of extreme simplicity, though that with fixed time ratio has fewer working parts owing to the omission of the dash pot and its accompanying lever.

In the operation the handle is placed in position and moved from point to point, it only being necessary to release the pressure against the handle after having taken a point. No backward movement of the handle is necessary to allow the dog to fall in the zigzag groove if the device is properly adjusted, so that the points of the automotoneer match with the points of the star wheel.

Both styles have proved entirely satisfactory in actual service during the past nine months, and give no indication of undue wear in even the most severe service. All parts are made interchangeable, so that repairs may be secured promptly when needed.

The Lintern Signal System.

On crowded city lines, and especially at track intersections, a seemingly unnecessary strain is put upon a motorman, who, in endeavoring to maintain his schedule, tries to follow a preceding car as closely as safety will permit. This close work results in a great many unnecessary applications of power and brakes, and therefore a waste of current and severe strain on the car equipment. To eliminate these faults is worth while.

A system has been designed and perfected the purpose of which is to inform a motorman by means of signal lights on the ends of the cars just what the motorman on a preceding car is doing with his controller. The successful operation of this signal system allows the motorman on the rear car to govern his actions in accordance with those of the motorman on the preceding car, which results in current economy and the avoiding of rear end collisions on a slippery rail, thus insuring proper spacing of cars and relieving the motorman of much mental strain. The indication of the position of the controller handle as shown by pilot lights on the ends of a car is also an effectual tell-tale of the method of operation of the car for the information of inspectors and superintendents. That is to say, they can observe improper handling of the car from a distance, which must have a good moral effect upon a motorman and greatly aid the enforcement of rules regarding the rapid application of current and the use of power on grades near dangerous points. Without such a signal system this information can only be gained by an inspector when actually in the vestibule with the motorman. It is easily seen that such a system of signaling is of great value at the intersection of two electric tracks, and especially so at night, when it is very difficult for the motorman of a car on one track to determine whether a car on an intersecting track has stopped and is waiting for his car to pass or intends running the crossing first.

This device, which is being placed on the market by its inventor, Mr. William Lintern, West Park, O., is furnished in two general forms; one used in connection with rear end signals only and requiring the addition of but one lamp to the regular circuit of the car and is independent of the motor circuits, and indicates whether the controller handle is at the off or any on position, the other is intended for use in any system of series-multiple control, and is arranged to indicate by means of signal lamps whether the controller handle is at the off, series or multiple position.

In the first mentioned system a green light is lighted at the rear end of the car when the controller is on any of the current points, and a red light is lighted when the controller is at the off position. The connections for this device are made by means of a double-throw single-pole switch blade, which with its switch-points is mounted on top of the controller box and immediately under the controller handle, so that the movement of the handle will engage the top of the switch-blade and make the connection with the proper pole, thus lighting the green or red light when the controller handle is at the on or off position respectively.

Such an installation as just described is suited for a single end car and a duplication of this installation is required for a double end car.

The connections for a signal system of the second sort, one which indicates whether the controller is in the off, series or parallel position, are as follows: A wire is led off from the main feed wire at the car circuit breaker to a series of red lamps, then through a series of green lamps to the ground. A second wire, tapped into the first circuit at a point between the red and green lamps, is led to one of the contact plates of the reversing switch, which places this tap on the negative side of No. 1 motor and the positive side of No. 2 motor when the motors are in series, and on the positive side of both motors when they are in multiple. When the power is off, current flows from the feeder tap through the red lamps and the lead taken off between the red and green lamps, then through the second motor to the ground, thus lighting the red lamps to their full power and leaving the green lamps out. When power is

applied the differences of potential in the motor circuits varies as, when on series positions the potential existing at the connection of the tap between red and green circuits and the motor circuits approximates 250 volts. This results in both circuits of lamps being lighted to about one-half candle power, which clearly indicates starting. When the multiple positions are reached the entire line voltage is thrown onto the green lamps, which are therefore brightly lighted and the red lights are out. As the voltage at point of connection is then approximately 500 volts, this signal then indicates full speed position of the controller.

As this system does not depend on any mechanical movements other than those necessary for regular operation, the signals cannot possibly be disarranged, and the completing of the circuits through the contact-plate on the reverser switch automatically adjusts the signal circuit for proper use according to the direction the car is running. The circuits are such that when the reverser is thrown to the back-up position the red lights are lighted for all feed positions of the controller handle.

Limited Express Trains to the Chicago Business District.

The running of trains by the Aurora, Elgin & Chicago Railway Co. to the Fifth Ave. terminal of the Metropolitan Elevated Ry. in the Chicago business district, begun March 11th, marks an important step in the handling of suburban traffic. It is believed that this is the first suburban electric road which has been able to offer both

CONCRETE-STEEL PLATFORMS, FIFTH AVENUE TERMINAL.

limited and local service from outlying towns to the very center of the business district of a metropolitan city.

The Aurora, Elgin & Chicago Ry., which was described in the "Review" for Aug. 20, 1902, is a double-track third-rail road extending from 52nd Ave., Chicago, the terminus of the Metropolitan Elevated, 21 miles to Wheaton, at which point the double tracks diverge, one running in a northwesterly direction to Elgin, the other in a southwesterly direction to Aurora. A seven-mile branch connects Batavia with a junction point on the main line about four miles northeast of Aurora.

The new service was made possible by an agreement between the managements of the Metropolitan elevated and the Aurora, Elgin & Chicago roads by which the suburban cars from Aurora and Elgin are given the privilege of running express schedule from the terminus of the Metropolitan road at 52nd Ave. to its new Fifth Ave. Stub-terminal. In exchange for this privilege the Metropolitan road will be allowed to run its Garfield Park trains from 52nd Ave to Des Plaines Ave., a distance of 3.2 miles over the Aurora, Elgin & Chicago tracks. This inter-arrangement is of mutual advantage because it does away with the necessity of Chicago passengers from Aurora and Elgin transferring to and from the Metropolitan elevated cars at 52nd Ave., and likewise passengers on the Metropolitan Elevated desiring to go to Des Plaines Ave. and Waldheim Cemetery are not obliged to transfer to the suburban cars.

The new schedule provides cars in each direction every half hour, with four limited trains a day each way. The distance from the new Fifth Ave. terminal to Aurora is 39.5 miles, to Elgin 41.5 miles. The running time for local cars to these points is 1 hr. 25 min., and the express service, which makes but three stops for passengers in the 41.5 miles, is scheduled to cover the distance in 1 hr. 10 min.

This high speed service from the heart of a great city to an outlying district has been made possible by the erection of the Fifth Ave. stub-end terminal station of the Metropolitan elevated road. This station is located but a short distance north, on Fifth Ave., from the point where the Metropolitan tracks enter and leave the Union loop, over which operate all the elevated roads in the city. As may be seen from the accompanying illustrations, this terminal has been built in a most substantial and fireproof manner. The Fifth Ave. front of the building is of tooled sandstone. The floors, ceilings and walls of the building are fireproof concrete construction.

ENTRANCE TO TERMINAL STATION.

and the stairs leading from the ground floor to the loading platforms are of cast iron. An accompanying illustration is a comprehensive view of the ground floor of this terminal, showing the ticket offices of both railway companies and the news stand.

The elevated structure, which forms the roof of this building, has four tracks—two island platforms with tracks on either side. Three of the tracks are used by the Metropolitan trains, which operate on express schedule out of this station during the night and morning rush hours. The fourth track has been set apart for the use of the Aurora, Elgin & Chicago suburban cars. A pit was furnished this track by omitting the ties, thus placing the rails directly on the girders, across the bottom of which has been laid a concrete-steel

OFFICES AND WAITING ROOM, FIFTH AVENUE TERMINAL.

floor. A view of the tracks and concrete-steel platforms is shown herewith.

Along with the initiation of this limited service to and from the business district of Chicago the Aurora, Elgin & Chicago road has introduced coupon mileage books, which will be honored on the Aurora, Elgin & Chicago, the Elgin, Aurora & Southern, and the Joliet, Plainfield & Aurora electric railways. This book consists of $6.00 worth of 5 cent coupons, which are accepted as cash by the conductors. The price of the book is $5.00.

Methods of Increasing the Capacity and Reducing the Noise Upon the Union Elevated Railroad of Chicago.

Abstract of the Second Arnold Report.

PART I.

In continuation of the study of methods for benefiting the Chicago traction systems, Mr. Bion J. Arnold, Mar. 11, 1905, presented to the Committee on Local Transportation of the Chicago City Council his second report, of which the following is an abstract.

In his discussion of possible methods and modifications for increasing the capacity and providing through routing of cars of the Chicago elevated railroad systems, Mr. Arnold describes the present elevated loop situation as follows:

"The Union Elevated Loop, which encircles the business district of Chicago, is a two-tracked railroad two miles in length, and it serves as a terminal for the traffic coming from practically seven different elevated railroad lines. The Metropolitan West Side Elevated brings in over the four-track structure east of Marshfield Ave. the traffic from its four double-track branches. The traffic from the South Side Elevated road, as well as that from the Lake Street (name since changed to Chicago & Oak Park) and the Northwestern Elevated lines, is operated over this two-tracked structure simultaneously with the traffic coming from the Metropolitan lines.

"No less than 1,600 trains, ranging from two to five cars in length are delivered to the Loop railroad daily. The total number of cars operated on the loop per day is 5,000. The traffic of the elevated railroads, like that of the surface lines which terminate in the business district, is principally handled during 90 minutes in the morning and 90 minutes in the evening. The period of maximum congestion on the loop tracks extends over approximately 30 minutes during the morning and 30 minutes during the evening rush hour. At these times the average headway between trains on the outer loop is 19.8 seconds and on the inner loop 19.5 seconds."

In discussing the capacity of the Loop, Mr. Arnold stated that although the ultimate capacity of the present double-tracked loop is limited to the maximum number of trains which can be passed through the junction points of the Loop and the three elevated systems which feed it, yet under existing conditions it is not the junctions which limit the number of trains that can be operated over the Loop, but it is the present condition of the station platforms. These platforms are much too short to admit of trains being operated at intervals and speeds which will equal the capacity of the junctions. They should be lengthened sufficiently to permit two trains of five or six cars each to simultaneously occupy a platform. Under the existing conditions about 20 minutes are required during rush hours for a train to encircle the Loop, but during the less crowded hours the time consumed is but 15 minutes. This is due to the fact that when one train is loading at a station there is not room for the second train to pull up to the same platform, therefore it must slow down at a safe distance from the station and wait until the preceding train has begun to move out of the way. It is this frequent starting and stopping of the trains which regulates the time schedules of the elevated railroads. The actual loss in efficiency is very closely represented by the difference in time required for a train to complete the round trip with crowded and uncrowded tracks. As shown by the foregoing statements, this loss is approximately 25 per cent. Unless some plan of separate loops is adopted after the full capacity of the present junctions has been reached through the extension of platforms, then additional terminal facilities can only be provided by establishing auxiliary stub-terminals outside of the loop.

Mr. Arnold reviews the present conditions of operation over the Loop and recommend a number of methods for increasing its capacity and providing through routing. These recommendations, when arranged in order of their merit, may be summarized as follows:

1. Reconstruct the track work and separate the grades of the intersecting tracks by elevating the tracks of the inner loop over those of the outer loop at Fifth Ave. and Lake St., and the outside track of the loop over the Metropolitan tracks at Fifth Ave. and Van Buren St. This will provide for the through routing of the South Side trains over the east side of the loop to the Northwestern road and back, and from the Metropolitan road over the west side of the loop [illegible] the roads.

Extend the platforms.

Develop the stub-end or auxiliary terminals.

If it is not found practicable to elevate, then:

2. Reconstruct the track work at the present grade and arrange the special work for through routing, as described in the preceding recommendation. This plan would necessitate the changing of cars by passengers desiring to go from the North or South Side to the West Side, but as each loop station could be made a transfer point, congestion would be avoided.

Extend the platforms.

Develop the stub-ends or auxiliary terminals.

If on account of the diversified ownership of the roads, or for any other reason, it is found impracticable to secure through routing, then:

3. Leave the loop as it is now and install power mechanism for operating the switches and signals at the junctions.

Extend the platforms.

Develop the stub-end or auxiliary terminals.

PART II.

Mr. Arnold next presents an analysis of the causes of the present noise, and discussed methods suggested for reducing the noise upon the Union Elevated loop.

In illustration of some of the succesful attempts which have been made in sound deadening were cited the experiments made by the New York Central & Hudson River Railroad Co. with its steel viaduct extending from the Harlem River to 110th St. in New York. The heavy trains passing over this viaduct at high speeds made so much noise that the railroad company was obliged to deaden the sound or defend itself in many damage suits. Sufficiently satisfactory results to cause the withdrawal of the suits were finally obtained by changing the floor system of the original viaduct. When first laid, the rails had been fastened directly to the transverse box beams of the floor system. The successful results were gained by filling the depressions of the box beams with gravel, in which were bedded ordinary ties carrying the rails. With this arrangement the ballast furnished a cushion between the rail and the steel floor, thus deadening the noise.

European practice, which Mr. Arnold illustrates by describing the noise reducing methods used on the elevated structures in Liverpool and Berlin, has accomplished to a considerable degree the object sought by using a rock ballasted track supported by buckled steel floor systems. While these methods of construction have accomplished to a considerable degree the object sought, they have not eliminated the noise as thoroughly as is desirable upon the Union loop.

The present typical loop-span comprises latticed deck, longitudinal trusses, semi-latticed girders and riveted posts. The rails rest immediately upon ties, which in turn are rigidly secured to the upper chords of latticed-steel trusses, thus giving the best condition for imparting the hammer blows caused by the wheels upon the rails directly to the structure that could have been devised, unless the rails had been placed immediately upon upper chords or upon a metallic support between the rails and the chords.

Mr. Arnold states that he is firmly of the opinion that were the present structure not in place a concrete structure could be built which would prevent to a large degree the noise now emanating from the present steel structure, the cost of which would not be greatly in excess of the present structure. In analyzing the relative merits of different classes of construction, the fact should not be lost sight of that the noise comes primarily from the trains, and a large part of this noise cannot be eliminated entirely, no matter how good the design of the structure, and the best, therefore, that can be expected is to minimize the noise caused by the operation of the trains to the greatest possible extent, and prevent it being intensified by the supplemental action of a vibrating or ringing structure.

A transverse section of such a concrete structure as has just been mentioned is illustrated herewith. This structure would be built of stone or concrete in a manner similar to that now becoming so generally used in railway bridges, buildings and other structures.

The use of concrete eliminates almost all of the difficulty encountered with the present structure due to vibration, and if in addition, the sides of the structure were carried up solid to a point above the floor of the car, much of the noise occasioned by the running gear of the train would be confined and to a certain extent dissipated in the structure itself.

Since it would be manifestly unjust to ask that the present loop structure be removed, and thus permit the erection of a design of this character, the problem then is how best to modify the present design so as to reduce the noise to the greatest possible extent without making the cost prohibitive.

There are four primary causes of the noises on the loop, which are as follows:

1. Imperfect track construction.
2. Imperfect rolling stock
3. Imperfect roadbed.

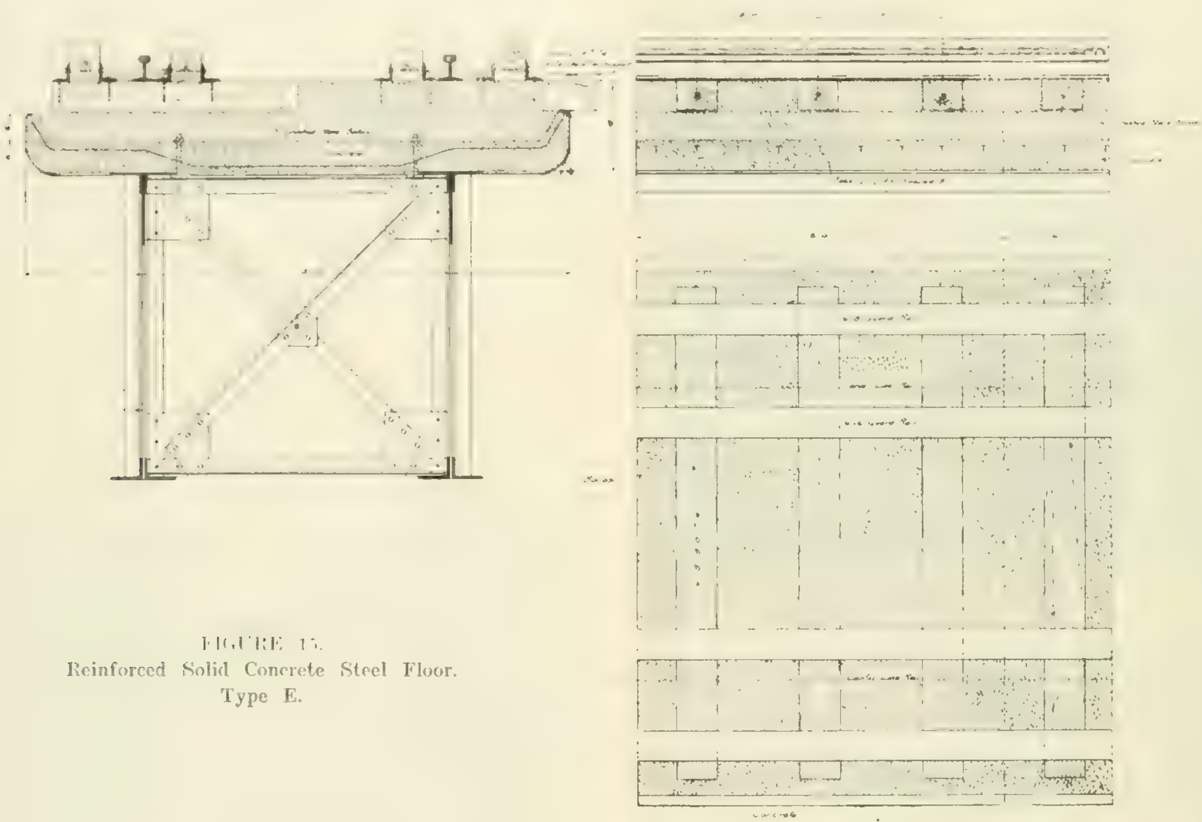


FIGURE 15.
Reinforced Solid Concrete Steel Floor.
Type E.

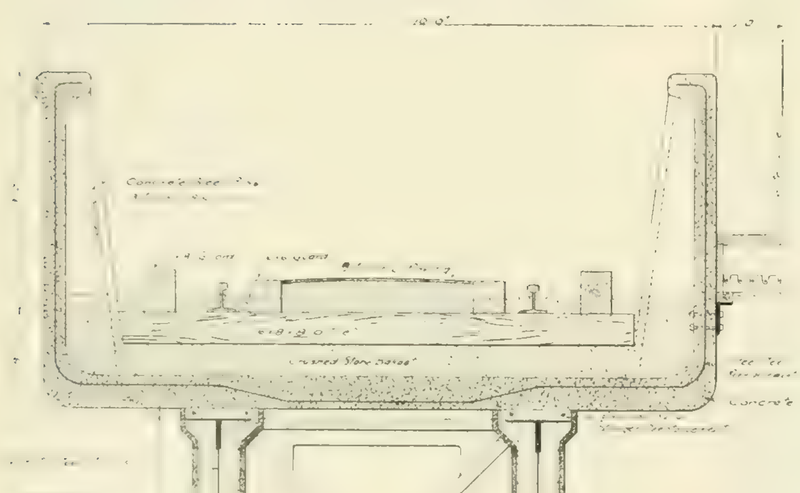
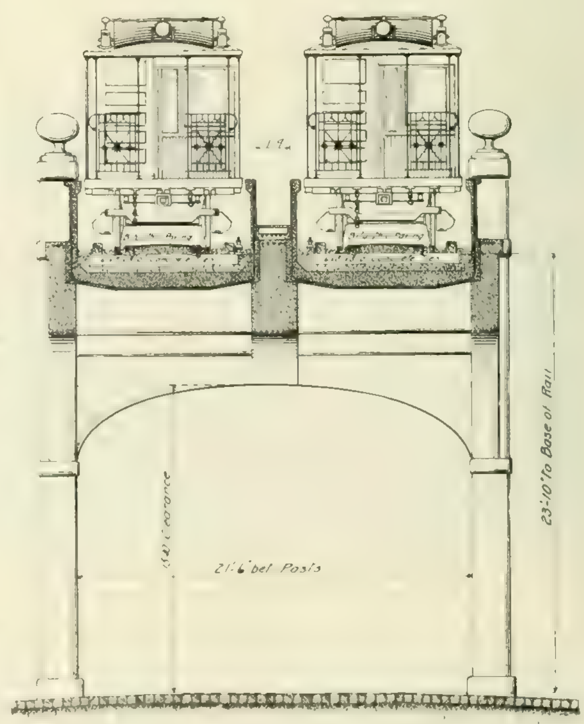


FIGURE 18.
Transverse Section of Typical Loop Span with Concrete Steel Reinforcement and Track Enclosures.



Cross Section

FIGURE 12.
Transverse Section of Suggested Concrete Structure.

4. Defect in structure as [illegible] rigidity.

In discussing the present imperfect track construction Mr. Arnold states that when the track was built in [illegible] the [illegible] and special work were new, and the noise was not excessive, but as the track work became worn the noise has increased until at the present time it is almost unbearable in certain places, and especially at the junction points. The present condition of the track is largely due to the failure of the tie plates, which proved to be too light for the duty imposed upon them. The principle cause of the noise imparted to the structure is the hammering of the wheels over the joints and uneven places, and therefore this cause can be removed and the running rails be maintained in a thoroughly first class condition. Mr. Arnold recommends that the most practical thing to do, since the present rail is badly worn, is to relay the tracks with a standard A. S. C. E. nickel-steel or rerolled T-rail, weighing not less than 80 lb. to the yard, having its ends cut at an angle of about 40 degrees, and provided with some first class joint of the bridge type, such as the "Continuous," the Weber, or other equally as good joint.

All special work not absolutely necessary for the proper operation of the trains should be removed, and worn special work now in place (and ultimately all the present special work) replaced with the best and most improved type of manganese steel special work, which, although very expensive, lasts so much longer than ordinary special work that, under the conditions existing on the loop, it is advisable to use it.

All frogs should be of the movable point type where conditions will permit or of a type which will offer as nearly a continuous rail as practicable for the rails over which the wheels are passing.

In order to make the rail and its support a unit all rails should rest on large and heavy tie plates and be secured to the ties by means of screw spikes or in such a manner as to prevent the rattling of the rail and plates, and be maintained in this condition.

Since a large part of the noise proceeds from the running gear of the rather light type of rolling-stock used, Mr. Arnold speaks of some method of enclosing the entire truck, including the wheels, with a light casing of sound deadening non-combustible material. This casing should have a bottom and the sides should be hinged to permit inspection. While such a casing would smother the noise due to many causes, yet from a railroad standpoint it would be a very objectionable thing to use for the reason that inspection of truck and motor parts would be more difficult and the capacity of electric motors would be reduced owing to their enclosure. It will be noted that the adoption of side walls on the structure as hereinafter described would practically serve the same purpose. Mr. Arnold recommends the use of multiple unit control with motors on each car, thereby imposing less duty upon individual gears, increasing the average speed of the trains and doing away with much of the noise. He also recommends that the floors of all cars be packed with some fireproof sound deadening material, that all future cars should be equipped with trucks having as few parts as practicable, and that the relief opening of the triple valves of the air brakes should be provided with some device for muffling the noise of the escaping air when the brakes are released and thus prevent the sharp whistle now common to some of the cars.

As has been previously pointed out, the roadbed of the present structure, though satisfactory for railroad operation, is defective from the standpoint of sound deadening, and in order to remedy this defect as far as practicable some type of ballasted floor must be used.

In order to compare the various types of floor construction, six such ballasted floors as would be applicable to the loop were illustrated in the report and carefully criticized. Two of the types were ballasted steel floors, one was a concrete-arch floor, one was a creosoted timber floor and two more concrete-steel floors. In all these designs the rail is mounted on wood ties imbedded in ballast which is brought up even with the head of the rail to reduce the singing or humming noise. The merits and demerits of these six designs were carefully considered and the two types of concrete-steel floors were recommended as being most suitable for the purpose. One of these suggested types, which is herewith illustrated, is a reinforced solid, concrete-steel floor. It was called Type E. The other suggested floor was of open, ballasted concrete-steel construction and was called Type F. There would be no great difficulty in removing the ties in any of these floors except where [illegible] for the removal of ties if necessary.

The principal objection, aside from its cost, that is usually [illegible] collecting it and carrying it away in case it became necessary to operate the loop with a solid floor.

The most important characteristic of these floors is their increased weight, as compared with the present floor, the greatest increment being 1,680 lb. per lineal foot of track for Type E and [illegible] weight increases the stresses in the structure throughout and necessitates its reinforcement to secure a corresponding increase of its strength.

Two kinds of re-enforcement were calculated, one a usual steel re-enforcement and the other a concrete-steel re-enforcement. The steel re-enforcement involves a large amount of drilling, cutting out of rivets and riveting, which must be done in the field under difficulty. The concrete-steel re-enforcement, on the other hand, requires no alteration in the metal work and can be applied without difficulty. Its greatest advantage over steel, however, is in removing the elements which produce the loop noise.

In applying the concrete-steel re-enforcement, the stringers, cross-girders and posts of the structure would be encased in concrete, in which there would be imbedded steel bars wherever necessary to make up the deficiency in section previously referred to, and also to carry the weight of the concrete itself and to support it in place. The steel would require no connection to the structure, thus avoiding to a large extent the difficulty at the fender-castings in case steel re-enforcement were used. The adhesion between the concrete and the present steel structure would not be depended upon for the re-enforcement but would obviously furnish an additional strength. To still further reduce the noise producing effect of the steel structure, it would be best to encase the laterals and transverse bracing.

Types E and F are the most economical of the six classes of floor systems suggested, and that Type F with concrete-steel re-enforcement is the cheapest of any of the types shown, the total cost of additions to the loop with this type being $272,000. If, instead of broken stone ballast, a granulated slag ballast is used, a slight reduction in the cost can be realized. Should a slag ballast weighing 35 lbs. per cu. ft. be heavy enough to hold the track, and if an overstress of 10 per cent in the stringers is allowable, the cross girders only would have to be re-enforced in Type F. For the loads the loop carries, and at the speeds they are carried, it is probable that slag ballast would answer. Stretching a point, then, as to the overstress in the stringers and columns, Type F, with steel re-enforcement, would require strengthening of the cross girders only, and could, therefore, be applied complete for about $12.50 per lineal foot, or $125,000 for the total structure.

A secondary result of the ballasted floor would be the raising of the base of the rail about 10 or 12 in., which would necessitate raising the station platforms a corresponding amount, which will involve an additional total expense of about $5,000 in both cases for the entire loop.

Mr. Arnold stated that from the foregoing and from observations made during his investigation of this subject, he is of the opinion that the objectionable noises now caused by the operation of cars over the Union loop can be greatly reduced and the degree of reduction will be almost inversely proportional to the money spent, along proper lines, in the attempt.

Further, that while the methods suggested in this report would in his judgment prove effective, some of them are to a certain extent experimental and it would therefore be unjust to demand that they be adopted and applied by the railroad company to the entire loop without their relative efficiencies having first been determined by experiments on short sections of structure, thereby keeping the experimental expense as low as practicable until the best type of construction could be determined by actual demonstration.

Mr. Arnold's recommendations for reducing the sound upon the loop and suggested methods of procedure are as follows:

1. If practicable adopt plan of increasing the capacity of the

[illegible] eliminate the maximum amount of special work and thus reduce the noise due to the hammering of wheels on frogs and switches to the greatest possible degree and at the same time increase the capacity of the loop to the greatest extent possible by track modification and leave it in the best condition for thorough routing or loop operation or both.

2. If this is not adopted, reconstruct in accordance with the second plan, which leaves all tracks at the present grades. Re-enforce the structure at all junctions and provide each junction with a solid floor ballasted with crushed stone or slag

3. If neither of the above plans is adopted re-enforce the present structure at all junctions and provide each junction with a solid floor ballasted with crushed stone or slag.

4. Equip sections of about 300 ft. each of the Market St. stub terminal of the Chicago & Oak Park road over which trains do not now operate with different floors, using stone, slag and gravel ballast in different sections and re-enforce the structure supporting these sections with the concrete-steel re-enforcement described in this report. Operate trains over this stub-terminal when so equipped until the relative merits of the different types can be determined. The equipment of this terminal is suggested to prevent interfering with present traffic, but should the railroad companies prefer to conduct the trials upon the loop or elsewhere they should be allowed to do so.

5. After the type of floor and kind of re-enforcement which most effectually accomplishes the elimination of noise is determined, the loop structure between junctions should be re-enforced and the type of floor selected applied.

6. In any event reconstruct the track and special work in accordance with the suggestions contained in this report and maintain the rolling stock, track and special work in first-class condition under rigid city inspection.

7. All changes in the structure should be made in accordance with plans approved by the city and prepared with the special object of sound deadening in view and the experimental and permanent work done in a manner satisfactory to the city.

New Equipment for Brooklyn.

During the summer months the heaviest part of the Brooklyn Rapid Transit Co's. surface traffic is the handling of the immense crowds which travel between the city and the amusement resorts along the ocean shore, south of Brooklyn. For this reason the design of an economical car for use on the Brooklyn surface lines should include features of a convertible type car. In order that no mistake might be made in the choosing of a type of car suitable for its summer and winter service, the company purchased a sample car of a new semi-convertible type. This car was built by the John Stephenson Co. and was given a thorough test so that its details might be more closely studied.

After an examination of this new type an order was placed for 200 similar cars, 175 to be built by the J. G. Brill Co. and 25 by the Jewett Car Co. The new cars are to be 42 ft. 6 in. overall and each will be mounted on two specially designed short wheel base trucks, manufactured by the Peckham Manufacturing Co. The cars will be equipped with two styles of brakes, the standard air brake equipment of the Westinghouse Traction Brake Co., and the "Peacock" hand brake of the National Brake Co., Buffalo. They will be driven by four Westinghouse Type 101, 40-h. p. motors, controlled by Westinghouse 28-A hand controllers. The wheels for these surface cars will be of the rolled-steel type manufactured by the Schoen Steel Wheel Co.

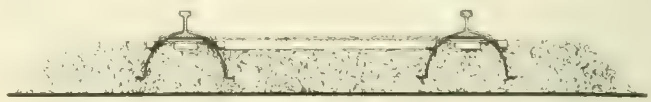
The interior of the cars will be fitted with the Heywood Bros. & Wakefield Co's. rattan covered cross-seats. The Sterling-Meaker Co's. fare registers will be used and the curtains, which will be made of heavy pantasote, will be fitted with the Curtain Supply Co's. fixtures. The heaters for these cars will be supplied by the Consolidated Car Heating Co.

Orders have also been placed for [illegible] on the Brooklyn Rapid Transit Co's. elevated lines. Fifty of these cars will be built by the Cincinnati Car Co., 25 by the Jewett Car Co. and 25 by the Laconia Car Co. Peckham trucks and 33-in. steel-tired wheels manufactured by the Taylor Iron & Steel Co. will be used. Westinghouse air brakes, manufactured by the Westinghouse Traction Brake Co., and Westinghouse 150-h. p., Type-50 motors, two per car, and Westinghouse controllers will be used. The cars will be fitted with rattan covered cross-seats, manufactured by Heywood Bros. & Wakefield Co. The Pantasote Co's. curtains will be supplied with the Curtain Supply Co's. fittings and the cars will be equipped with Sterling-Meaker fare registers and "Consolidated" electric heaters.

Fifty freight cars have also been ordered, 35 of which are to be flat cars and 15 box cars. These 50 cars will be built by the Laconia Car Co. and mounted on Peckham trucks, fitted part with the Taylor Iron & Steel Co's. steel-tired wheels and part with the Schoen Steel Wheel Co's. rolled-steel wheels. The order for the electric motors and control apparatus has been placed with the Westinghouse Electric & Manufacturing Co. Both "Peacock" and Westinghouse brakes will be used on these cars.

A New Track Substructure.

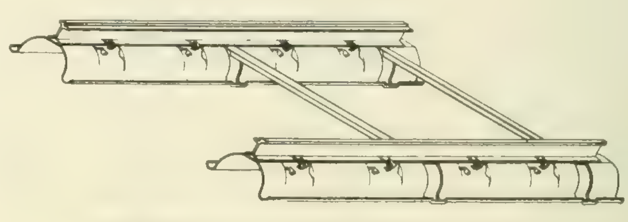
The criticism has often been made that the type of street railway substructure which consists of deep girder rails bedded in concrete and held in gage by tie-rods is too rigid. This criticism is given weight by the fact that many roads, which have had such rigid types of substructures, on rebuilding have incorporated in the detail of the rail support some sort of a cushion or seat or bearing plate for the base of the rail which would be capable of reducing the shocks imposed upon the rail at joints and other irregularities in the surface and alignment. In this style of track construction it has also been found necessary to anchor the rail down as well as hold it up. On some tracks of this class, this too rigid holding of the rail has



STANDARD STEAM RAILROAD CROSS-SECTION.

proved itself incapable of caring for the shocks and strains due to rolling loads, and has therefore been subject to crumbling at the joints, bearing plates, anchors, etc.

The continued increase in the cost of wooden cross-ties has necessitated the use of concrete and other forms of substructure which require less wood than the ordinary tie construction. Several forms of concrete ties have been designed, but these are only in the experimental stage. Realizing the need of a substructure not subject to these criticisms, the American Railway Tie & Girder Co., of Pittsburg, Pa., has recently developed the railway substructure shown in the accompanying illustrations. Mr. Samuel E. Duff, its inventor, has had a wide experience in track work, and therefore has been



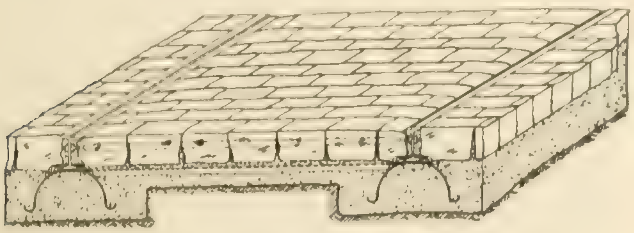
PERSPECTIVE VIEW OF SUBSTRUCTURE AND RAILS.

able to incorporate in the design of this "Railway Substructure" many details which help to make his invention meet the practical needs.

As may be seen from the illustrations, this substructure consists of a continuous support for the rail in the form of a sheet steel arch of a shape furnishing sufficient elasticity to absorb the shocks of traffic, while resisting any permanent deflection or change in form. The rails are firmly fastened on the girders with closely spaced clips, and the sections of the girders are permanently locked to each other by connections immediately under the rail base. Any good ballast material may be used as a bed for this substructure, and when once well tamped it is said that the tracks will remain in line and surface an unusually long time.

The illustration showing the Duff substructure in a paved street

is to some degree misleading, as it may give the impression that it is required to use concrete. Such is not the case, as the ballast recommended for use with the Duff substructure is broken stone or gravel, but if the railway engineer insists upon concrete, then it is claimed that the Duff system is the only one that will adequately protect the concrete from breaking up under the shock of traffic.



[illegible] RAILWAY TRACK PAVED WITH BLOCKS.

This substructure has been severely tested by both steam and electric roads, and has successfully held up under heavy traffic of both classes, which speaks well for its maintenance cost. The construction cost for track using this substructure is not excessive in comparison with concrete girder construction, if the life, durability and maintenance of the track, paving and rolling stock are considered.

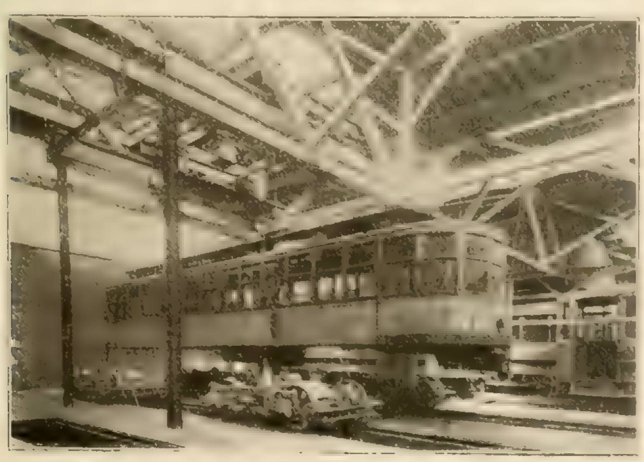
New Shops of the Duluth Street Railway Co.

The Duluth Street Railway Co. recently completed an addition to its car shops measuring 100 x 150 ft., a large part of which will be used for a new paint shop. Eight cars may be painted at once in this shop. The remainder of the ground floor of this addition will be used for a store room and for wood working machinery, and on the second story a new drawing room has been provided which measures 20 x 60 ft.

The company has recently placed in its shops a number of new machines comprising an electrical compressor, built by the National Electric Co., of Milwaukee, which has a capacity of 200 cu. ft. of air at a pressure of 90 lb.; also a new compressed air hammer of 400-lb. capacity and new shears of 20,000-lb. capacity. The shop also contains a small crane used for lifting car bodies, trucks, etc. The hoist consists of a large special trolley with double drums with four lift hooks mounted on a structural steel runway which spans the car tracks. The trolley has a frame of structural steel. The lifting capacity is 20 tons and the crane is operated by a 25-h. p. direct current electric motor which lifts the load. The travel of the hoist is operated by a 7½-h. p. electric motor which is controlled from the floor. The hoisting speed at full load is 10 ft. per minute and for lighter loads is about 25 ft. per minute. The speed of the travel is from 100 to 150 ft. per minute. [illegible] five.

The [illegible] will set when the current is off. A limit stop is provided in connection with a limit switch, which throws off the current when the hooks reach the desired point in the lift, thus preventing the overtravel of the hoist. The steel runway which supports the hoist consists of four Z-bar columns supporting the double I-beam runway girders.

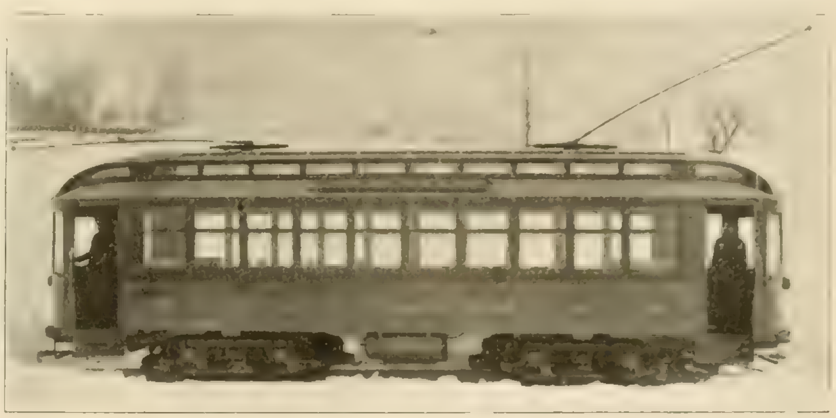
This crane is used principally to lift the car bodies from one set of trucks to another [illegible] will be seen in the illustration. Steel clamps are attached to the car bodies to which crane hooks are fixed and, as all the blocks travel at the same speed, the body is lifted from one set of trucks and the travel motor put in operation, transferring the body to another set of trucks. This operation of lifting and transferring the body requires but a few moments and only one man is necessary to attend to the lifting and traveling, although it is necessary to have helpers to locate the trucks under the body when the latter is lowered. The crane was built by the Northern Engineering Works, of Detroit, Mich., and can be arranged for use with either direct or alternating current motors of any voltage.



HOIST FOR CAR BODIES.

Semi-Convertible Car for the Portsmouth, Dover & York Street Railway Co.

Besides the new combination mail and express car which the Laconia Car Company Works has built for the Portsmouth, Dover & York Street Railway Co., and which was illustrated in the "Review" for February, this company has built several standard 28-ft. passenger cars, of which the accompanying illustration is a type.



STANDARD 28-FT. PASSENGER CAR FOR [illegible]

This is a Laconia semi-convertible type of car having ten double sash windows on a side, both sashes arranged to drop flush with the window stools. The interior of the car is finished in red birch, with ceilings of three-ply quartered oak. The curtains are of the Curtain Supply Co. make; the seats of the No. 42 Wheeler pattern in rattan, with polished bronze grab handles on back; and the car is fitted with DeWitt sand boxes, Consolidated heaters, Wilson trolley retrievers, Pfingst fenders and Christensen AA1 air brakes

Tray Plate Battery Co.

The Tray Plate Battery Co., of Binghamton, N. Y., has purchased the equipment, patents, rights and franchises of the Smith Storage Battery Co., and has increased its capital and enlarged its factory. [illegible] the batteries manufactured by the Tray Plate Battery Co. are that it [illegible] lighting or power plants, isolated plants, etc. The company also [illegible] cluding electric vehicle batteries.

Personal.

MR. WILLIAM FRAZEE [illegible] Indianapolis & Cincinnati Traction Co., with headquarters at Rushville, Ind.

MR. L. A. WALTON, vice-president of the Equitable Trust Co., Chicago, was on March 15th elected president of the South Park Commission, of that city.

MR. JOHN DAVEY has tendered his resignation as chief engineer and electrician for the Winnebago Traction Co., Oshkosh, Wis., after eight years' service.

MR. H. T. FISKE, superintendent of the Citizens Railway & Light Co., of Muscatine, Ia., has resigned, and will move from that city to Cleveland, O., on April 1st.

MR. F. R. FORD, of Ford, Bacon & Davis, who have been retained by the new management of the Chicago City Railway Co. in an advisory capacity, is now in Chicago, where he will remain for several weeks.

MR. CHARLES W. CROSS, formerly of the Roberts & Abbott Co., Cleveland, O., and later electrical engineer of the Eastern Ohio Traction Co., has become associated with the Cleveland, O., office of the Crocker-Wheeler Co.

MR. FREDERICK SARGENT, of Sargent & Lundy, Chicago, sailed for London, March 11th, having been summoned to testify before the Parliamentary Commission regarding the railway and lighting situation in London.

MR. C. H. BYRNE, treasurer of the Houston Electric Co., has been transferred to a similar position with the Jacksonville Electric Co., Jacksonville, Fla., both properties being under the management of Stone & Webster, of Boston.

MR. E. B. GUNN, formerly general superintendent of the Dayton, Springfield & Urbana Electric Railway Co., is now manager of the Springfield, South Charleston, Washington Court House & Chillicothe Electric Railway Co.

THE OFFICERS OF THE WESTERN RAILWAY CLUB gave an elaborate reception and banquet to its past presidents on Tuesday evening, February 21st, at 7:30 o'clock, in the banquet hall of the Auditorium Hotel, Chicago.

MR. R. H. DERRAH, general passenger agent of the Massachusetts Electric companies, delivered an address on "Transportation Systems, Old and New," before the Board of Trade of Salem, Mass., Friday evening, February 24th.

MR. R. O. JASPERSON, who has been on the staff of the Evening Wisconsin as a reporter, has been appointed chief clerk to Mr. John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

MR. WILLIAM BARCLAY PARSONS, late chief engineer of the New York Subway Commission, and member of the Isthmian Canal Commission, delivered an address at the Eliza Fowler Hall, Purdue University, Lafayette, Ind., March 13th, on "Rapid Transit in Great Cities."

PROF. W. F. M. GOSS, Purdue University, Lafayette, Ind., delivered an address at Franklin Institute, Thursday evening, March 2d, on "The Application of Highly Superheated Steam to Locomotives and the Probable Economy and Increase of Power to Be Derived Therefrom."

MR. H. S. REYNOLDS, who has managed for the last four years the Stone & Webster interests in Columbus, Ga., has resigned to accept a position in the operating department of J. G. White & Co., engineers and contractors, 43 Exchange Place, New York, where he will reside in the future.

MR. JAMES A. PEARCE, of St. Louis, Mo., has been appointed general superintendent of the Mexico Electric Tramways, Ltd., City of Mexico, which controls and operates the Ferrocarriles del Distrito Federal, and the Mexico Traction Co. The general offices of this company are at Indianilla, Mexico.

MR. HENRY M. TOWNE, president of the Yale & Towne Manufacturing Co., Stamford, Conn., and past-president of the American Society of Mechanical Engineers, February 24th gave an address before the faculty and students of Purdue University. His subject was "Industrial Engineering."

MR. R. M. BOYKIN has been appointed auditor of the Indianapolis & Northwestern Traction Co., succeeding Mr. H. St. G. Eldridge, who was transferred to Duluth, Minn., where he became auditor for the water power company controlled by the same interests as the Indianapolis & Northwestern Traction Co.

MR. C. J. OLMSTEAD, who for 15 years has been private secretary to Mr. George F. Brown, general manager of the manufacturing department of the Pullman Co., Chicago, will on April 1st assume charge of the traction department of the Westinghouse Air Brake Co. for the Chicago district, succeeding Mr. Guy A. Hagar, who goes to St. Louis to represent the Weber Railway Joint Manufacturing Co. Mr. Olmstead will make his headquarters in the office of Mr. A. L. Humphrey, western manager of the Westinghouse Air Brake Co., 1545 Railway Exchange Building, Chicago.

MR. E. E. WINTER, general manager of the Montgomery (Ala.) Traction Co., has been appointed receiver of the company, the result of an application filed in the United States Court by attorneys for the North American Trust Co.

MR. B. A. SCHRODER, for some time attached to the St. Louis office of the Crocker-Wheeler Co., has been placed in charge of the New Orleans office of the company. Mr. Schroeder succeeds Mr. W. P. Field, who has been transferred to the Boston office.

MR. L. T. GIRDLER, of the Standard Underground Cable Co., Pittsburg, has been appointed superintendent of the Muskegon Traction & Lighting Co., vice Mr. W. G. Whildin, resigned. Mr. Girdler is a native of Jeffersonville, O., and a graduate of the engineering department of Lehigh University.

MR. L. B. COOL, chief clerk in the copyright office of the Library of Congress, Washington, D. C., and formerly lessee of the Grand opera house of Akron, O., has been appointed manager of the two pleasure resorts, including the Park theater, at Meyer's lake, for the Canton-Akron Railway Co. Canton, O.

MR. ARTHUR WARREN, manager of publicity for Allis-Chalmers Co., on February 17th delivered before the American Trade Press Association of New York a very interesting paper entitled "A Plain Talk on Trade Journals." On February 27th, Mr. Warren repeated his "talk" before the Chicago Trade Press Association, addressing one of the largest meetings of that association that was ever held.

MR. C. A. ALDERMAN, chief engineer of the Appleyard lines in Ohio, has resigned, to enter the service of the Elkins-Widener Syndicate at Cincinnati. Mr. Alderman has been with the Appleyard Syndicate ever since its organization, and for some time past, in addition to his duties as chief engineer, has been acting general superintendent of the Dayton-Springfield & Urbana and the Urbana, Bellefontaine & Northern lines.

MR. L. J. WOLF, president of the Aurora, Elgin & Chicago Railway Co., on March 17th, invited the electric railway officials of Chicago and representatives of the press to meet Mr. H. M. Brinckerhoff, general manager of the Metropolitan Elevated, and inspect the Aurora, Elgin & Chicago property. A special train of two cars left the new Fifth Ave. terminal at noon and returned at 5:30 p. m., having taken the party over the entire third-rail system. An elaborate luncheon was served en route.

MR. HARRY E. BEACH has joined the selling force of the Mayer & Englund Co., of Philadelphia, making his headquarters at their New York office, 85 Liberty St., New York, and of which he will have full charge. Mr. Beach is well known in the street railway supply business, having been for several years the representative of the New Haven Car Register Co., which latter was purchased some time ago by the International Register Co., of Chicago. Mr. Beach is thoroughly conversant with many of the lines handled by the Mayer & Englund Co., and with his thorough knowledge of mechanics will make a valuable acquisition to the selling force of his company.

MR. CHARLES G. LOHMAN resigned as division superintendent of the Indianapolis Traction & Terminal Co., and on March 15th assumed charge as superintendent of transportation of the Indiana Railway Co., South Bend, Ind. The Indiana Railway Co., it will be remembered, operates an interurban line from Niles, Mich., to Goshen, Ind., and the city systems of South Bend, Mishawaka and Elkhart. The company is about to undertake the construction of a 30-mile line from South Bend to Michigan City. Mr. Lohman has been connected with the Indianapolis Traction & Terminal Co. for the last six years. Before that he had been for three years secretary of the Indiana Traction Co., organized by Mr. Noah Clodfelter. Mr. Lohman has been active in city and state politics while in Indianapolis.

Obituary.

COL. GEORGE W. MILES, president of the Radford Water Power Co., Radford, Va., died in Memorial Hospital, Richmond, Va., Saturday morning, February 25th. The funeral services were held from the M. E. Church, Marion, Va., February 27th, at 11 o'clock a. m.

MR. ALPHEUS P. GODDARD, president of the Freeport Railway, Light & Power Co., formerly mayor of the city and one of its foremost citizens and business men, died at his home in Freeport, Ill., February 12th. Mr. Goddard was born in Franklin county, New York, Aug. 29, 1833, and went to Freeport with his parents in 1835, where he has since lived, with the exception of about four years, two of which he spent in the Civil War.

MR. WILLIAM WHITE, claim agent of the Chicago City Railway Co., died at his home in Chicago, Sunday afternoon, March 5th, after an illness of ten days. Mr. White came to Chicago in 1884, and entered the employ of the company as a conductor, advancing through several official positions until he became the head of the claim department. Mr. White was a member of the executive committee of the American Association of Street Railway Claim Agents and was actively interested in its promotion and organization at St. Louis last year.

Changes at Buffalo, N. Y.

A recent event of great interest in the traction world is the important change in the management of the International Railway Co., at Buffalo, N. Y. Formal transfer of the control of this company from the Ely interests to the Pierce interests was effected at a meeting of the directors of the company at the office of J. P. Morgan & Co., New York City, March 4th, at which time Mr. Henry J. Pierce was elected president of the International Traction Co.,

H. J. PIERCE

THOMAS W. WILSON

which is the holding company for the International Railway Co. and the Crosstown Street Railway Co., to succeed Hon. W. Caryl Ely.

Mr. Henry J. Pierce was born in Bath, Me., Aug. 29, 1857. While very young, his parents moved to New York, where his father was president of Rutgers Female College for many years. Mr. Pierce went to Buffalo when 17 years of age, and in 1880 helped to organize what is now known as the Wood Products Co., which handles and refines over 90 per cent of all the wood alcohol made in this country, and of which company he is president. Mr. Pierce is also president of the Chamber of Commerce, of Buffalo, and president of the Netherlands Tramways Corporation, which operates electric railways in Amsterdam and Haarlem, Holland, a description of which appeared in the "Review" for January, 1905. Mr. Pierce has also been a director of the International Railway Co. since its incorporation, and was one of the organizers of the Buffalo & Niagara Falls and Buffalo & Lockport electric railways.

Other changes in the personnel of the company include the appointment of Mr. Thomas W. Wilson, chief engineer of the company, as general manager, to succeed Mr. T. E. Mitten. Mr. Wilson was graduated from Lehigh University in 1890, and for five years thereafter was connected with the Pennsylvania Steel Co. Afterward he became chief engineer of the Charleston City Railway Co., resigning this position to serve as chief topographer with the [illegible] at the organization of the International Railway Co.

The following officers have retired from their connection with the company: Van Horn Ely, assistant to the president, this office being [illegible] succeeded by J. F. Slocum, who has been his assistant for the past two years; [illegible] H. M. Pease, auditor, no successors to these gentlemen having been appointed at the present writing. Fred D. Hoffman, formerly secretary to Manager Mitten, will hold a similar position with Mr. Pierce.

The officers and directors of the International Traction Co., the holding company, are as follows: President, Henry J. Pierce, Buffalo; vice-president, Thomas Dewitt Cuyler, Philadelphia; secretary and treasurer, J. F. Slocum, Buffalo. Directors: Henry J. Pierce, Buffalo; G. L. Boissevain, New York; Arthur Robinson, New York; T. Dewit Cuyler, Philadelphia; Thomas E. Mitten, Chicago; A. M. Robinson, Louisville, Ky.; Pendennis White, Buffalo; William B. Rankine, Niagara Falls, N. Y., and L. J. Hayden, of Park Ridge, N. J. The directors who have retired are Francis Lynde Stetson, Charles McVeagh and Richard Trimble, all of New York; W. Caryl Ely, of Buffalo, and Burt Van Horn, of Newfane, N. Y.

Poor's Manuals.

POOR'S RAILROAD MANUAL APPENDIX, special edition of February, 1905; 240 pages; price $2.00; published by Poor's Railroad Manual Co., 68 Williams St., N. Y. This special edition is printed as an appendix to the annual number of the well-known Poor's Manual of Railroads in the United States. The appendix contains all the important facts relative to the bonded indebtedness, interest charges, etc., of the leading steam and electric railways in the United States. To this information is added a number of tables, giving the dates of the annual meetings, the location of transfer agencies and the registrars of stock, also statements of the rates and dates of all dividends paid by steam and electric railway companies and industrial corporations from 1897 to 1904, inclusive, with the time and place of payment. A much appreciated feature of this book is the diary of annual meetings and times closing of transfer books. This diary is arranged by days of the week, and includes the time for the 12 months from March 1, 1905, to Feb. 28, 1906. The book is thoroughly indexed and arranged in its usual readily accessible style, and will be found a most convenient reference for those requiring information on bonds and stocks.

POOR'S RAILROAD MANUAL APPENDIX, 1905; 5⅞ x 8⅞ in., 132 pages, with index to contents and index to advertisers; Poor's Railroad Manual Co., 68 William St., New York City. This edition of January, 1905, is a supplement to Poor's Manual of Railroads and is a directory of railway officials (steam, electric and other) of all the railroads in operation in the United States, Canada and Mexico. The directory of steam railroad officials is arranged in an alphabetical list of the roads, while that for the electric railways is arranged alphabetically according to states and cities. The list is revised and corrected to Dec. 15, 1904.

The Indianapolis & Northwestern Traction Co. has concluded arrangements with the Holland Palace Car Co. whereby two Holland palace cars will be put in the limited service on this line between Indianapolis and Lafayette, on April 1st.

"Come Along."

"Come Along" is the title of the successful trolley song which won the $200 offered by the Detroit United Weekly, and the composer is Mr. Paul Hoffrichter, a Detroit letter carrier. Se[illegible]ber 29th last the Detroit United Weekly announced the cond[illegible] and opening of the competition, and since that time manuscripts were received from all parts of the country and from many well-known composers until January 7th, when the contest was c[illegible] The [illegible] song is dedicated to the Detroit United Ry., and the company retains the privilege of using the song and verses for advertising purposes.

The Arnold Co.

For some time the increasing scope of the work carried on by the Arnold Electric Power Station Co. has caused the management to recognize that a change in the name of the concern to one less indicative of power station work merely, was very desirable; this change has now been made and the concern will henceforth be known as the Arnold Co. The company was organized in 1896 to incorporate the business of Mr. Bion J. Arnold, other than his individual consulting work, and soon enlarged its staff to handle contracting and constructing as well as designing, and extended its operations into different fields so that the name first chosen was not descriptive.

The Arnold Co. styles itself "engineer and constructor" and its ability to undertake and carry out the construction work gives it an important advantage in its practice as engineer. The company's staff has been increased as the business developed, the latest addition being its general building construction force, as distinguished from the railway, power house and shop construction in which it has been especially prominent.

Among the electric roads with which the Arnold Co. has been connected are the Chicago & Milwaukee Electric R. R.; Chicago Electric Traction Co.; Lansing, St. Johns & St. Louis Electric Ry.; Kenosha Street Ry.; Grand Rapids, Holland & Lake Michigan Electric Ry., and the Bloomington, Pontiac & Joliet Electric Ry. It will be noted that two of these roads are single-phase lines in which class of work the company's president is a pioneer. It is also significant that the company was one of the first to bring to successful completion an electric railway operated by a high tension, rotary converter system of power distribution.

Among the electric power stations designed and built by the Arnold Co. are those of the Chicago Board of Trade, Albert Dickinson & Co., Chicago and Minneapolis; Chicago & Alton, Springfield, Ill.; Imperial Lighting Co., St. Louis.; W. B. Conkey Co., Chicago; Land Title & Trust Building, Philadelphia; Otis Elevator Co., Chicago. And the company has had active charge of the work of equipping modern shops for the following steam railroads: Chicago & Eastern Illinois; Chicago Great Western; Denver & Rio Grande; New York Central & Hudson River; Oregon Short Line; Pere Marquette; St. Louis, Iron Mountain & Southern; Union Pacific and Wisconsin Central.

The Arnold Co. has just completed the design and construction of a hydro-electric plant at Lowell, Kan., which will furnish current for lead and zinc mines near Joplin, Mo. This is a 3,000-kw. installation with a 33,000-volt transmission line.

As a means of placing on record for convenient reference data as to its work, the company publishes a series of "Bulletins" describing the interesting technical features and giving engineering data of its various installations. A blue print book containing data of interest to the mechanical officials of steam railroads and the set of blue print maps which have been published in the "Review," detailing the location and progress of interurban railroad work in the western states are other of the Arnold publications which have been much appreciated.

The officers of the Arnold Co. are: Bion J. Arnold, president; W. L. Arnold, vice-president; Ralph G. Arnold, secretary and treasurer, and George A. Damon, managing engineer.

Electric Railway Statistics in Canada.

The electric railway statistics for the Dominion of Canada for the year ended June 30, 1904, give the following data: There were in operation 767 miles of line, as against 759 in 1903. The capital, including Dominion and Provincial subsidies and municipal aid, was $80,453,609, an increase of $1,219,932. Working expenses were $5,326,517, an increase of $853,659 over the year previous. Net earnings were $3,125,092, or an increase of $366,273. There were 181,689,998 passengers carried, against 155,662,812 for the preceding year. Of freight 400,161 tons were carried, 28,876 more than in [illegible] the number in the previous year.

It is reported that preliminary steps are being taken towards the construction of a subway which will relieve the congestion in the Public Square at Cleveland.

New Publications.

THE TESTING OF CONTINUOUS CURRENT MACHINES, by Charles Kinzbrunner, A. M. I. E. E. Book of 326 pages; 249 illustrations; price, $1.50; published by John Wiley & Sons, N. Y. This book is intended for use in laboratories and test rooms, and is a practical work for students and engineers. The work originated in a number of instructions for making experiments in mechanical laboratories, which the author gave as a series of lectures at the Municipal School of Technology, in Manchester. The purpose of the book is to prepare the student for his laboratory work, to explain the meaning of the various experiments, and to give him exact instructions for carrying them out. Exceptional stress has been laid on the introduction of characteristic examples. This is a good feature, because the value of an experiment is not so much in the carrying on of the work as in its application for practical purposes. The work is also intended for electrical and mechanical engineers who are engaged in testing, installing and supervising electrical machinery. The user of the book is expected to have a working knowledge of the fundamental principles of continuous current machines and apparatus. After a few general instructions concerning the carrying on of experiments, given in the form of an introduction to the book, the writer discusses the subject of the general design and distinguishing characteristics of the instruments and auxiliary apparatus required for making various tests. Methods are then given for taking measurements of resistances, temperatures, insulations and speeds. The author next describes the various experiments for obtaining the no-load characteristics of the several types of direct current machinery. A chapter is devoted to magnetic measurements, and the different methods of obtaining the efficiency of machinery and the separation of the losses in machines are carefully described. This book closes with the report of the committee of standardization of the American Institute of Electrical Engineers, an appendix consisting of a few pages of general instructions regarding the care and maintenance of electric machines, and a set of log sheets suitable for use in testing direct current machinery.

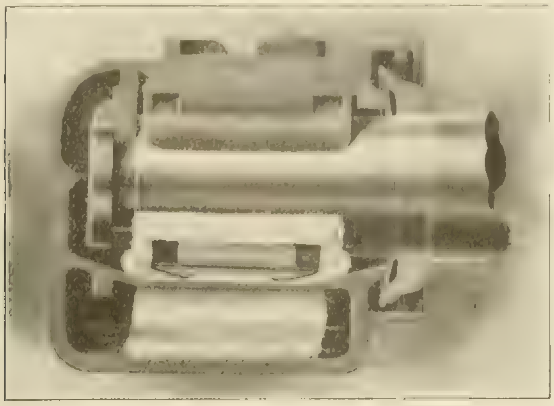
NOTES ON MECHANICAL DRAWING INTRODUCTORY TO MACHINE DESIGN, second edition, by P. M. Chamberlain, M. E., professor of mechanical engineering in Lewis Institute. Sold by A. C. McClurg Co., Chicago. 68 pages; 96 illustrations; price, 75 cents net. The first edition of this book was published three years ago and has enjoyed a good sale. In revising for the second edition, which is now offered, many additions have been made which make this book more nearly meet the requirements of students in drawing in the earlier years of an engineering course. The treatment of the subject is commenced with a description of the instruments used in the drawing room and instructions regarding the best general methods of attacking a drawing board problem in design. The next subjects treated in their order are lettering, screw thread construction and some easy drawing board methods for plotting the outlines of conic sections. The new matter which has been added to the first edition begins with a very thorough and much needed discussion and explanation of first angle and third angle projections, which naturally leads into the subject of the intersection of solids by planes. Some of the elementary problems of descriptive geometry are given here. Next are described handy drawing board methods for laying out the more commonly used types of toothed gears and a general description of the elements of designing bevel gears. Following this is a set of well selected tables giving handy mathematical data and machine design standards. The book concludes with a number of well selected problems in drawing, design and a list of exercises in conic sections.

While this work does not go into an elaborate detail of each subject treated, the reader will find that the problems and exercises are exceptionally well selected and that all the elementary questions are sufficiently well treated for ordinary use in a drawing room.

STONE & WEBSTER ELECTRIC RAILWAY AND LIGHTING PROPERTIES, 1905, giving information about the properties under this management. Besides a brief description of these various properties, the publication, which is issued regularly by the firm, includes summaries of the capitalization and earnings, and particulars regarding the securities, maps of the electric railway lines, list of coupons and dividends due, and suggestions for guidance in transferring stock.

The Armstrong Journal Oiler.

The ordinary method of packing a journal box [illegible] in comparison with the oiling systems on the usual types of stationary machinery, notwithstanding the fact that the railway journal must submit to more severe service, although perhaps at not as high speeds as the stationary journal. The journal oiler question, from these causes, has been one of the most inviting fields for the exercise of inventive ability. These attempts have been warranted by the imperative need of some really satisfactory oiling device. The Armstrong Oiler Co., Philadelphia, Pa., is now placing on the market the very satisfactory Armstrong journal oiler, which reports of service test show is able to withstand the severe conditions.



BRILL JOURNAL BOX WITH OILER IN POSITION.

The design and use of this device are clearly shown in the accompanying illustrations. The oiler consists essentially of an elastic metal frame-work which adapts itself to the general outlines of the journal-box and the under side of the journal, the metal being held at a set distance from the journal by a number of buttons which rest against the surface of the revolving axle. This metal framework, with the exception of the buttons, is covered with a specially woven pad of cotton and wool fiber, which is intended to lightly rub the under surface of the journal, thus at all times keeping it evenly oiled. From the lower part of this pad hangs a large bunch of the wicking material, so arranged that its lower portion is well immersed in the oil, and by capillary attraction enough oil climbs to the journal to keep the steel well covered. Due to the spacing of the buttons the loosely woven pad cannot be pressed tightly against the journal, which fact relieves this oiler from one of the most severe criticisms of journal oilers, namely, that the packing material when tightly pressed against the steel becomes incrusted with a metallic covering, which if not removed will tend to cut the metal. It is thus seen that the buttons in this device are of much importance, since the usefulness of the oiler depends on them, but their life is said to be longer than that of the truck. The Armstrong journal oiler [illegible] hot water whenever the truck is being repaired.

ARMSTRONG JOURNAL OILER.

New York Central Storage Battery Installation.

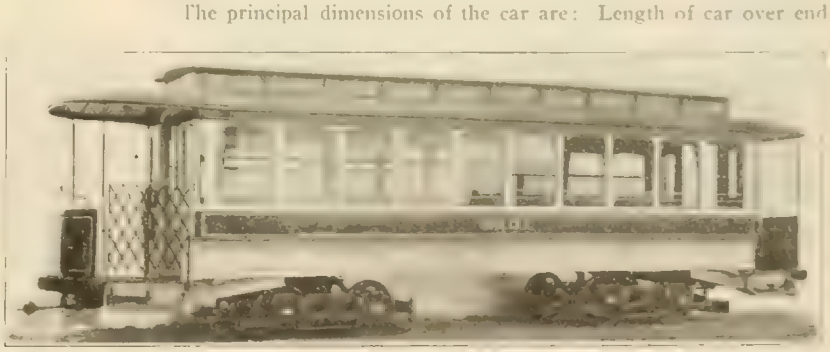
The New York Central & Hudson River Railroad Co. has awarded a contract for the equipping of several power houses with electric storage batteries to be used for operating trains into and out of New York City. The company will place power houses at intervals [illegible] used as the motive power between New York and Peekskill. Contracts were signed with the Electric Storage Battery Co., of Philadelphia, for the installation of eight batteries on the line of the New York Central and its branch, the Harlem railroad, between [illegible] White [illegible] gate capacity of the batteries is 40,000 kw. h.

Semi-Convertible Cars for Philadelphia.

Eighty-one cars of the builders' patented semi-convertible type are being completed by the J. G. Brill Co. for the Philadelphia Rapid Transit Co. An improvement in the window system which has been thoroughly tested will be introduced in these cars. The new arrangement will do away with the metal runways and the sash trunnions heretofore used, and a casual observer will see a pair of sashes sliding seemingly upon nothing. A close examination, however, reveals two guides, close under the roof, secured at the lower end to the letterboard and at the upper end to the ventilator rail. These guides are of flat steel about ¾ in. wide and spaced about 14 in. apart. Two small slotted castings with roller bearings on either side of the slots are attached to the top of the upper sash and slide upon the guides. The lower sash is attached to the upper one by a sliding connection consisting of a tongue on either side of the upper sash, which moves in a groove on either side of the lower sash. A lock, which is automatically released when the top of the lower sash reaches the height of the top of the upper sash, holds the upper sash in its lower position. Metal pieces with inclined faces at the lower corners of the frame bear against other inclined metal pieces upon the posts when the upper sash is drawn down, thus wedging the upper sash against the lower, making a weatherproof connection.

The cars are mounted on Brill No. 27-G trucks for fast and heavy city and suburban service. This type of truck is in standard use in Philadelphia. The cars are neatly finished in ash and have ceilings of decorated birch. Among the Brill patented specialties with which the cars are equipped are radial drawbars, "Dedenda" gongs, "Retriever" bells, angle iron bumpers, ratchet brake handles and folding gates.

The principal dimensions of the car are: Length of car over end panels, 28 ft.; length over crown pieces, 37 ft.; length of platforms, 4 ft. 6 in.; width over sills, 7 ft. 8½ in.; width over posts at belt, 8 ft. 3 in.; sweep of posts, 3¼ in.; height of car from rail over trolley board 11 ft. 6 in.; between centers of posts, 2 ft. 8 in.; size of side sills, 4¾ x 7¾ in.; end sills, 4¾ x 5⅞ in.; sill plates, 12 x ⅜ in.; thickness of corner posts, 3⅝ in.; and side posts, 3¼ in.



[illegible]

The Philadelphia Rapid Transit Co. has 544 miles of track. The number of cars operated is about 3,600. Cars and trucks of Brill manufacture are standard.

The Schoen Steel Wheel.

[illegible]

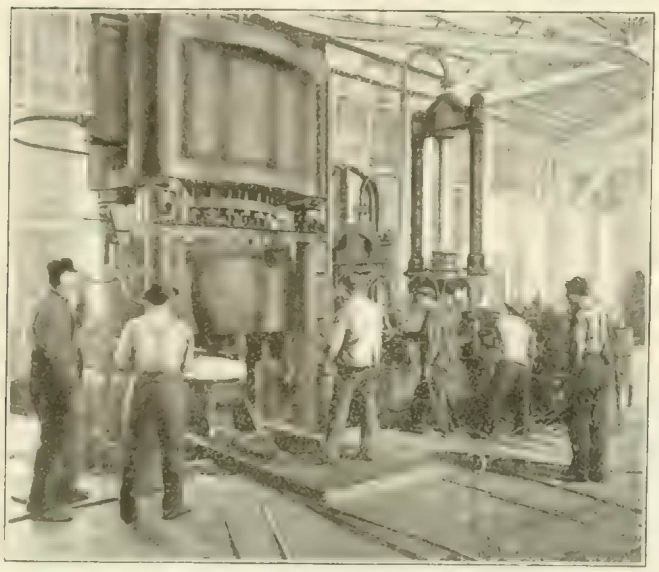
During [illegible] years there have been in progress attempts by various manufacturers to produce a steel wheel that should possess all of the desirable properties of the steel-tired wheel, and yet have that one great advantage of the cast iron wheel in being composed of a single piece of metal. The most of these attempts have been based upon the use of a steel casting, the manipulation of the rim of which, either by rolling, stretching or compressing, was to bring the metal into a physical condition that would make the tread suitable for wear upon the rails, and obtain a mileage per unit thickness of metal lost corresponding to the results obtained with the steel tires used.

Among the workers in this direction has been Mr. Charlés T. Schoen, who, after some experiments with castings, came to the conclusion that they were not well adapted for use in wheels, and turned to a metal made direct from the ingot and which had been so manipulated that the preliminary work needed for the formation of the wheel had been done.

For this purpose the starting point of the formation of the wheel proper is a slab, taken from the slabbing mill of the steel works, and which was rolled direct from the ingot after a suitable amount has been cut from the upper end to remove the piping and segregation. The chemical composition of the slab is, of course, taken care of in the original making of the steel.

It is, of course, evident that in order to form a car wheel out of a rectangular slab by a rolling and forging process, heavy and special machinery will have to be employed. The machinery that is used for this purpose consists of very powerful, vertical hydraulic forging presses and a rolling machine that has been designed and built for the formation and working up of the rim with its tread and flange.

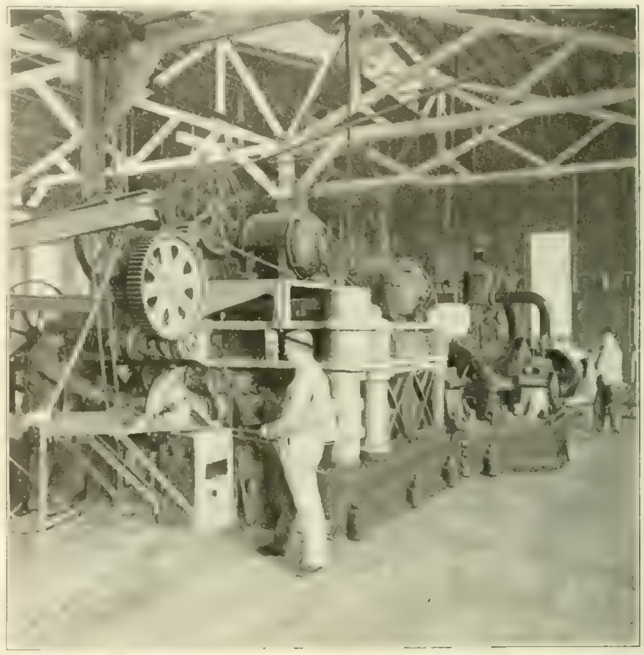
The progress of the work on the wheel is from the center to circumference. The first step then is the formation of the hub and bore. The blank is first heated in an ordinary furnace and placed



PRESSING THE BLANK.

beneath the dies and punch of the press. A single movement forms the hub, cuts the hole for the bore and forces the metal down around the outside of the hub until it is the proper thickness for the web. It is still square, but slightly larger than the original dimensions. To roll this square block into a circular form would evidently require an amount of work incompatible with the making of a wheel that could compete in price with others, so the round form is obtained by cutting with a punch under a press. In this way the circular, partially formed blank is obtained by the simple movement of the plunger of the forging press, which cuts off and rounds the corners. After this the blank is reheated and taken to the rolling mill.

This mill consists of five rolls driven by a double engine with cylinders 22 in. in diameter and a piston stroke of 36 in. and capable of developing about 600 h. p. under working conditions. The five rolls that are used are so arranged as to bear upon all sides of the rim being formed. One comes with a direct thrust against the tread and flange and serves to form these surfaces. Two rolls are pressed



ROLLING THE WHEEL.

upon either side of the rim at the front and back, serving to limit it to the proper width and form the curves at those points. The other two come up against the inside of the rim and the web, reducing the latter to the proper thickness from the point, where it was left by the punch of the forging press, to the root of the large fillet by which it flares out to the sides of the rim, and when this work is completed the blank has assumed the form of a wheel.

This whole rolling process is strictly analogous to that which takes place in the rolling of an ordinary tire. In the latter a blank of a comparatively small diameter is used. A hole is punched through the center, and after this hole has been somewhat enlarged by hammering on the horn of an anvil it is taken to the rolling mill, where it is rolled out into its final form, the metal being drawn and the diameter increased as the thickness is worked down. So here the rolling draws the metal and increases the diameter of the forming wheel. The amount of this increase in diameter is about 5 in., the blank for a 33-in. wheel as it leaves the forging press being about 28 in.

After leaving the rolling mill, and while it is still hot, the wheel is taken to another hydraulic press and dished into its final form. This last makes it possible to relieve the internal stresses that would otherwise exist, besides putting the hub in the position for use.

In a wheel made in this manner the first question that naturally arises is whether the metal has been worked sufficiently to give it the physical properties needed to meet the requirements of the service to which it will be put. The steel tires regarded as a standard upon American railways possess the two qualities of hardness and a high tensile strength. In order then to perform the same service as the standard tire these qualities should be at least equaled. The fear has been expressed regarding the Schoen wheel that it would be impossible to put a sufficient amount of work upon the rim to secure such a density beneath the center of the tread that durability would be insured. Test specimens taken from three points in the rim of a Schoen wheel show the tensile strength to be from 126,000 lb. to 134,000 lb. per sq. in. of section, with an average of 130,280 lb., while in the case of test specimens taken from five different makes of tires that are rendering satisfactory service on locomotives and cars, the range was from 105,800 lb. to 131,300 lb. per sq. in. of section, with an average of 124,230 lb.

In the matter of hardness the only system of testing for this quality that has been standardized is the one devised by Col. J. T. Rodman, and which has been adopted by the French government.

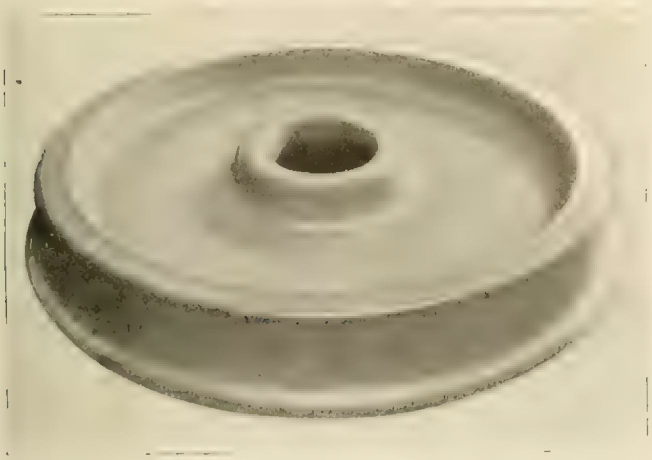
It is based upon the principle of the use of a drop falling upon a punch of a peculiar shape and measuring the amount of metal displaced by indentation in the metal tested. When subjected to this test, and a comparison made with a steel tire of a first-class brand that had been worn out in locomotive service, the metal of the Schoen wheel proved to be nearly 17 per cent the harder.

The following analyses are those of a Schoen wheel and of the first-class market brand taken from a locomotive.

	Schoen. Per cent.	Locomotive Tire. Per cent.
Carbon	72	62
Phosphorus	019	051
Sulphur	028	03
Manganese	82	91
Silicon	187	234

In this the higher carbon and manganese content would account for the greater hardness of the Schoen wheel. Especial attention should be directed to the lower percentage of phosphorus, sulphur and silicon, which add to the value of the metal.

Up to the present time, the electric railroads engaged in a purely city service have not considered that a steel wheel would be the best for their work. The constantly repeated application of the brakes



THE FINISHED WHEEL.

has so great an influence upon the wear of wheels in this service that it has come to be regarded as the controlling factor, and hard chilled cast iron has been thought to be the metal best adapted to resist this peculiar wear.

For one reason or another a few steel wheels have been introduced for special services. The results have been more than satisfactory, and in some cases something of a surprise. One manager, who has had them in use in a combined city and suburban service, was troubled with worn flanges on account of trucks being out of line, but found upon turning off the wheels that, at the rate they were wearing, they should make from 150,000 to 200,000 miles before they were worn out. In another case a steel-tired wheel made more than 100,000 miles before it was worn half way to the possible limit. Finally a heavy traffic city road has equipped two of its lines with steel-tired wheels, and though these have now been in constant service for nearly nine months, in all of that time not a single car has been laid off or sent to the shop on account of wheels. A careful investigation of these wheels shows that they are wearing at the rate of 1-16 in. per 5,000 miles. If we take the possible wearing away of 1¾ in. of metal, at this rate the total life of a Schoen wheel may be estimated at 140,000 miles. There is no apparent reason why this should not hold, since the physical properties of the metal well down in the rim are apparently the same as they are close to the surface.

If such a life be granted, or even if 10 per cent be deducted for accidents, the margin over and above that obtained with a cast iron wheel is sufficient to warrant a serious consideration of the steel wheel. In the case of the cast iron wheel it is a fortunate road that averages more than 30,000 miles per wheel. With a steel wheel costing but three times as much, a mileage of 90,000 would seem to be enough to justify its use. But when at least 125,000 miles may be expected [illegible] annoyances due to defective wheels is almost positively insured, there is still more reason for the use of the steel wheel.

[illegible]

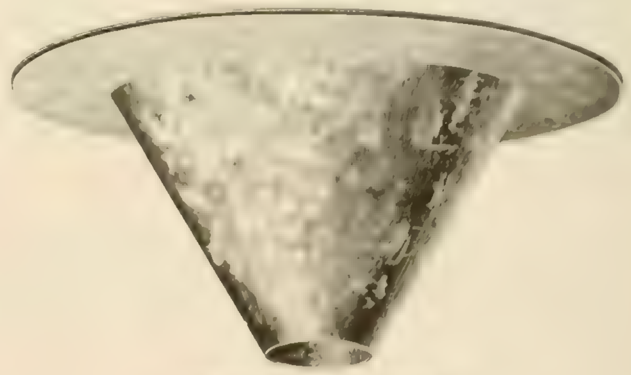
Lower cost per thousand miles of service.

Greater [illegible] wheel defects.

Greater safety of operation under heavy cars at high speeds.

A Safe Canopy Insulator.

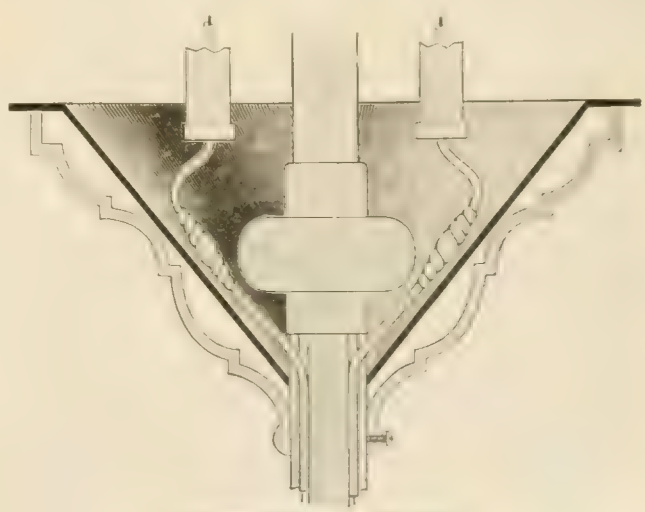
The points where service leads are brought through a ceiling and [illegible] quently the location of short circuits and ceiling fires. Trouble is often occasioned by the ornamental brass canopy, which is used to cover the porcelain tubes and splices at the ceiling, becoming loose on the piping of the fixture and the continual jar or vibration of



MICANITE CANOPY INSULATOR.

the fixture wearing away the insulation on the leads, which finally become grounded or short circuited.

The accompany cuts clearly illustrate a satisfactory remedy for such trouble. This device is called the "Young" micanite canopy insulator, and is manufactured by the Mica Insulator Co., New York and Chicago. The insulator is made from several large laminations of mica, molded into the form of a truncated cone with a flange at the wide end. In assembling the fixture the canopy insulator is fitted inside the ornamental brass canopy, so that when the fixture leads have been spliced to the feed wires this cone of insulating material can be pushed tightly against the ceiling and secured there, thus separating the wires from the brass canopy by



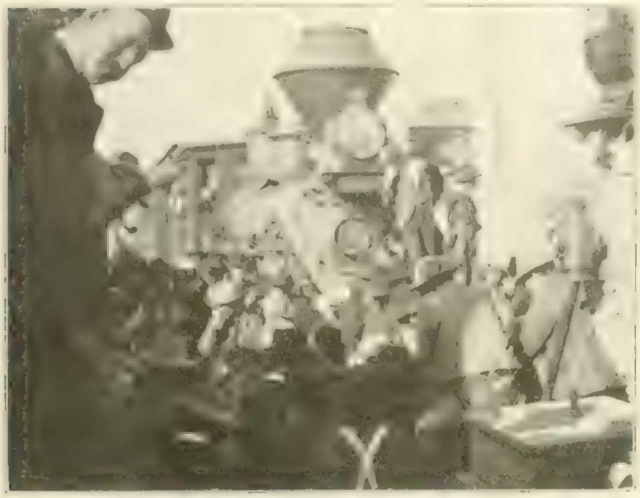
CANOPY INSULATOR IN [illegible]

a layer of fireproof insulating material. The presence of the flange of the cone between the ornamental canopy and the ceiling is a feature which will be much appreciated, and is of a special worth when fixtures are hung from sheet-metal ceilings.

This canopy insulator has received the approval of the National Board of Fire Underwriters.

An Exciting Crossing Fight in California.

Santa Rosa, Cal., was the scene of an exciting fight between the Petaluma & Santa Rosa Railway Co. and the California North-



LOCOMOTIVES AND WORKMEN AT THE CROSSING.

western Ry., March 1st, over the Sebastopol Ave. crossing. An injunction which had been secured by the steam road (the California Northwestern Ry.) was dissolved, and the electric railway people sought to put in their rails to cross the line. The steam railroad had two large engines on the scene, together with several cars of gravel. When the workmen for the electric railway began to dig under the tracks of the steam road, the workmen on the gravel cars filled the holes with gravel, and a fight ensued. When the locomotives began to move up close to the gap where the workmen were engaged, one of the electric railway men threw himself upon the track in front of the locomotives. Men of the steam road tried to lift him from the rails, and men of his own company tried to prevent this action, while steam was turned on the men from the locomotives. Each time a section of rail was taken out by the electric company the steam road would throw a flat car off the track and obstruct the road by ditching the cars. In the meantime the officers of the Petaluma & Santa Rosa Railway Co. secured an injunction against the steam road, after which the locomotives and cars were removed, and the crossing put in. During the progress of the fight several wagons filled with sand were driven on the tracks by the electric company and in turn were reduced to splinters by the steam road.

SEBASTOPOL AVE. CROSSING.

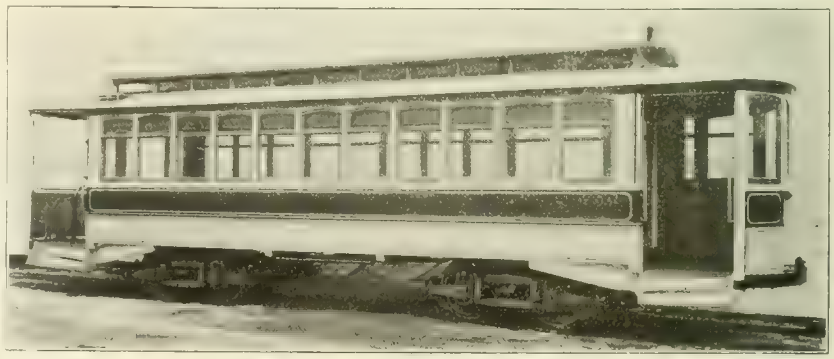
Mr. E. E. Downs is general manager of the Petaluma & Santa Rosa Railway Co., and we are indebted to him for the information and photographs accompanying the article.

The Sturtevant Progress Club.

A growing tendency among those connected with our large corporations to organize for purposes of mutual improvement is noticeable in all lines of trade. An interesting organization has just been perfected by those connected with the B. F. Sturtevant Co., of Boston, Mass., its object being to consider questions of engineering and commercial interest, and to increase the mutual acquaintance of the members. Its character is well suggested by its title, the Progress Club. Its membership is open to all, high or low, who are in any way associated with the company. Its membership, however, is classified into seniors and juniors, the former including those who are twenty-one or over, who have had charge of the work of others, or who have been juniors in regular standing for three years.

New Cars for Detroit.

The Detroit United Ry. has added to its equipment 25 cars similar to the one shown in the accompanying illustration, which were built by the American Car Co., of St. Louis. The Detroit United Ry. has several suburban and interurban lines and operates about 1,175 cars with 385 miles of track. The new cars will be used in the city and suburbs of Detroit, and are admirably adapted to such service. They are provided with a single sliding door, of the Brownell semi-accelerator type, in the right-hand corner, which permits the use of a diagonal partition with swinging door extending from the



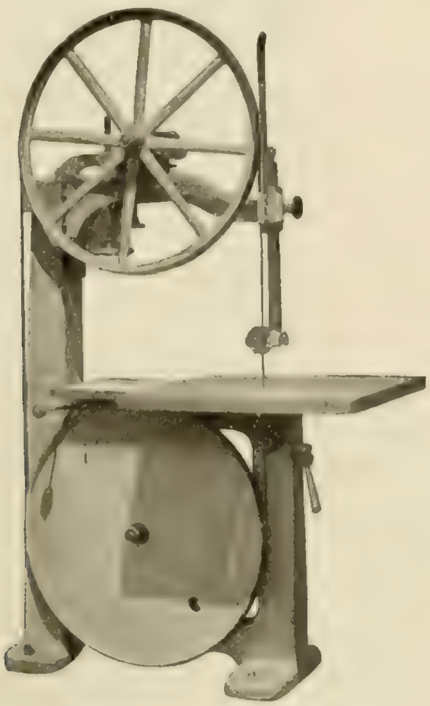
AMERICAN CAR FOR DETROIT UNITED RY.

inner door post of the car end to the vestibule corner post, thus giving the motorman a comfortable vestibule where he is not disturbed by crowds or by passengers getting on and off. The rear platform, divided by a heavy iron railing, is of the Detroit type, which not only affords extra standing space, but greatly facilitates ingress and egress. There are 12 double cross seats in the center, and longitudinal seats at the ends of the car. The seating capacity of the car is for 43 passengers, one less than the capacity if transverse seats alone were used, while having longitudinal seats at the ends provides standing space for many more passengers. The transverse seats are of spring rattan, with stationary backs, and are 33 in. long, and the aisle is 20½ in. wide. The lower sashes are arranged to drop into wall pockets, the pocket openings being closed with hinged covers, while the upper sashes are stationary. The cars are handsomely finished in quartered oak with bronze trimmings.

The general dimensions are as follows: Length over end panels at sill, 29 ft.; length over crown pieces, 41 ft. 1 in.; from panel over crown, 5 ft. at front, 6 ft. 6 in. at rear; width over sills, including panels, 8 ft. 1 in.; width over posts at belt, 8 ft. 5 in., including drip rail; sweep of posts, 1¾ in.; centers of posts, 29 23-32 in.; side sill size, 4 x 7¾ in.; end sill size, 5¼ x 6⅞ in.; sill plates, ⅜ x 12 in.; thickness of corner posts, 3¾ in.; thickness of side posts, 2¼ in.; height of steps, 15¼ in.; height of risers, 14 in. The equipment includes Detroit standard sand boxes and drawbars of the builders' make, and Brill angle iron bumpers and signal bells. The trucks are Brill No. 27-F, with 4-ft. wheel base and 33-in. wheels.

A New Band Scroll Saw.

A band saw used in car shop work is called upon to handle many different kinds and shapes of material. To do this work successfully the saw must not only be arranged for easy adjustment, but must be capable of being pushed to its extreme capacity. One of the latest designs of band scroll saw machinery is shown in the accompanying illustration. This machine, which has met with much favor, has many points of advantage gained by the long experience of its maker, the J. A. Fay & Egan Co., 250 West Front St., Cincinnati, O. The frame of this machine is made very stiff and strong, thus enabling the band to run at a high speed without vibration. The saw table is so pivoted that it can be tilted and clamped at any angle. For straining the saw a new device is used; the top wheel is sensitively balanced on knife edges, and thus maintains a uniform tension on the saw blades, and thereby increases the life of the blade. The lower wheel is made solid without spokes. This style of wheei con



NEW BAND SCROLL SAW.

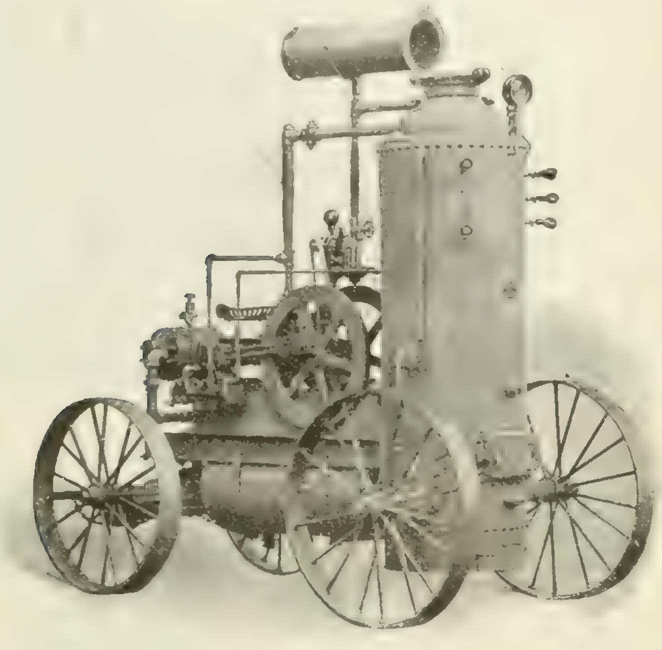
struction prevents the circulation of sawdust and, also by reason of its weight, increases the momentum, thus it being heavier than the upper wheel controls the movement of the blade and removes the possibility of over-running. The adjustments of this machine are easily made, the upper wheel can be raised or lowered while the machine is in motion. It is claimed that this machine will do the work or cutting of at least two of the ordinary type of machines, and that it is especially efficient where fine intricate scroll work in either light or heavy wood is desired.

"The 999."

The love and admiration of the average boy for the locomotive was prettily illustrated a few evenings ago. A seven-year-old had been to a Sunday school concert with his parents and listened to some of the beautiful songs that Bliss and Sankey used to sing, such as "Too Late," "Let the Lower Lights Be Burning," "It Is Well with My Soul," "Hold the Fort," "Pull for the Shore," and "The Ninety-and-Nine." The last made a deep and lasting impression. George H. Daniels, an old friend of the family, visited them the following night, and the youngster, running to him, exclaimed, "Oh, Mr. Daniels, I heard 'em sing your everlasting song last night!" "Indeed!" said the dean of passenger agents; "what was the name of it?" "The 999," replied the boy, thinking of the most advertised engine in the world, that which gave fame to the Empire State Express. Best thing Daniels has heard in ten years.—From On the Tip of the Tongue, New York Press.

Portable Boilers and Air Compressors.

There is a demand in many industries for a portable air compressing outfit which can easily be carried from one location to another and used for the operation of drills, chipping and riveting tools, sand blasting and similar purposes. The outfit illustrated herewith has been designed by the Clayton Air Compressor Works, of 114

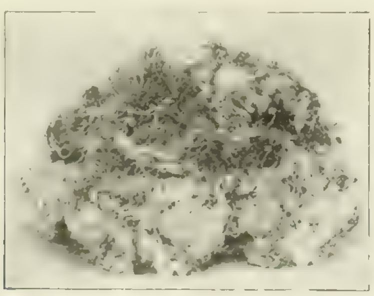


CLAYTON PORTABLE AIR COMPRESSOR.

Liberty St., New York City. It is entirely self-contained, as the boiler, compressed air receiver, air compressor, and circulating pump for cooling the air-cylinder jackets are all mounted on one truck. For riveting hammers the compressor is proportioned to deliver air at about 100 lb. pressure per sq. in., while for sand blasting and stone tools air is supplied at 70 lb. pressure. The receiver permits the storing of air, so that a much larger number of tools may be operated than otherwise, since it is only occasionally that all tools are in operation at the same time. The pressure of the air is maintained by a pressure governor, while the compressor is prohibited from running away, in case of a break on the air line, by a fly-ball speed governor, the two governors being so combined that they operate upon a common throttle valve. The compressor engine exhausts into the stack, thus increasing the draught. The air compressor cylinder walls are jacketed and are supplied with cooling water by a small duplex pump.

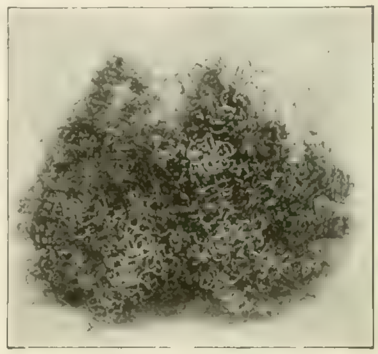
Rogers' Indestructible Packing.

Rogers' journal packing is made up of equal quantities of very fine, long, hair-like steel shavings and high grade cotton waste. These two materials are mixed by special machinery so that the



ROGERS' JOURNAL PACKING.

steel shavings cannot become separated from the cotton waste. The purpose of the steel is to furnish elasticity to the saturated waste, and thus hold it firmly against the journals without the necessity of packing the boxes as tightly as when ordinary wool or cotton waste is used. Porter & Berg, Inc., Chicago, which company was recently appointed exclusive sales agent for this material in the United States and Canada, states that this material, which at first thought to some may appear unsuitable for such purposes, will not injure the journals nor bearings nor cause any undue wear. The steel shavings act as a filter in cleansing the oil and by conducting the



STEEL SHAVINGS.

heat away from the journal keep the oil throughout the boxes limpid during cold weather. It is claimed that Rogers' journal packing will keep journals in good condition for from 15 to 24 months without repacking, which shows a great saving in labor, oil and waste, as an ordinary wool-waste packing must be renewed several times each year.

The definite claims made are savings of 50 per cent in waste, 66 per cent in oil, and 75 per cent in labor. These are not based upon theory alone, but upon tests which have been carried on by the Illinois Central R. R. for a period of seven years. The journals of one engine on this road were packed with Rogers' improved journal packing, which packing remained in use while the engine ran 210,000 miles.

Security Drill Clamp.

A drill clamp which is specially adapted for use on track work where the running of cars cannot be interrupted is made and being furnished to the trade by the F. Bissell Co., 226 to 230 Huron St., Toledo, O. The main arm of this clamp is of very heavy section and shaped to hook over the base of the rail on the opposite side

DRILL CLAMP IN POSITION.

from the drill. On the drill side a sliding claw fits snugly over the main arm and the base of the rail, thus holding the framework and the vertical arm of the clamp frame rigidly parallel to the web of the rail. In this vertical arm are two adjusting screws, one above the other, which are made to follow the drill forward. The use of two such adjusting screws has advantages which greatly facilitate work upon high girder rails and still allow no part of the clamp to interfere with continuous operation of cars.

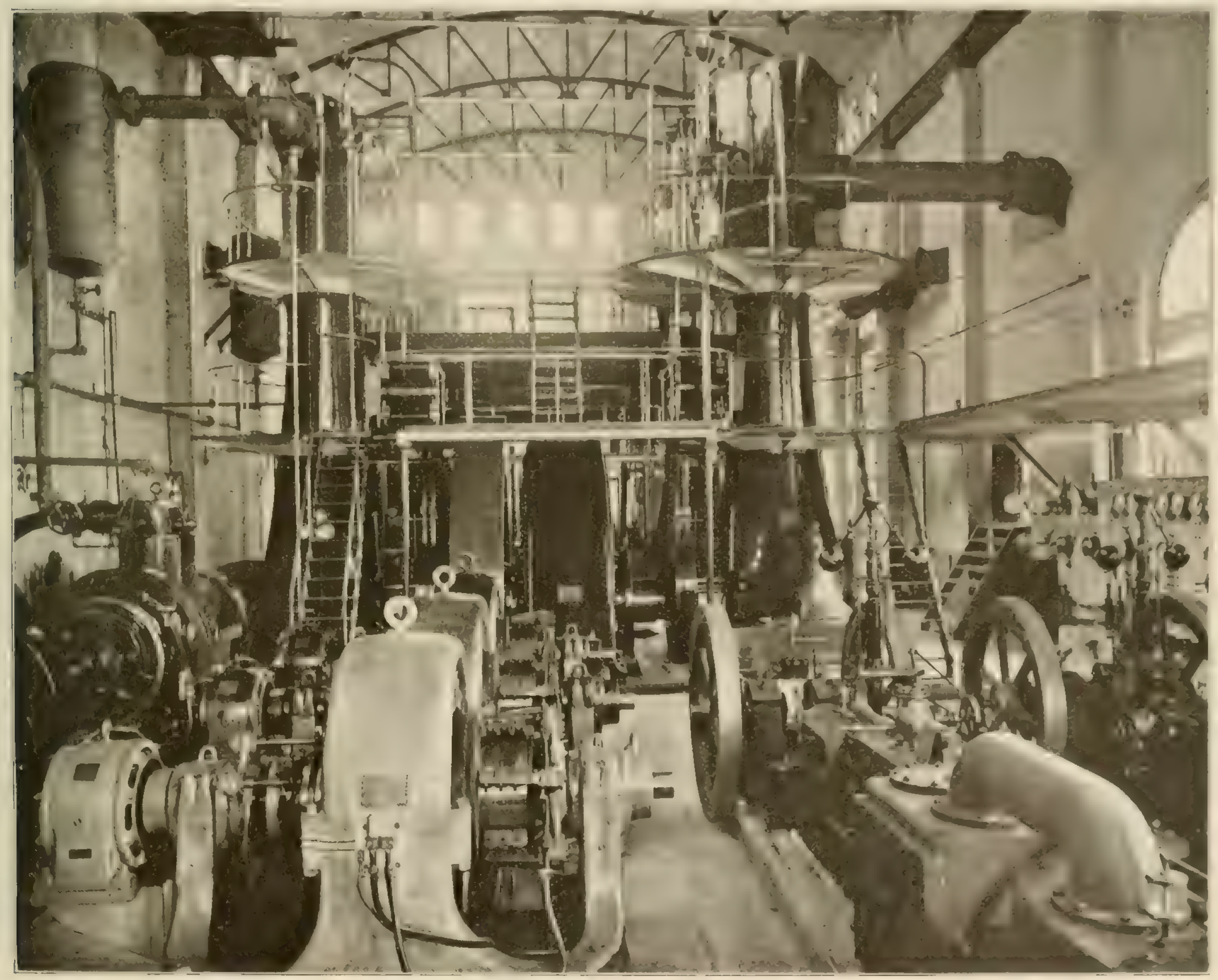
The Lake Erie & Western Railroad Co., it is stated, has decided to start work of converting a number of its lines in the state of Indiana for electrical operation, orders having been placed for the construction of electric cars.

STREET RAILWAY REVIEW

Vol. XV APRIL 15, 1905 No. 4

The West Penn Railways System.

The properties comprising the system known as the West Penn Railways are the Pittsburg, McKeesport & Connellsville Ry.; the Uniontown & Monongahela Valley Ry.; the Connellsville Suburban Street Ry., and the Greensburg & Southern Electric Street Ry. This system is an example of the effects of rehabilitation and modernization of obsolete and disconnected lines of railway. From eleven short lines, many of them with worn-out track, broken down



INTERIOR VIEW OF POWER HOUSE WEST PENN RAILWAYS SYSTEM.

equipment and poor and unreliable power service, have come forth the present modern and up-to-date lines of the West Penn Railways Co. with a total of 106 miles of track. The business interests in the country operated through are industrial almost entirely, and while farming communities are served in a few sections even this territory has been invaded by the coke operator until there are but few miles that do not enjoy a population very greatly in excess of any agricultural section. The territory served is in the three adjacent counties of Allegheny, Westmoreland and Fayette, which counties are among the [illegible] [illegible] Allegheny, which bears the distinction of being the only county in the United States having three incorporated cities within its limits, has a population of 775,058. Six of the towns within these counties aggregate [illegible] Greensburg and Uniontown. Twenty-four small towns with populations from 500 to 2,000, are also situated along the lines, but the coke and mine workers scattered through the rural district go to make up the great body of patrons. From a conservative estimate on the population living in a strip two miles in width on either side of the route, there are 360,000 inhabitants who may be counted on as patrons of the line.

Taking Uniontown, the county seat of Fayette, a wealthy little mountain city of about 16,000 inhabitants, as a starting point, the main line runs north through the coke producing towns of Lemont,

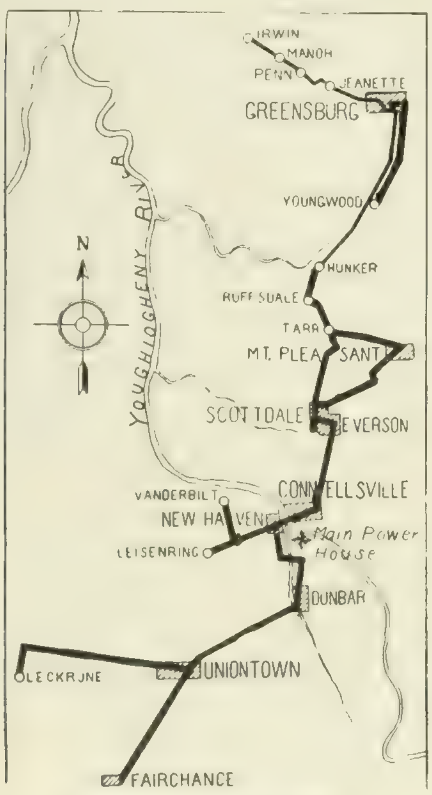
Mt. Braddock, Dunbar, New Haven, Connellsville, Mt. ... Scottdale, Alverton, Tarr and Hunker, the distance being 29 miles. This is, however, not the terminus of the line as by a traffic arrangement with the Pittsburg, McKeesport & Greensburg Ry., through cars are operated from Uniontown to Greensburg, a distance of 58 miles.

Greensburg is the county seat of Westmoreland county, and an

FOOTEDALE VIADUCT ON THE UNIONTOWN LECKRONE LINE.

important station on the main line of the Pennsylvania R. R., its population being about 12,000. Connection is made with through trains east and west and with cars on the Greensburg & Southern and Pittsburg, McKeesport & Greensburg for various points.

At Connellsville two branches leave the trunk line, one to the



MAP OF WEST PENN SYSTEM.

west known as the Vanderbilt line serving the coke towns of Trotter, Leisenring No. 1, Vanderbilt, Dickerson Run and Dawson, with a second branch from Leisenring No. 1 to Leisenring No. 3. Along this line are some of the greatest of the H. C. Frick Co's coke plants. The length of this line with branch off is 9 miles.

From Connellsville south a short line is operated to South Connellsville, a manufacturing suburb of Connellsville, where is located one of the American Tin Plate Co's. mills, also a safe works and an automobile factory. The length of this line is 2½ miles.

At Scottdale a spur about one mile in length runs to the mills of the American Sheet Steel Co., while to the right the Mt. Pleasant line runs in an easterly direction to Mt. Pleasant touching the coke towns of West Overton, McClure, Bridgeport, Hammondville and Buckeye. At Mt. Pleasant the line heads northwesterly, passing through Morewood and Raineys to Tarr, where it again meets the main line; this line is 10 miles in length.

Westward from Uniontown lies the famous "Klondyke" coal and coke region which is rapidly being developed. Through this valuable territory the West Penn Railways have a line 12.5 miles in length affording service to Continental, Revere, Footedale, Shamrock, New Salem, Buffington, Leckrone and the Masontown field. Along this line the latest and most improved coal mining and coke producing plants are in active operation.

To the southwest from Uniontown a line 7½ miles in length

YOUGHIOGHENY RIVER BRIDGE.

affords transportation to the towns of Brownfield, Hutchinson, Oliphant and Fairchance. The importance of this system is greatly in excess of many other lines having a greater mileage due to the densely populated territory through which it operates.

The McKeesport division is as yet operated separately from the coke region lines, and consists of four city lines and one suburban line with a total of 25 miles of track. The routes are known as the Versailles, Jenny Lind, Grandview, Byrn Mawr, Duquesne and Scott Haven lines. The Versailles, Jenny Lind, Grandview and

Bryn Mawr lines serve city territory while the Duquesne line affords direct service to Pittsburg and the important intermediate towns of Duquesne, Braddock and Homestead, at which points are located the great mills of the United States Steel Corporation.

The Scott Haven line runs southward, affording service to the mining towns of Boston, Buena Vista and Scott Haven.

McKeesport is a busy industrial city of 40,000 people and is the home of the great National Tube mills, an industry employing over 8,000 men at the blast furnaces, rolling mills, steel mills and pipe mills which are located along the river front. The American Sheet Steel Co., the McKeesport Tin Plate Co., the United States Tin Plate Co. and several other large plants are also located in McKeesport, making the patronage of the West Penn Railway Co.'s cars by wage earners exceptionally heavy. Cars operate on the city lines at 15-minute headway with additional service at rush hours. During the park season cars on the Versailles line are operated at as close as 2 minutes apart.

Olympia Park is a beautiful resort owned by the railway company and located on the banks of the Youghiogheny two miles from the center of the city and comprises 76 acres of woodland, the natural beauty of which has been added to by the addition of fine walks, flowers and substantial buildings of architectural beauty. The Colonial Inn, a large brick building of the Colonial style, furnishes accommodations for guests and has facilities for serving banquets for special occasions. The Olympia Theater is a commodious building with slate roof and in keeping with the substantial buildings surrounding; its seating capacity is 2,000. A figure 8 roller coaster, merry-go-round, miniature railway, pony track and various other amusements are included in the equipment of the park. A complete lighting plant furnishes arc and incandescent illumination to the grounds, the dancing pavilions, theater and other buildings. A lake furnishes boating and a base ball field affords opportunity for athletics. As many as 38,000 people have been handled on holidays without accident, showing the great capacity of the park line to handle traffic.

Rolling Stock.

The interurban rolling stock comprises 40 double truck cars with 4-motor equipments. Fifteen of the double truck cars are of the Narragansett type open car, and seating 90 persons. The closed double truck cars have a 34 ft. Stephenson body mounted on Brill No. 27-E trucks and are equipped with 4 Westinghouse No. 56 motors, K-14 controllers, double trolleys and Mosher arc headlights, 14 have Westinghouse magnetic traction brakes and 11 Christensen air brakes. The double truck open cars have similar equipment. For city service there are a number of single truck cars with two Westinghouse No. 56 motors and B-23 controllers; for the most part these are equipped with magnetic brakes. The summer cars are also equipped in the same manner, all cars using arc headlights and are equipped with oil-burning markers with red and green lenses, six flags are for signals by day. Each motorman is provided with a tool box and each conductor carries a standard railroad lantern for use in flagging railroad crossings, etc.

[illegible] line and freight [illegible] equipped [illegible] motors [illegible] devoted to [illegible] rotary plow [illegible] car for snow fighting.

The main shops are located [illegible] latest improved machinery, affording facilities for all classes of

LINE AND TRACK CONSTRUCTION ON [illegible]

repair work and also for the building of new cars several of which have been turned out the past year. The New Haven shops consist of three separate buildings which are of brick with Kinnear rolling steel doors, windows are deep and furnish plenty of light for inspection.

The shop tools include one each of the following: New Haven lathe, Schumacher & Boye lathe, 18 in. x 12 ft.; Gardner air compressor, gang radial drill with 36-in. arm., Jarecki pipe machine, Olmstead power hack saw, "Yankee" tool grinder, Schaffer 150-ton wheel press, friction drill, shaper, shears, Franklin portable hoist, Barrett motor lift, 40,000-lb. hydraulic car lift, jib crane with 15-ft. arm and air lift of 4,000 lb. capacity, natural gas heated babbitting outfit, 24-in. Buffalo fan [illegible] Westinghouse armature testing transformer, post borer, double spindle shaper, band saw, jointer, combination [illegible] machine, 48-in. grindstone.

This machinery is driven by two 20-h. p. General Electric motors.

At Uniontown, McKeesport and Iron Bridge are located barns for making light repairs and inspection purposes. All the buildings are of brick and are substantial in construction.

IN THE FOOTHILLS OF THE ALLEGHENIES

Track and Roadway.

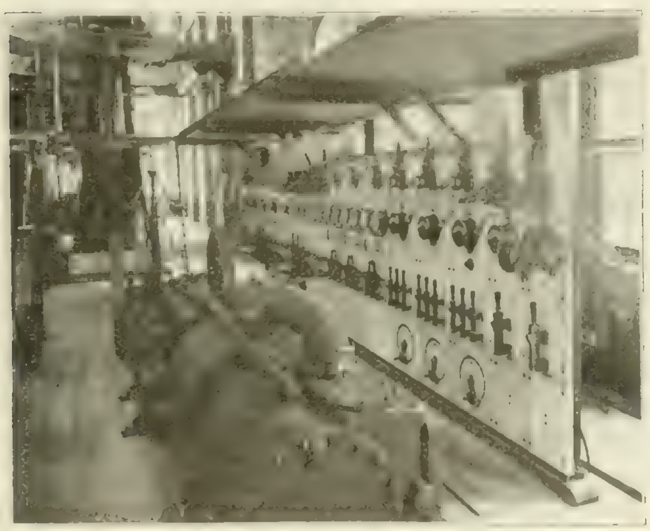
[illegible] C. E. section. The city track, some 10 miles, are laid with 7-in. [illegible] rails of standard rolled section bolted to the rail every 16 in. are used at all curves with the exception of those of very long radius. Wharton and Lorain special work with hard centers is the standard. Special work is protected from track leakage by stranded copper

MAIN POWER STATION, WEST PENN SYSTEM.

cable running underneath the track. "Crown" protected bonds are used with numerous cross bonds.

The bridges are of steel, and there is a total of 6,877 ft. of steel bridge and viaduct work on the line. These bridges are of the deck girder pattern. Trestles to the amount of 4,475 ft. span numerous small streams. Road crossings have standard railroad warning signs and crossing guards are of the inverted V type. Ties are of oak and chestnut 6 x 8 in. x 8 ft. spaced 24 in. between centers. In addition to the large amount of stone ballast used, a considerable portion of the roadbed is ballasted with furnace slag which gives a foundation of great solidity. All construction is of the best workmanship and designed to withstand the heaviest loads.

The overhead work is of double pole and span construction, No. 0000 trolley wire being used. The feeders are 800,000-cm. aluminum



[illegible]

in towns and bare copper through the country. Poles are set with a rake of about 3 ft. from trolley wire. Feeder taps are located at every tenth pole. In towns iron poles are used for the greater part. A high voltage is kept up to the farthest point on the line and feeder capacity is provided to take care of any load liable to be thrown on any part of the system.

Power Station.

The main power plant is at Gibson on the banks of the Youghiogheny, a short distance above Connellsville and approximately at the center of the system. The water obtained at this point is pure mountain water which is an important factor, as most of the sources of water supply throughout the region are so contaminated by sulphur and acids from the various coal and coke plants as to make boiler repairs a very considerable item of expeuse.

The power house is a substantial building 207 ft. in length by 85 ft. in width, the engine room being 46 ft. in width and the boiler room 37 ft., giving a floor area of 165,000 sq. ft. The building is of fire proof construction throughout; the foundation walls are of concrete and expanded metal, and concrete is used in roofs and flooring. The walls are of Pompeian brick.

A high tension transformer building is located about 50 ft. from the main building to which it is joined by a bridge.

The stacks are 185 ft. in height with an inside diameter of 10 ft., and were built by the Custodis company.

The boiler room contains 12 Geary water tube boilers of 400 h. p. each, the drums being 36 in. with 250 3½-in. tubes per boiler. Steam pressure is carried at 170 lb. The boiler feed pumps are 12 x 7½ x 10 in. of the Worthington outside packed duplex type, and normally take the feed from the condenser hot wells of the railway engines; a duplicate connection is provided for the general supply line to a duplex pump in basement pumping from the intake well to an elevated tank back of the boiler room. This pump is kept floating on the line being automatically controlled by a pressure regulator. The pumps discharge into a 2,000-h. p. "National" closed heater and thence into a 5-in. feed line running parallel with the boiler fronts. The heater is supplied with steam from the exciter engines and other auxiliary apparatus.

The coal conveying system consists of a pan conveyor taking the coal directly from hopper bottom railroad cars to a motor-driven crusher, from which it is elevated to storage bins over the boiler room; these bins have a capacity of 1,000 tons. The conveyor system is of the Altman type and was installed by the Interstate Engineering Co. It has an hourly capacity of 60 tons. The firing is by hand, coal is dropped in front of the furnaces from the bins by means of supply pipes. Ashes are taken care of by an ash-wash which consists of a concrete lined gutter through which running water carries the ashes, without handling, to the river. The engine room is spanned by a 3-motor Cleveland girder crane of 30 tons capacity.

In the engine room are three vertical cross compound condensing,

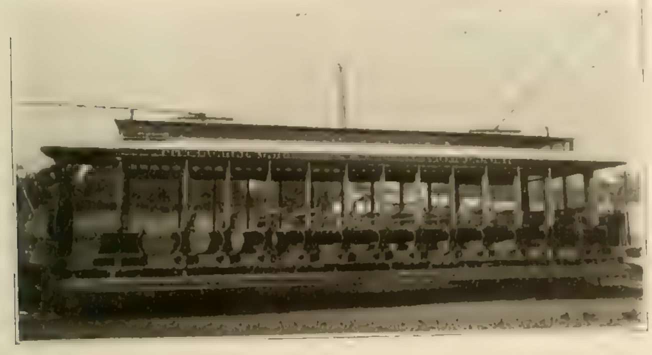
BOILER ROOM, MAIN STATION.

Allis-Chalmers heavy duty, railway type engines. These engines have cylinders 28 and 56 by 48 in. and make 94 r.p.m., developing 2,000 h. p. each, and are direct connected to Westinghouse 1,000-kw. 3-phase alternators giving 1,484 amperes per terminal at 390 volts. The exciter units consist of two Westinghouse "Kodak" sets with cylinders 11 and 19 by 11 in. ,each set having a capacity of 65 kw.

at 125 volts. Four 250-kw. rotary converters are located in the power station supplying direct current for the trolley line operating in the vicinity of the station, the pressure carried being 600 volts. A complete oiling system operated by compressed air with the usual filtration tanks is provided for the lubrication of the engines. A power driven waste separator renovates the waste used in wiping, cleaning it for re-use.

The switchboard is of blue Vermont marble fitted with Westinghouse type F instruments.

The lighting load which comprises a very important part of the station load is handled by three Parson's steam turbines direct con-



STANDARD SUMMER CAR.

nected to Westinghouse 1,000-kw., 2-phase alternators with a frequency of 60 cycles, and e.m.f. of 2,200 volts at 1,200 r.p.m. Three Alberger surface condensers with 2,000 sq. ft. of condensing surface each are installed in connection with the turbines. The circulating pumps for this work are driven by De Laval steam turbines of 30 h.p., and each pump has a capacity of 3,000 gallons per minute. The condensing system also includes a Worthington elevated jet condenser for the three engines. The vacuum pumps, of which there are three, consist of two Alberger-Corliss two-stage pumps and one Worthington dry air pump. A Worthington duplex, compound, direct-acting, steam circulating pump of four million gallons capacity per 24 hours circulates water for condensation purposes.

All condensation in the steam mains and separators is returned by the Holly system.

In the transformer room are located two banks of three 500-kw., 25-cycle, oil-insulated, self-cooling transformers which are delta connected. Of the 60-cycle lighting transformers there are two banks of two 750-kw. oil-insulated, water-cooled transformers Scott connected, with one transformer in reserve. High tension switchboards are fitted with static interrupters on each transformer and Westinghouse non-arcing lightning arresters. The potential of the transmission line is 22,000 volts.

Transmission Lines.

The current is transmitted on pole lines built on private right of way, the transmission being at 22,000 volts. The pole lines were located with a view of avoiding the coke ovens as far as possible, as the smoke deposit and fumes from the ovens have a deteriorating effect on the wires. The main power station furnishes lighting current as well as railway current and both the 25 and the 60-cycle lines are carried on one pole line. These are arranged in two equilateral triangles, one on each side of the pole with base uppermost, giving 36 in. between centers. The conductors are of stranded aluminum equivalent to No. 00 copper, and of Nos. 0, 1, 2 and 4 bare copper, the sizes varying as the load. The line insulators are No. 0 "Provo" type with 8-in. and 4-in. petticoats and support wires 6 in. above the lower rim and 12 in. above the cross arm. Cross arms are 4 x 6 in. yellow pine dipped in asphalt, bolted through the pole, wooden braces being used on account of their insulating properties. The poles are chestnut with 8-in. tops, and are spaced 100 ft. apart. On account of the mountainous region through which the pole line passes various lengths, from 35 to 60 ft., are required. The number of miles of pole line connecting the different sub-stations is 45, and owing to the rugged county traversed, the most substantial and rigid construction was necessary; this territory is frequently visited by severe storms.

Sub-stations.

There are eight sub-stations [illegible] rotary converters [illegible] [illegible] of one bank of three [illegible] connected transformers [illegible] handled by [illegible] with one reserve transformer. The six railway stations have rotary converters of the same capacity [illegible] In addition to the rotary converters [illegible] storage batteries [illegible] Westinghouse boosters.

Signal System.

The operation of cars is controlled by a manually operating block signal system consisting of [illegible] side of the track. Between each switch are located five target lights, the two end ones being at the extremes of the block protected, and the other three being distributed at curves or other important points. Movement of cars is governed by the lights on the right hand side, a light appearing on the opposing side indicating a car within the block in the opposing direction. Owing to the headway, which over a considerable portion [illegible] part of them is 15 minutes, the telephone system of dispatching alone, hardly seemed sufficient and good results have been obtained from the use of the block system. The crews are provided with time table and instructions in the operation of signals are such that little delay occurs.

In connection with the signal system there is maintained a complete telephone system one circuit of which follows the railway, having iron box telephones installed at each switch and wall sets at the car houses, dispatcher's and superintendents' offices. Another line follows the high tension system connecting stations and main power house; intercommunication between the two lines is obtained at several points and connection is also available between these lines and the trunk lines of the Tri-State Telephone Co. This makes the system very flexible and a loss of means of communication almost impossible.

Operation.

The severe physical conditions, due to the fact that the territory served lies for the greater part among the foothills of the Allegheny Mountains, calls for careful operation and a strict observance of

[illegible]

regulations on the part of employes. Grades running as high as 12 per cent are to be found at some points on the line but are operated over daily without trouble or delay.

A train register is kept at division points and shows the arrival and departure of all cars, color of signals carried, names of crew and condition of track. From these registers [illegible] every 15 days showing [illegible]

report for 1909 showed the remarkably high schedule observance of 97.1 per cent of cars on time. The power interruption report showing current on the line 99.8 per cent of scheduled time.

For operating purposes the lines are divided into the Connellsville, Uniontown, Mt. Pleasant, Greensburg and McKeesport divisions; these are again subdivided into routes numbering from 50 to 67 inclusive.

Fares are based on 1½ cents per mile with no form of round trip or reduced rate tickets on sale with exception of two points where a city ticket is sold.

Considerable revenue is obtained from special car service, this item alone amounting to several thousand dollars per year. Funerals form a considerable part of the special car traffic.

At Uniontown, Connellsville, Scottdale, Greensburg and McKeesport commodious stations are maintained, while 24 small waiting stations erected at various points along the lines provide shelter for patrons. An up-to-date time card modeled along steam railroad lines showing time of cars at all stations is widely distributed, and hotels and stores are provided with large wall time tables.

Municipal Ownership a Burden on Taxpayers.

(London Correspondence to Chicago Evening Post.)

During the flowing tide of so-called "municipal enterprise" in Great Britain controversy was naturally limited to an academic struggle between opposing theories, and all the popular "talking points," the promises and visions of better times for the community were on the side of the advanced party, whose opponents could do no more than reason, and could not rhapsodize with mere cold economic eternal verities for their material.

As in other political contests truth may prevail in the end, but glittering fiction often gets a long start, and in the case of municipal policy it was, of course, not possible to give positive contradiction to the claims of the speculators, because no actual data were available. A little later it became even more difficult for the cool-headed minority to check the extravagances of the active spirits, who were in many cases very much incited by considerations of either direct personal gain or increased political importance, because in the first year or two of municipal electric and traction undertakings, with new plant and growing business, everything looked rosy, and there were still no signs of the coming trouble. It is easy to show progress when you start from zero, and in the numerous towns in which horse cars were superseded by municipally owned electric cars there was naturally an improvement in public traffic, which was thoughtlessly credited entirely to the municipality and not to the electricity.

Faults of the System.

However, the economic faults of the municipal socialists have since that first period of glory been gradually coming home to roost, and it is the most damning evidence against the system that opposition has become stronger and more general in exact proportion to the length of time during which its results can be observed. The more experience people have of municipal ownership the less they like it. First it was the railway and other companies that complained of unfair competition supported by local taxation toward which they themselves are forced to contribute. For them, of course, there was, however, no popular sympathy. Then came the banks and the financiers and the directors of industry, who began to find that the money market was being bled into a miserably anaemic condition by the incessant raising of municipal loans for commercial speculations; so that the normal requirements for business extension could not be met and the trade of the country was crippled. After that the investors themselves became alarmed at the steady and heavy fall in municipal stocks, formerly considered "gilt-edged" securities almost equal to government bonds, but now degraded by overborrowing.

Now Feel the Pinch.

So far the working classes had not felt the pinch, and they still hoped that in the squandering of so much money they would pick up a few stray sovereigns. But now they, too, like all the rest, are beginning to be disillusioned. The municipal street railways are no cheaper or better than any others, and the employes on the London county council system held a meeting the other day at which they agreed that they would be much better off under company management. Employment on the northern lines of London, which are worked by a company, is preferred to service on the southern system worked at a heavy loss by the London County Council, the wealthiest local governing body in the world. The municipal "housing" schemes again have proved a hollow sham.

With money exceedingly "tight" for local authorities they have not been able lately to give much away, and municipal rents are actually higher than those of at least equally eligible dwellings erected by private enterprise, the difference being simply due to the fact that these local bodies cannot build on sound commercial lines. Their workmen "go easy" and their officials have no incentive to make haste or save money.

Strike in Belfast.

In Belfast there is a strike at the present time by the men employed in reconstructing the municipal street railways, and the lord mayor keeps making higher bids to them every few days, like an auctioneer. They know they can get what they want, and they simply smile at that dignified personage.

The workman is at last beginning to understand something about local taxation. In most of the poorer quarters the landlord pays the taxes for his whole block of property and then charges it in his rents, and consequently the tenants have never known how much of their rent represented taxation. All they knew was that their rents kept going up, and of this they did not approve. In some towns many of them took advantage of the municipal tramways to go and live outside the city at lower rents, so that they have been lost as taxpayers, and a greater strain has been put on those that remain. Rather disconcerted by this movement, which seriously threatens the stability of the town finances, it has actually been suggested among municipal councilors, as at Leeds the other day, that the cars shall cease running beyond the town boundaries, and that the terminal shall be about half a mile short of the border, so that it will be less easy for people to escape the tax collectors by living in the outer suburbs. To regular passengers of Chicago's transit system any such proposal must sound absolutely insane; but it was publicly discussed at a meeting in Leeds, and supported by the member of parliament for the borough.

Must Pay Penalty.

In other ways the workman is being taught that soonor or later he must pay the penalty of his rashness in encouraging wild-cat municipalization. In the Town of Lincoln, for example, which has a population of 48,000, there has been a municipal electric light business since 1898, which cost £225,000 to start and which has steadily being organized for which £400,000 has been borrowed. Meanwhile the councilors have been so busy with this work that they have not had time to attend to the water supply of the town, which has been known to be dangerously polluted for years past, and which has now caused a serious outbreak of typhoid. These unsalaried delegates cannot supervise so many departments, and they choose to spend their time rather on those that give them the most advertisement and enable them to put on most frills, while humdrum questions of sanitation and the like are neglected.

Another significant announcement has just been made which has a weighty bearing on this question. One of the most "enterprising" of metropolitan boroughs is Battersea, and its largest ratepayer is the South Western Ry., which has works in the district employing between 3,000 and 4,000 men. Living in this part is costly, and local taxation is very high, owing to the extravagance of the council, so that the railway company has at last decided to move these works to the small and "unenterprising" town of Eastleigh, 50 miles from Battersea, and the whole of the employes will be taken down there.

The departure of the company will, of course make the burden of the remaining taxpayers more oppressive than ever, and appearances point to a general adoption of this policy of removal on the part of factory owners, who find the strain of municipal glorification at their expense becoming quite intolerable. Again at West Ham, one of the large East London manufacturing districts, are the Great Eastern Ry. shops. Municipal extravagance and trading have sent the local rates and taxes up in West Ham to nearly 10 shillings in the pound. That is, that for every pound paid in rent, 10 shillings, or one-half additional, must be paid for local taxes. Now, what the Nile is to Egypt the Great Eastern shops are to West Ham, employing as they do over 10,000 mechanics. The burden of taxation has become so great at West Ham that the company has more than once seriously considered the advisability of removing its shops elsewhere.

Correspondence.

MILEAGE DIAGRAMS

Editor "Review":

In the "Review" for Nov. 20, 1904, page 901, I notice a mileage diagram. We have diagrams of our entire system, giving all the information shown on the one referred to and some additional. A copy of one sheet is enclosed herewith. This shows all the distances your correspondent's diagram shows, and also every curve with the length and radius. It also gives the name of the street along which the track is laid and the name of the municipality. As our system extends through ten different municipalities, we often require the latter information. In accordance with the practice here, all distances are given in chains and links, and the radii of curves in feet. We also have vertical sections to the same horizontal scale.

Yours truly,

J. S. Badger,

Brisbane, Australia. Manager Brisbane Tramways Co.

AUTONOMY OF DEPARTMENTAL ASSOCIATIONS SHOULD BE PRESERVED

Editor "Review":

I fully agree with your editorial in the February "Review" on the reorganization of the A. S. R. A. Nothing should be done which will affect the usefulness of the Accountants' and Mechanical and Electrical associations. They should be, as far as possible, maintained as more or less separate organizations with a representative on the directory or executive committee of the A. S. R. A., so as to arrange to carry out the work of the different associations to the greatest advantage. The A. S. R. A. should not undertake to dictate the amount of time to be devoted to reading and discussing papers, or any other details of the work of the departmental conventions.

It is clear to me that the great good which has been accomplished by the Accountants' and the Mechanical and Electrical associations is due to their independence of the A. S. R. A. These two associations have acted entirely upon their own responsibility, have laid out their own work and performed it admirably. The A. S. R. A has gone backward while the other two associations have gone forward. It seems to me the only association that needs to be reorganized is the A. S. R. A. and the sooner the better.

Yours truly,

G. O. Nagle.

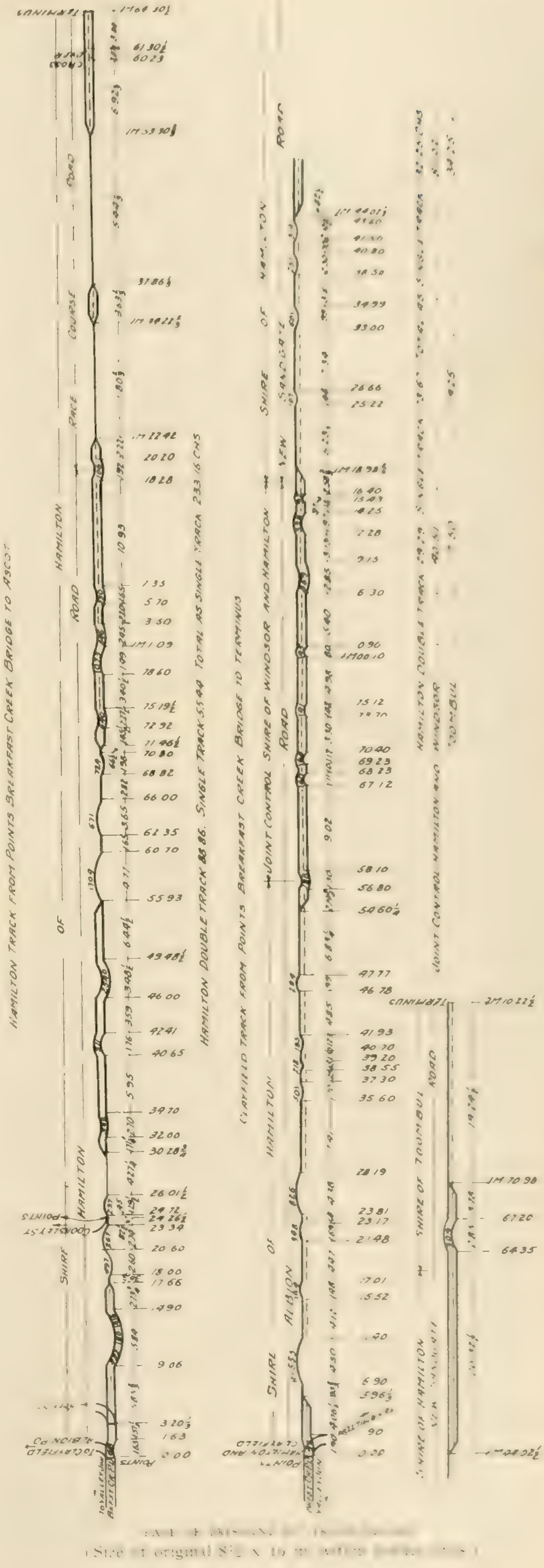
Wheeling, W. Va. Gen. Mgr. Wheeling Traction Co.

A WORD FOR THE SHOP SCRAP PILE

Editor "Review":

We read so much of new cars, new motors, new shops, new trucks, etc., that one really forgets that there is such a thing as the scrap pile that needs attention. How many master mechanics are as particular to see that nothing of serviceable value goes in the scrap pile, as they are to see that the new equipment is what it should be? If not looked after properly, the scrap pile is the most extravagant adjunct of the street railway system. Trolley wheels, motor bearings, track, wheel, and many other parts of the equipment, when worn out and unfit for further service, have depreciated but very little from their original weight or size, and we therefore wear out only a small portion of the weight of the article when new. There are many hundreds of dollars thrown away by not having a first-class man to sort the scrap, one who thoroughly understands each department. In the general repair shops we have sweepers or janitors whose duty it is to pick up the scrap, and who are told to keep the floor clean. Very seldom do they have a knowledge of what is scrap or what is fit for further use. The consequence is that in looking through the scrap pile we find material which has had very little or no wear, and means a loss to the company if not reclaimed.

On roads of considerable size, a system of collection should be adopted, whereby all scrap from the outlying barns is brought to the general repair shop, unloaded, and there inspected by a compe-



[illegible]
(Size of original 8½ x 16 [illegible])

[illegible] scrap and what to save. The scrap from the general repair shop should be placed in a pile where [illegible] and get what is good. There should be separate bins for different grades of scrap to get the best bids from the scrap metal dealers; there should be separate bins for old armature coil wire, for old field wire, for rubber insulated wire, for pure composition, for impure composition, for copper turnings, for iron turnings, for gray iron castings, for malleable iron and steel, and for miscellaneous scrap. By keeping the scrap sorted in this manner, the advance in price obtained will pay handsomely for the trouble. It is surprising the amount of material that can be reclaimed from the would-be scrap, and also the faults that can be easily rectified in equipment, and money saved by slight alterations in patterns. Many things to the one not thoroughly in touch with the shop work look to be worn out, but with a slight cost in labor or material can be made practically as serviceable as when new.

The practice of making the different pieces of the equipment so that the wearing parts only are necessary to be removed, is getting to be the general practice. We have the motor gear with removable rim, car wheel with removable tire, controller cylinder with removable segments, controller fingers with removable tips, armature bearings with removable linings, etc.

There is a wide field in the street railway shop for the master mechanic to show his ingenuity, and thereby assist in making a dividend for the company. The practice of bushing wearing parts is certainly a salvation for the maintenance of car equipment. We have bushed armature shafts, bushed brake levers, bushed trolley wheels, bushed trolley stands, etc., thereby getting extra life out of what would be scrapped material. The life of a number of parts around the equipment can be prolonged by placing shims at the proper place, as on worn brake-beams, between journal box and pedestal box and pedestal, between truck bolster and transom bars, etc.

The chill in our car wheels does not run even, and we often find an axle on which one of the wheels has worn flat; its mate has left plenty of chill to justify mating with another wheel and giving another run.

The chill of these wheels can be determined by drilling the tread of the wheel from the under side and measuring the chill with suitable gage. These wheels are a loss to such companies as do not take the trouble to investigate the chill of their old wheels, and this item is certainly worth considering.

From the scrap pile we find out the weak points of the equipment and whether things are getting the proper care. From the old shoes we notice whether the foreman is taking them off before worn out, or if worn too far we know the shoe head has been spoiled. The tales told by the old scrap are far more convincing and reliable than any written report that can be submitted. It is more the good maintenance man than the good construction man who makes a success out of the operating road, and the scrap heap is the telltale.

M. M. J.

Manganese Steel Rails on the Boston Elevated.

The rails originally laid on the Boston elevated structure were commercial Bessemer steel, and were so low in hardening ingredients that at some of the sharper curves they were completely worn out in from 40 to 50 days. It was remarked that the wear on the adjacent rails was not always equal. This led to a careful analysis of the steel in the different rails, which resulted in finding that the slow wearing rails, though intended to be of the same composition as the soft rails were higher in carbon, and therefore had more surface hardness. Some special high carbon steel rails were rolled and placed at the points of severe service. These lasted about three times as long as the ordinary commercial rails, and cost but little more. A nickel-steel rail was tried on a 100-ft. radius curve, between two hard steel rails. It was necessary to remove this rail at the end of 204 days on account of the excess of its wear over that of its neighbors; the nickel-steel rail wore down on the head .528 in., as against .18 in. for the hard steel rails, the side wearing being about the same.

At the entrance to the Park St. station in the Boston subway is a reverse curve with a radius of 82 ft. The daily traffic at this point is 44,000 tons. The commercial Bessemer rails first placed here wore out in about 44 days, the head being worn down .78 in. at that time, with but slight disfiguration in the original crown.

In order to save in trouble and excessive maintenance cost manganese steel rails, supplied by Wm. Wharton, Jr., & Co., of Philadelphia, were laid on this curve and at other critical points. The life of the two kinds of rail is widely different. After one year's wear on this same curve the manganese steel rail showed a top wear of .096 in., and at the end of 1,028 days the total top wear was only .204 in., and was uniform across the top of the head. The Bessemer rail wore .78 in. in 44 days, which would be equivalent to 18.228 in. in 1,028 days, as against the wear, .204 in., just mentioned as that of the managnese rail. The manganese rails cost about $5 per foot, in comparison with 38 cents a foot for Bessemer rails, making the relative cost of the manganese rail about one-seventh that of the other, aside from the fact that the long life of the manganese steel makes its use economical in such places as curves and special work on elevated structures, where the labor cost for renewals is high. Manganese steel is so tough a material that it cannot be rolled or machined; the rails are cast in 20-ft. lengths with bolt holes for joints cored in the web.

At the present time the Boston Elevated has in use about 475 ft. of manganese steel rails and several ordinary frogs and three sets of crossing frogs made of this material.

Right of Way Data.

The report of the 1905 committee on records, reports and accounts, submitted to the members of the American Railway Engineering and Maintenance of Way Association at its annual convention in Chicago last month, contains many interesting suggestions and instructions for those whose work is included within the scope of the subjects studied by the committee.

The subject of right of way records, including right of way maps and deeds, was considered by the 1901 committee and reported in the proceedings for that year. The present committee submitted a sample right of way map, together with appertaining data, which are illustrated herewith.

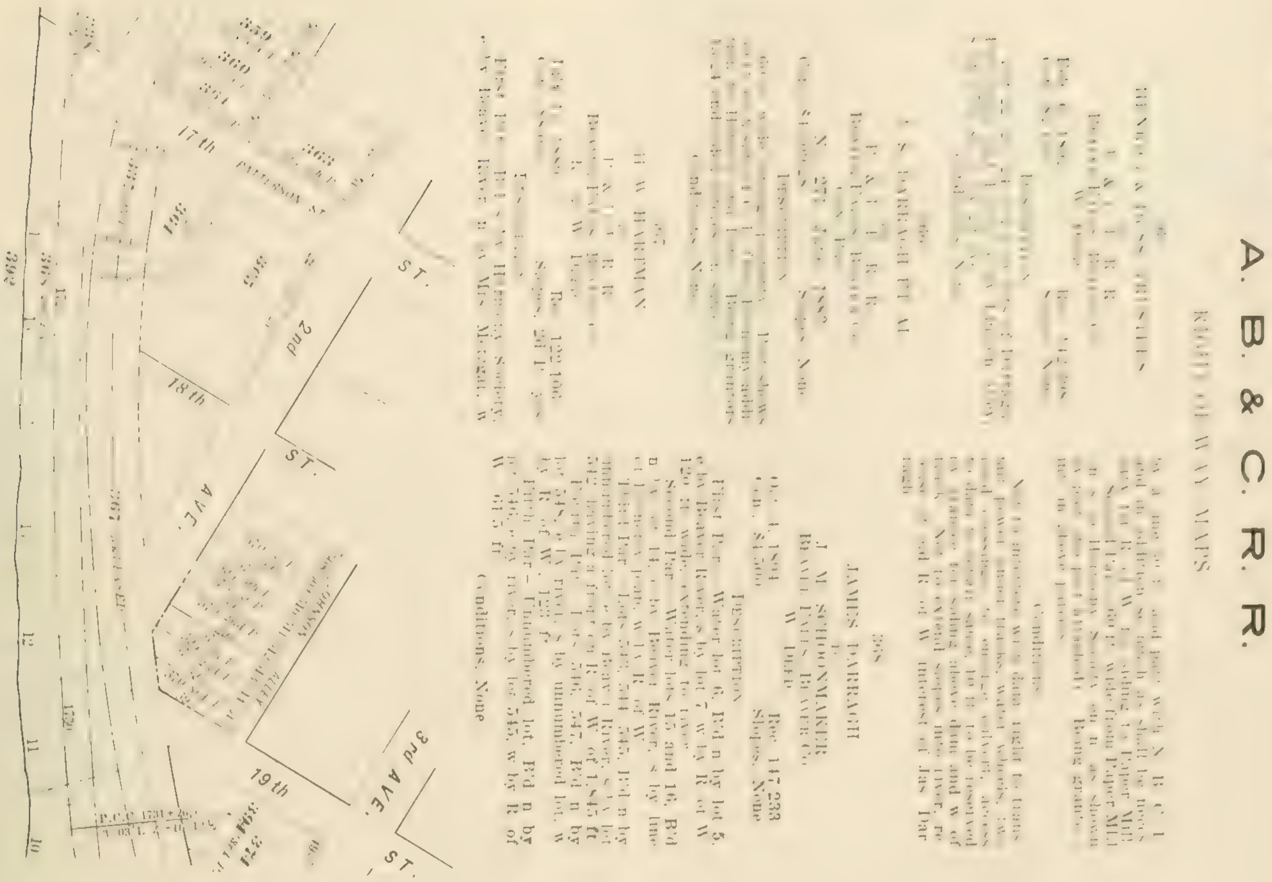
It is the opinion of the committee that right of way maps, except in cities and large towns, should generally be drawn on a scale of 400 ft. to 1 in. They should be made in separate sheets for convenient handling, the width of sheets generally not to exceed 18 in. Right of way maps of lands owned in cities or towns should be made on a scale of 100 ft. to 1 in.; the length of the sheets being generally determined by the size of the printing frame.

These right of way maps or sheets should be preserved in one of three ways:

1. They may be bound together into an atlas.
2. They may be bound loosely in board covers in such a manner that sheets may be easily removed, corrected and replaced.
3. They may be preserved as separate sheets and filled in regular order.

Right of way maps should show the state, county, township, town or city; the right of way alinement complete; the station plusses of the crossing of all important land or property lines and streets, with distances to all permanent line or street corners; the angle which the center line of the road makes with property lines; the number of the right of way sheet; the points of the compass; the scale of the map; the boundaries of the several parcels of land owned by the company; the width of the right of way, particularly at those points where the widths change; any additions or subdivisions of towns or cities with numbers of lots and blocks and names of streets. On or near each parcel of land shown on the right of way map should appear the deed custodian's number, with name of grantor, date, book and page of county recorder, and an abstract of any unusual conditions appearing in the deed.

The recommendations for the register of title deeds state that deeds are to be filed with the chief engineer, the real estate agent, or the secretary of a railroad company, according to individual practice, and that the custodian of deeds should keep a register of title deeds. The essential feature of a deed record is a direct or grantor index of the deeds in alphabetical order in a book of convenient size. Deeds should be numbered consecutively, from No. 1 up, after they are received by the railroad company, then forwarded to the proper officer to record on right of way maps, then returned by the



chief engineer to the custodian of deeds with a notation thereon that the deed has been properly entered, after which the deeds should be filed in numerical order in a fireproof vault.

The committee proposes a standard page form called "Register of Title Deeds." An illustration of this form is shown herewith.

Leases should be numbered and filed in numerical order by road, branch or division. They should be kept in a fireproof vault. The custodian of leases should keep a lease record book containing in the body of the book a full record of the lease. In the back part of the book 12 pages for the 12 months should be ruled into columns for years.

Immediately after the receipt of a lease and its being entered in the body of the book, the lease number should be entered under the year on the proper month page when it expires. The names of the lessees should be indexed alphabetically in front of the book and each lease should be indexed by the station name.

A few pages in the back of the book should be used for the purpose of keeping a record of leases removed from the files.

Form M. W. 1011.

A. B. & C. R. R.

MAIN LINE. REGISTER OF TITLE DEEDS. WAYNE COUNTY, MICHIGAN

No.	Township	City	Sub-Div'n	Sec.	Town	Range	Block	Lots	Description	Grantor	Grantee	Date of Conveyance (M. D. Y.)	Consideration	Length	Width	Area	Recorded Book	Recorded Page	Recorded Date (M. D. Y.)	Kind of Deed	[illegible]
41		Detroit					H	16-17-18	N. E. Cor. 4th and Front	Catherine H. Jones	M. C. R. R.	Apr. 16, '47.	$2,300	[illegible]	[illegible]	1.34	[illegible]	273	Sept. 14,'47	W	None.
43							H	25-26	North of Front...	J. Harbern and Wife		Mar. 5, '47	600	86.44	[illegible]	79	[illegible]	274		W	
55							K	1-2	S. W. Cor. 4th and Front	Lewis Cass and Wife		Sept. 8, '47	19,000			[illegible]		278		W	
40	Springwells							Water Lot 2-3	Bounded E'ly by Canal Bank, W. Ann Hunt, N. Woodbridge St., S. by channel	J. Mullet and Wife		Apr. 16, '47	5,200	[illegible]	[illegible]	[illegible]	[illegible]	112 113 114	[illegible]	W	
255									Triangular piece S. E. Cor. 12th and Woodbridge St.	M. C. R. R.	Fort St. Union D.	Dec. 29, '90	2,900	[illegible]	[illegible]					[illegible]	
8									Bounded W.'ly by Henry Stanton, E'ly by Peter Godfrey	Farm. & Mech. Bank, J. A. Weiss and Wife	M. C. R. R.	Jan. 21, '47	200	[illegible]	[illegible]	2.63	[illegible]	[illegible]	[illegible]	W	[illegible] crossing.
250			[illegible]					120	S. ½ of E. ¼ of E. ½ of P. C. 77	H. Warren and Wife		Apr. 3, '02	1.00			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
106	Dearborn..			29	2S	10E			W. ½ of N. E. ¼	A. Clay and Wife		June 1, '72.	75.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	W	
12	Nankin			31	2S	9E			W. ½ of S. E. ¼	C. W. Brink	St. of Mich.	Mar. 3, '41.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
70				31	2S	9E			W. ½ of S. W. ¼	Wm. Bell and Wife	M. C. R. R.	Feb. 25, '48	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	W	R. R. [illegible]
33	VanBuren			5	3S	8E			E. ½ of N. W. ¼	B. Cotton and Wife		[illegible]	[illegible]	[illegible]	100	2.92	[illegible]	[illegible]	[illegible]	W	
94	Canton			[illegible]	2S	8E			N. of and adj. R'y of Way in S. W. ¼	L. Sterling and Wife		Jan. 10, '59.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	W	R. R. [illegible]

SPECIFICATIONS: Form as shown, size of page 12x28 [illegible]
(Form shown is two-thirds reduction.)

Discipline in Europe and United States.

BY E. J. NICHOLL

In making a comparison of the systems in force in Europe and in America for the regulation of patrons and employes on the various transportation lines and conveyances generally, the first thing that strikes one is that of the discipline or obedience to the laws of the country and the rules and regulations of the institution under which the work is performed. Now I am of the opinion that quite a brief consideration of this subject will lead almost any thoughtful minded man to the conclusion that discipline or rather the want of discipline is the direct or indirect cause of a large majority of the accidents and shortcomings of transportation companies the world over. I do not say that it is responsible for all by any means, because the forces of nature play a prominent part, and the local conditions are equally accountable for much that seems to go wrong; still above and beyond these the want of proper lawfulness will be found to be the greatest cause of trouble and the constant worry of managers generally.

The keeping of the law, the fear of the law, or obedience, is somewhat of a habit and must be acquired. With some peoples it takes years and even generations, while others acquire it in shorter time. Some individuals never submit and consequently live always in a state of disobedience to the family, the institution or the state, believing that they have a divine right to do as they please, no matter what the consequences.

In Europe the great mass of the people have learned to be generally obedient. They have grown into it, as it were. Few ever dream of being anything else and those few standing out in bold relief are promptly taken care of, and made an awful example to the others.

How different are things in America. I mean the United States of America, although Canada has much of the same thing to contend with, and I believe will have more. The seed of disrespect and disobedience is often sown in the family. A child is permitted, nay, sometimes encouraged, "because it sounds cute," to call his father "Billy," or his mother "Lizzy." He is allowed to eat or drink, or do what his own sweet will dictates, with a quiet reprimand should he overstep the bounds of respectability, but never, or at least very seldom, is a good whipping administered. Now the boy grows up under this sort of treatment and becomes a man. He enters a profession, goes to the halls of legislation, or may be simply becomes a conductor of a street car—in every case imbued with the idea that he is a law unto himself, and that every law or rule must have many exceptions. How is it possible to obtain good discipline with such material as this? And yet that is the task we have before us in the United States. Of course this picture is somewhat exaggerated. Although I have personally known several equal examples, the average is much better or else the troubles of managing transportation properties would be very much multiplied.

We pass in our legislatures and congresses the best laws the world knows, each act being most thoroughly scrutinized by the maker and the public interested, through their representatives, but our legislators are always lawyers and they always take care in framing a law to "leave a hole in it large enough to crawl out of" if need be, or, in other words, a flaw, that although hidden in verbosity will defeat the operation of the law should it become necessary at any time.

Now I have dwelt somewhat at length upon this subject to begin with, simply to show by comparison why it is that the management and operation of railways in America is so much more difficult than in Europe, where laws and rules are obeyed infinitely much better. For instance, in England or on the Continent, should a street car or omnibus be "complete," that is, with as many passengers as the rules of the company. or the laws of the country, permit the car to carry, it would be quite useless to attempt to get on the vehicle; in fact, no one does try except perhaps an American or some one out of his mind. Now, in America things would be different, for notwithstanding the law or the rule, if there was room for another person to get on the steps, it would probably be occupied, even if the passenger had to hold on by the handles or stand on the bumper with the rain trickling down his neck. He had made up his mind to go on that car, no matter what the consequences, and it makes very little difference to him, even if there is another car following, going to the same place, and is told of this by the conductor, that there is "plenty of room in the car following." He will not believe it, and sticks to the place despite the protests of the conductor, which become more and more urgent until at last the conductor indicates that he will exert his legal rights, in return for which he gets some good sound abuse, in words not taught in Sunday schools, and is informed by the passenger that he will report him to the superintendent, which he does. Accordingly the next day, or very soon, Mr. Conductor is summoned before the superintendent, who hears his truthful story, in which he admits practically all that the passenger has charged him with, but explains that he was simply endeavoring to carry out the rules of the company. The superintendent then informs the conductor that he has done wrong and gives him a severe reprimand for using ungentlemanly language to a passenger, warning him to be more careful in future, that the gentleman he had talked to was Mr. So-and-So, who would probably hereafter be an enemy of the company, possibly might agitate some unfriendly legislation and should the conductor be guilty again in a like manner he would either be discharged or punished by being suspended for a time. So the poor fellow goes back to work with the determination to use his own good sense, and as far as possible to let the passengers have their own way, even to smoking on the back platform.

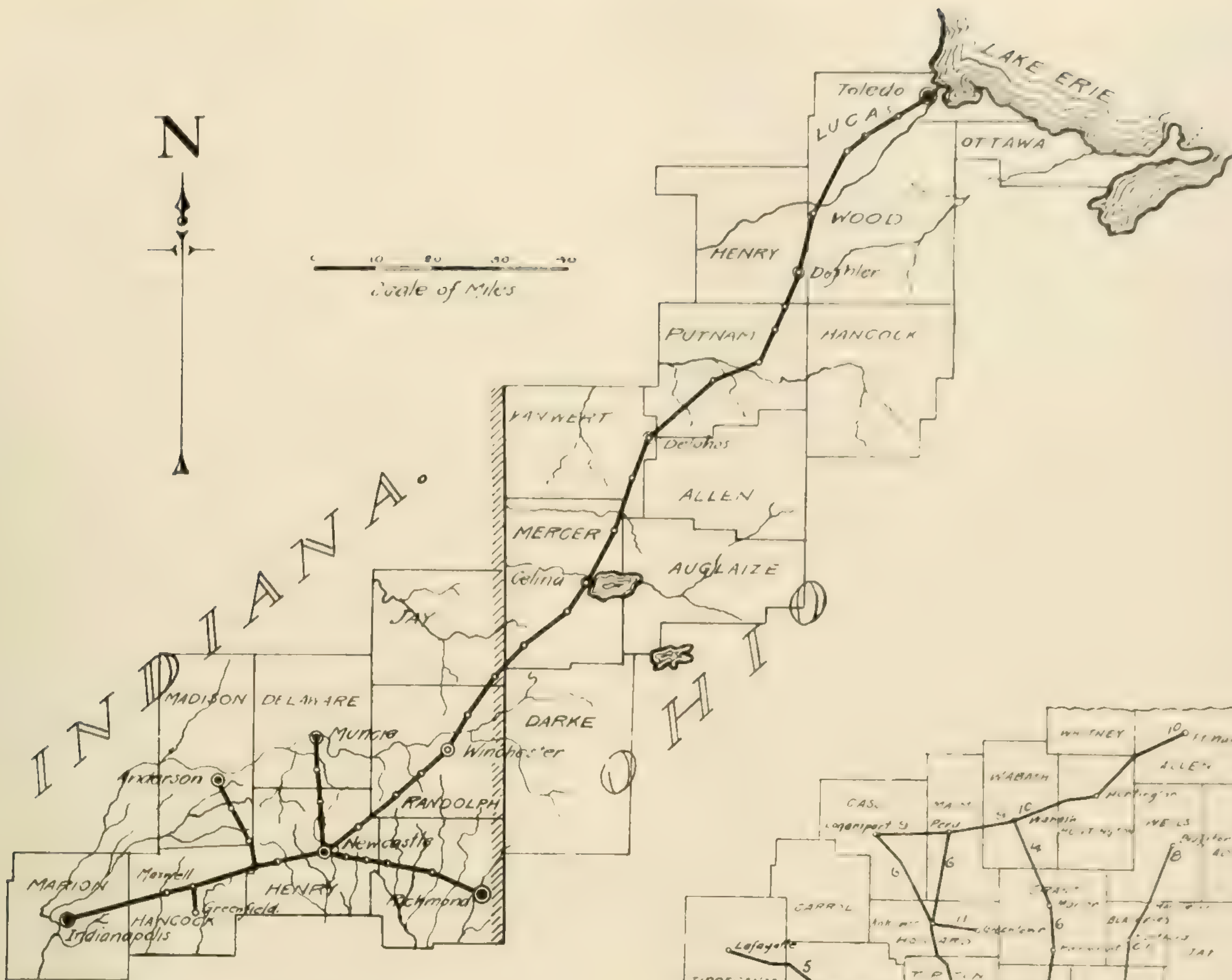
In America passengers generally are required to get on or off a car on the back platform or steps, the front being fastened so that they cannot, and inasmuch as ladies must pass, there is usually painted in large letters on the back part of the car "No Smoking," and perhaps no rule is better carried out than this one, simply because Mr. A does not want his wife insulted and will not therefore insult Mrs. B. But even this rule is very often disobeyed by a dogged passenger or one that thinks he has "pull" at headquarters, and he will tell the conductor that he means to smoke, and dares him to take steps to prevent. Now, how different would this be in Europe. To begin with, seeing a sign forbidding it, no one attempts to smoke, and if his attention was particularly called to it by the conductor, not even a drunken man would dare disobey the rule.

I could go on multiplying examples of this kind that have come under my own observation, but it is useless. They all lead you to the same conclusion, that for the safe, regular and comfortable transportation of persons or property the first necessity is obedience amongst its employes to the rules of the company and laws of the country. The second necessity is that the people who patronize the transportation companies must learn to support the employe in his duty and cease urging him to break the laws and rules, and until this is done we in the United States generally shall always have more accidents and trouble than they do in Europe. Let me say that necessary rule of obedience applies not only to the transportation, but also to the financing, construction and operation of the entire system, where the breaking of the law will be found to play an important part, and is often responsible for much loss of life as well as of temper on the part of patron and employe.

Let us have better discipline in America. We are ahead in most other matters, why not this? It can be accomplished simply by a proper and just administration of the splendid laws already in force, and an insistence of this policy by the great railway and street railway associations of America will help much.

In Formosa, as feeders for the government railways there are small tramways, from 3½ to 15 miles in length, reaching out into the more important of the productive districts along the line. Chinese coolies furnish the motive power on these tramways, and while they are miniature affairs, having a gage of but 19½ in., and the beds of the cars being but 4 ft. square, they generally meet the requirements, the chief of which seems to be cheapness of transportation.

A plan is under consideration for building an automobile race course at Hampton Beach, N. H. This will be a straightaway course, and with some filling, will give a length of about six miles, extending from Great Boars Head to Seabrook Beach. It will be located on the lines of the New Hampshire Traction Co., which would be largely benefited by the resultant traffic. Hampton Beach has a hard, smooth surface, unequalled by any in New England, and would prove an ideal place for automobile racing.



Indianapolis, Newcastle & Toledo.

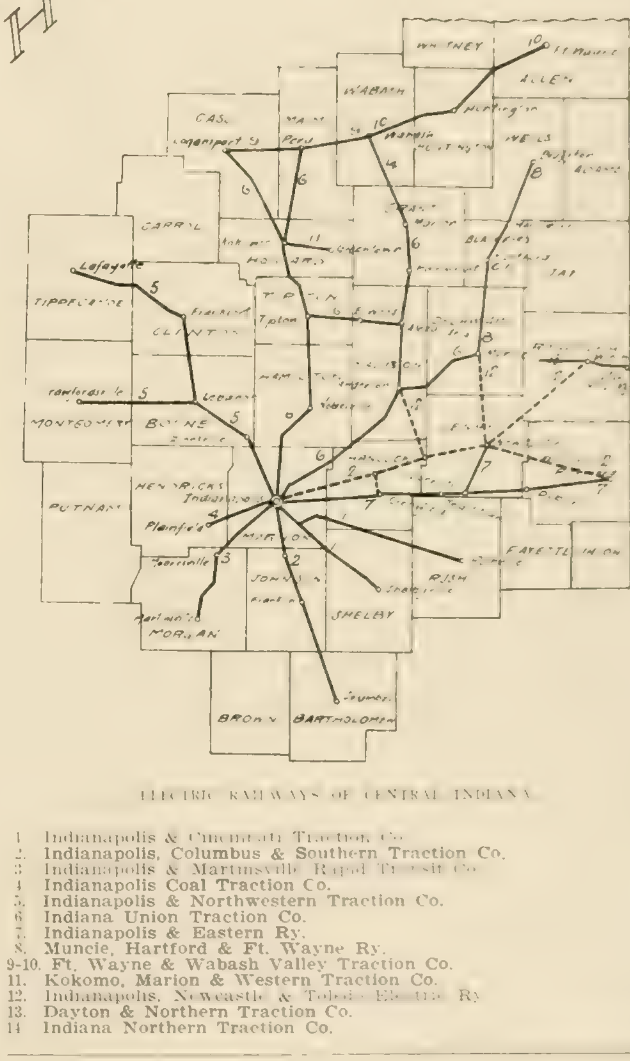
The Indianapolis, Newcastle & Toledo Electric Railway Co. was organized to build an electric railway 140 miles in length, that will connect 31 of the best cities and towns of Indiana with Indianapolis; twenty-four of these towns do not now have any interurban road. The cities and towns on the route include Newcastle, Richmond, Winchester, Muncie, Markleville, Mt. Summit, Kennard, Wilkinson, Maxwell, Losantville, Hagerstown and Mooreland. The population of the territory, not including Indianapolis, is given as 165,000, and stated to be the greatest per mile served by any interurban road, except one, that enters Indianapolis.

The roadbed it to conform to standard steam road specifications with grades not to exceed 1½ per cent and curves within 6°. There are to be 3,000 standard size, white oak ties per mile, on which are to be laid 80-lb. steel rails. All bridges are to be of steel or concrete and of sufficient strength to carry the heaviest loads and rolling stock. Ample depot facilities will be provided before the road is open for operation. The power plant will be at Newcastle.

It is the intention to handle all classes of freight, as well as passengers, and to do this it is more than probable that electric locomotives will be employed.

This company has been granted a franchise by the city of Indianapolis to lay tracks, turnouts and switches over a private right-of-way in the city, from the corporation line, for a distance of three miles into the very heart of the city's population, where commodious freight terminals will be erected at 10th St. and Massachusetts Ave. This right-of-way has been secured by purchase for the entire distance.

There is no way at this time for heavy or carload lots of freight to be brought into Indianapolis over interurban roads except it would be through resident streets over tracks already down. This has never been permitted, and probably never can be, on account of damages to private property by the additional burden that would be thus imposed. It is to provide this great convenience that this com-



ELECTRIC RAILWAYS OF CENTRAL INDIANA.

1. Indianapolis & Cincinnati Traction Co.
2. Indianapolis, Columbus & Southern Traction Co.
3. Indianapolis & Martinsville Rapid Transit Co.
4. Indianapolis Coal Traction Co.
5. Indianapolis & Northwestern Traction Co.
6. Indiana Union Traction Co.
7. Indianapolis & Eastern Ry.
8. Muncie, Hartford & Ft. Wayne Ry.
9-10. Ft. Wayne & Wabash Valley Traction Co.
11. Kokomo, Marion & Western Traction Co.
12. Indianapolis, Newcastle & Toledo Electric Ry.
13. Dayton & Northern Traction Co.
14. Indiana Northern Traction Co.

pany is going to the large additional expense of providing the freight terminals proposed. Large sums of money have already been expended in the work done so far on this enterprise.

The union terminal passenger station of the Indianapolis Traction & Terminal Co. will be used for passenger service.

The officers of the Indianapolis, Newcastle & Toledo Electric Railway Co. are: President, Hon. D. M. Parry; vice-president, Hon.

Charles S. Hernly; secretary, W. E. Stevenson; treasurer, Eli Marvin. Directors are the officers and Judge E. H. Bundy. The general offices are at Nos. 406-407 Terminal Building, Indianapolis, Ind.

The portion of the system that it is intended to build first is shown on the larger of the two maps herewith; later the line is to be extended to Toledo. The relation of the new road to the other electric lines now operating in central Indiana is shown in the smaller map.

The company will also build a belt line, which will completely envelope the city of Indianapolis. Its mean distance from the center of the city will be between five and six miles, and in its course it will open a hitherto untouched territory.

The line will intersect the main line of the Indianapolis, Newcastle & Toledo road at a point east of the city, as well as other lines entering Indianapolis. Its course will be that of a square, and will pass through the towns of Millersville, Lawrence, Malott Park, Mt. Nebo, Broad Ripple, Poplar Grove, Flackville, and run through the Eagle Creek valley for a distance of five miles and pass close to the fair grounds and through the army post, to the westward of the village of Lawrence. An attractive feature of the suburban road, and one of its most important uses, will be the opening of territory. Many people are desirous of building country homes at convenient distances from the business section of the city, and the new line will solve all problems that have been prohibitive.

Handling Freight in Birmingham.

For several years the Birmingham Railway, Light & Power Co. has been engaged in handling express and freight matter between Birmingham and the various outlying points in the Birmingham district reached by this system. A very complete account of this service was given in the paper read by Mr. J. B. McClary before the American Street Railway Association at the Saratoga meeting in 1903. Comparatively recently there have been developed what may be called special classes of freight traffic, which will interest other companies which are at all similarly situated. Since 1903 the service has been greatly extended.

Perhaps one of the most important changes made in the freight department was to establish a higher schedule of rates. The old rates were found to be very low in comparison with those charged by the steam railroads, and were increased 5 to 10 per cent without loss of business or complaint on the part of the patrons, as it was realized that the new rates were in every respect reasonable.

The sepcial classes of freight business referred to are the handling of slag and chert. Slag is got from the blast furnaces, and is used a great deal for street foundations and concrete building work. This slag is loaded by the company at the furnaces, and costs, when loaded on the cars, 15 cents per yard. It is sold to the various contractors having need for it, and delivered at the nearest point reached by the railway line at a price which will average 45 cents per yard. The slag is hauled in center dump cars of about 9 yd. capacity and on flat cars of 13 yd. capacity. The slag business amounts to about 3,000 yd. per month.

In handling chert, it is delivered at the company's track by the owner of the pit at a cost of 47½ cents per yard. After hauling this to its destination, the railway gets for it from 75 cents to 80 cents per yard. The unusual feature of this is that the company acts as dealer as well as the carrier, the sales being made to it by the producer, instead of the latter selling direct to the consumer.

The Birmingham company has also a package delivery system by which the city stores are enabled to send packages to the suburbs. Transportation is paid for by tickets attached to the package. These tickets are sold in books of 100 at the rate of 7½ cents each, the maximum weight carried on one ticket being 50 lb. Delivery at destination is secured by a special service, for which is paid 2½ cents per package. The amount paid for delivery at destination ranges from $10 to $15 per day.

Gross earnings from freight for the last three years have been as follows: 1902, $30,700.38; 1903, $31,168.57; 1904, $44,982.55.

In order to secure exact data as to the cost of conducting the freight and express department, Mr. W. B. Brockway, for the general accounting department of the Newman interests, has arranged a classification of freight expenses under the following accounts:

201. Maintenance of Track.
202. Maintenance of Line.
203. Maintenance of Buildings.
206. Maintenance of Cars.
207. Maintenance of Electrical Equipment.
209. Miscellaneous Shop Expense.
210. Power.
216. Superintendence.
217. Wages of Motormen.
218. Wages of Trainmen.
219. Agency Service.
220. Wages Car House Employes.
221. Car Service Supplies.
222. Agency Expense.
226. Officers and Clerks.
227. Printing and Stationery.
231. Advertising and Soliciting.
232. Miscellaneous General Expense.
233. Damages.
238. Insurance.

It will be remarked that this list is intended to include all of the expense accounts affected by freight operation. The number given each is 200, added to the number in the general classification.

The Effect of Temperature Changes on Catenary Trolley Construction.

Some interesting data were lately given by Mr. Theodore Varney in a paper on "High-Pressure Line Construction for Alternating Current Railways," which was presented before the American Institute of Electrical Engineers. These measurements were made on a road five miles in length which has been in operation for about five months, and upon this road several forms of construction have been installed. One portion has been equipped with 120-ft. spans, with sags of 24 in. in the messenger cables. Another section has spans of about 96 ft. and sags about 4 in. In the latter case both messenger and trolley wire are tighter than the former. The effects of temperature upon these two forms of construction are indicated by the following observations during a period of two months:

Date.	Temperature, Deg., F.	Height of Trolley Wire above Rails. Span No. 1.	Span No. 2.
		120-ft. Span.	
12-22-04	33.8	21 ft. 3.4 in.	21 ft. 5.1 in.
12-23-04	52.3	21 ft. 2.0 in.	21 ft. 3.6 in.
1- 4-05	16.0	21 ft. 4.1 in.	21 ft. 5.5 in.
		96-ft. Span.	
12-22-04	34.7	20 ft. 7.0 in.	20 ft. 7.5 in.
12-23-04	52.3	20 ft. 6.8 in.	20 ft. 7.4 in.
1- 4-05	14.7	20 ft. 7.4 in.	20 ft. 7.9 in.

The greatest temperature variation noted on the 120-ft. spans was 36.3°, and the corresponding changes in height at the centers of the spans were 2.1 in. and 1.9 in., respectively. For the 96-ft. spans the temperature variation was 37.6° and the corresponding changes in height were 0.6 in. and 0.5 in., respectively.

The combined weight of messenger, No. 000 trolley wire, and hangers averages one pound per foot, which gives a tension in the messenger cables with 120-ft. span and 24-in. sag of about 900 lb. The tension with 96-ft. span and 4-in. sag is about 3,500 lb.

Measurements were also taken on a more elaborate style of construction, designed for use in electrically equipping steam roads operating two or more tracks. The trolley wires in this case are hung from double catenaries, each messenger being a steel stranded cable .4375 in. in diameter, supported by lattice steel bridges, such as are used on many roads to support semaphores and other signal apparatus. The trolley wire is No. 000, grooved, and the supporting hangers are placed 10 ft. apart. The average total weight per foot supported by each cable, including its own weight, is 0.91 lb. The vertical sag in the first span, which is 230 ft. long, is 2.6 ft., and in the second span, which is 270 ft. long, 3.6 ft., both at 26.6°. The corresponding tension in the messenger cables is 2,300 lb.

The observed variation in height of trolley wire due to temperature change was as follows:

Date.	Temperature. Deg. F.	Height of Trolley Wire above Rails. 230-ft. Span.	270-ft. Span.
1-16-05	26.6	23 ft. 9.1 in.	23 ft. 7.1 in
1-26-05	6.8	23 ft. 10.1 in.	23 ft. 9.9 in.
2- 9-05	39.2	23 ft. 7.3 in.	23 ft. 4.3 in.

The maximum temperature variation is 32.4° and the corresponding change in height of trolley wire is 2.8 in. for the 230 ft. span and 5.6 in. for the 270 ft. span.

Mr. Varney states that 300 ft. appears to be a satisfactory spacing distance for bridge construction; this is not a long enough distance to permit undue vibration in the cables and not so short as to require a large number of bridges per mile. For messenger cables of this length span extra-high strength steel strands ⅝ in. in diameter are suitable, with a No. 0000 grooved trolley wire and hangers spaced 10 ft. The average load per foot on each cable is 1.43 lb., and with a vertical sag of 2.7 ft. the tension is 6,000 lb. In rough climate, wind and sleet will at times increase this tension. Assuming that the tension may be doubled, a factor of safety of about 3.5 will still remain, as the breaking strength of the cable is about 40,000 lb.

For use in localities where milder weather conditions may be assumed, lower grades of steel may be used, having breaking strengths for the same weight per foot of 25,000 lb. and 19,000 lb. These latter cables are somewhat easier to handle and would be sufficiently strong for most conditions.

The sag given above is taken to be the cold-weather condition, and for 100° F. rise the sag would be about 4.4 ft., or a variation of 1.7 ft. This allowance is made in the height of the bridge so that the lowest point of the trolley wire will be 22 ft. above the track. It is not believed that the variation will be this much on account of the giving of the supports and other causes.

Honolulu Rapid Transit & Land Co.

The Hawaiian Tramways Co., Limited, has lately been acquired by the Honolulu Rapid Transit & Land Co., which now owns and operates 23.1 miles of track extending throughout the important parts of the city and suburbs of Honolulu.

The annual report for the calendar year of 1904 of this company's business shows that the property is being improved and its income increased. The gross earnings for the period reported were $327,461 and operating expenses $197,877, leaving the net earnings from operation $129,584. The total income from other sources was $4,562, leaving the gross income less operating expenses as $134,146, from which when $55,324 is deducted for taxes and interest leaves a net income of $78,822. From this sum $52,429 was used to pay dividends throughout the year, thus leaving the addition to surplus for 1904 as $26,393. This, added to the former surplus of the company, gives a surplus carried over to 1905 of $148,251. The operating expenses of the railroad were 60.43 per cent of the gross earnings. The gross earnings per mile of road operated were $15,146.91 and the net earnings $5,993.98.

The capital stock authorized, issued and outstanding at the date of the report consisted of 6 per cent non-cumulative preferred stock to the amount of $343,000 and common stock to the amount of $800,000. The funded debt of the company amounted to $690,000 in first mortgage 6 per cent 25-year gold bonds.

Throughout the past year the properties and transportation facilities have been improved with the expenditure of $148,669.03 distributed among the usual railway departments and including $4,227.44 expended in completing and equipping an aquarium which is one of the attractions of Kapiolani Park.

The freight traffic amounted to $974.90. A substantial increase in the car-mileage is included in the reported figure given as 1,480,154.07 miles with earnings per car-mile for the year reported as 21.75 cents.

The total number of passengers handled in 1904, 6,689,401, is an increase of 15½ per cent over the previous year and is equal to the whole population of Honolulu taken 167 times. Of this number of passengers 125,584 were free rides. The average daily car-mileage of 4,055 is stated to be about equal to the distance from Honolulu to San Francisco and return.

The officers of the Honolulu Rapid Transit & Land Co. for 1905 are: L. T. Peck, president; L. A. Thurston, first vice-president; J. B. Castle, second vice-president; Charles H. Atherton, treasurer; George P. Thielen, secretary; F. William Klebahn, auditor; C. G. Ballentyne, manager; W. R. Castle, director.

Preliminary steps are being taken for the erection of a scenic railway at Highland Park on the lines of the Houston Electric Co.

Montgomery Traction Co. Changes Hands.

On February [illegible] by the United State District Court upon petition of the North American Trust Co., the Montgomery Traction Co. was placed in charge of a receiver, Mr. E. E. Winter, general manager of the company, being appointed. While the action was pending in the court the property of the traction company was purchased by Mr. R. D. Apperson, president of the Lynchburg Traction & Light Co., of Lynchburg, Va., representing Philadelphia capitalists who control the Lynchburg property. The new owners of the property satisfied the claims of the trust company, and a new street railway company was organized with Mr. R. D. Apperson as president and Mr. Charles R. Miller, of Philadelphia, secretary and treasurer. Mr. Winter was succeeded as general manager by Mr. W. H. Ragland, while Mr. J. W. Holliday will be succeeded as superintendent by Mr. C. C. Hogshead, formerly superintendent of the Lynchburg Traction & Light Co.'s lighting department. Mr. R. S. Maultsby, who recently succeeded Mr. Lloyd Lyon as auditor, will retain his present position. Considerable improvements are contemplated by the new management, and orders for four new combination cars have been placed, and others will follow.

Attempted Holdup of Denver Tramway Crew.

Shortly before midnight of March 26th, J. O. Eade, motorman of Welton St. car No. 196, of the Denver City Tramway Co., brought his car to a stop at the end of the line, while the conductor, R. C. Roberts, got out to report to the train dispatcher. As he was coming out of the telephone booth he was confronted by a masked man with a revolver and ordered to throw up his hands. He ignored the command and closed with the robber just as the latter grabbed at his change holder. The motorman heard the noise and ran to his assistance, whereupon a second highwayman made his appearance and fired four shots at the motorman, without effect. Motorman Eade then attacked the first robber, who was engaging the conductor, with his controller handle, and brought him to the ground. In the meantime the other robber escaped. The crew then reported the matter to the dispatcher, placed the robber in the car and ran into the city, where they were met by the police ambulance. Both the motorman and conductor are old and trusted employes of the company and have been substantially rewarded by the company for their conduct.

Park Attractions for York Street Railway Co.

The York (Pa.) Street Railway Co. has completed the arrangements for the summer amusements at Highland Park.

The contract for furnishing the professional attractions has been given to Nathan Appel, of Reading, who furnished the attractions last year. He will supply stock companies to produce standard and popular plays for a season of eight weeks. There will also be vaudeville features. In addition to the professional attractions, there will be entertainments by local talent.

The preliminary season will open on May 29th, when William H. Newborough will present comic opera by home talent for one week. Beginning June 5th, the local lodge of Red Men will have the Highland Park Theater for three nights. The regular professional season will open June 26th and will close August 12th. For the weeks of August 14th and 21st comic opera by local talent is booked. The open dates in June, August and September will be filled by other home talent attractions.

Improvements will be made to the interior of the theater and to the stage. The stage will be in charge of an efficient corps, which already has been engaged. Many improvements and repairs will be made throughout the park. Several new specimens will be added to the zoological collection.

The annual trip of inspection of the Schools of Engineering of Purdue University occurred March 30th, 31st and April 1st, the party consisting of about 170 students and 9 members of the faculty. The party arrived at Chicago by special train over the Monon at 11:30 Thursday morning and returned by the same route Saturday evening, having headquarters at the Victoria Hotel while in the city.

THE STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE

KENFIELD PUBLISHING CO.,

45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:

New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV APRIL 15, 1905 No. 4

CONTENTS OF THIS NUMBLR.

CITY ENTRANCES FOR INTERURBANS.

In operating through municipalities long distance electric railways meet a number of difficulties which are particularly annoying in terminal cities of 100,000 or more inhabitants. There are, as a rule, restrictions included in the franchises granted by the municipalities which, while not seriously affecting urban car service, are undesirable limitations upon long distance high speed operation; the use of the tracks of urban companies which are not designed for large interurban cars involves additional labor and expense for the mechanical department of the interurban road and for the track department of the city line; having to conform to a local schedule in the terminal cities results in a loss of time that is most aggravating to through pasengers. The ultimate solution of these difficulties will doubtless be that the interurban company will seek private rights of way inside as well as outside of the city limits.

For a new railway line to thus enter a large city involves an expenditure for right of way, elevated structures, embankments, crossings and subways that is in general too great to permit of such a project being considered when the road is built. Yet knowing that such an entrance must be provided at some future day it is indeed painful to reflect that the cost of making the improvement will be proportionately more as the necessity for it grows.

A compromise plan could probably be carried out in all save the largest centers of population, whereby the interurban company would get a private way through the suburbs and residential districts to within perhaps a mile or so of the down-town terminal, and run only this shorter distance on the city tracks. Joint user of private rights of way by a number of interurban lines would in many cases be entirely practicable, and would reduce the cost to each company. The plans of a new Indiana electric railway, the Indianapolis, Newcastle & Toledo, provide for a direct line from the corporation limits to the center of Indianapolis, all over a private right of way and on which there shall be no grade crossings. This company's plan, we understand, also contemplates the use of the Traction Terminal station, on the same terms as other lines entering the city, in order that all of the advantages derived from the union station may be conserved.

HIGHER LINE POTENTIALS.

In Mr. Damon's paper, an abstract of which is printed elsewhere in this issue, some suggestions are made which will undoubtedly lead to much interesting discussion relative to a standard pressure for the working conductors of electric railways. Mr. Damon classifies interurban electric traction projects into three general types, moderate speed lines, high speed lines, and electrically quipped trunk lines, then after exhibiting fitting examples of types of overhead construction now in succssful use, he recommends the adoption of standard forms of overhead construction and standard line pressures.

Six thousand volts is recommended as a standard for the first two classes of roads and 15,000 volts for the trunk lines.

Those who in times past have experienced rainy-day troubles with 600-volt lines will look with awe upon the adoption of a trolley pressure ten times as high, but our European colleagues have shown us that operation can be successfully maintained with such high contact voltages if the design of the overhead work is an elaborate one, and much care is taken in its maintenance. No word comes to us, however, regarding the ease and rapidity of clearing such a line for continued operation after such common accidents as are occasioned by defective span wires or broken poles. But such criticisms are matters which will call for more care in the design, and should not be used as arguments against the adoption of high working conductor pressures.

The benefits to be derived from such an increase in trolley voltage are many, and prominent among them stands the one of cost, both of construction and operation. On an interurban line of the average length, operating with a potential difference of 3,000 volts, there would undoubtedly be needed a transmission system of much higher pressure, together with its reducing transformer sub-stations. But if 6,000 volts is adopted as a standard trolley pressure, it would seem that the effective radius of the generating system would so be increased that many roads of the average length could be operated from the working conductor alone, thus saving the first cost, the maintenance cost and the liability for interruption, which are at-

tendant on a separate system of high tension feeders and reducing transformers.

DOES THE FREIGHT AND EXPRESS DEPARTMENT PAY?

Two years ago, in his paper on "Freight and Express on Electric Railways," read before the Saratoga meeting of the A. S. R. A., Mr. J. B. McClary summarized the reports received from 66 companies that themselves provided this class of service, as follows: Profitable, 45; unprofitable, 2; doubtful and noncommittal, 19. The preponderance of opinion is doubtless now as it was then, that the express business is a paying one, but too much is left to be merely a matter of opinion, and few, if any, companies can now make statements based on knowledge of all the facts.

Whether a given branch of the service appears to be profitable or otherwise depends often upon whether it has been favored in keeping the accounts, and the favoritism may be by design, or because the classification of expenses in use does not permit of differentiating all the express and freight costs, and those not shown exactly are in consequence estimated or omitted entirely.

When 50 to 70 per cent of the gross receipts is required for operating expenses, considering the railway as a whole, and the freight department is reported to have been operated on only 20 or 25 per cent of gross earnings, there is room for doubt as to the accuracy of the result. We do not mean that there is intentional misrepresentation, but that the company may be deceiving itself.

Quite recently a step towards eliminating existing doubt has been taken. Mr. W. B. Brockway, for the general accounting department of the Newman properties, has formulated a classification of express accounts for the freight department which was put in effect by the Birmingham Railway, Light & Power Co. Such an analysis of freight expense will add to the cost of accounting, but it is recognized that accurate knowledge is necessary in order to determine what is the correct policy to pursue. With complete data as to cost of operation, the Newman interests will soon be in a position to determine whether the express and freight department is one to be extended.

AUTO CARS FOR RAILROADS.

There are a number of questions which have, so to speak, regular orbits and periodically appear to invite and receive discussion, and one of these that is now attracting considerable attention is the design of a motor car that will be satisfactory as a substitute for steam locomotives in conducting passenger service on the branch lines of railroads. Those who have followed this particular question will recall that about seven years ago great interest was manifested in steam and oil motor cars. Several types of car were put in service experimentally, but after short trials nearly all of these were found unsatisfactory. So far as the steam cars were concerned, it may be said, generally, that when engines, boiler, fuel bunker and water tank of sufficient capacity were placed in a passenger car there was either not enough room for the passengers, or the arrangement became so undesirable mechanically that the regular locomotive was more economical to build and maintain. With the gasoline or oil motor cars the difficulty was principally in getting a satisfactory variable speed connection between the prime mover and the car axles. In certain sections the motor car was abandoned for reasons quite aside from their mechanical or economic merits, that is the rules of labor unions had to be considered. In the case of one road the choice was found to lie between abandoning the motor cars and making a trial of strength with the trainmen's unions, which objected to the substitution of a train crew of two for one of four or five. In the operation of steam and gas motors it has been remarked that if a steam engine does not work the cause can be readily ascertained, but that a gas engine may and often does fail to operate while the cause of the trouble will for a long time evade detection. Improvements in the details of construction and greater simplicity in gas motor design have to a considerable extent reduced the importance of this objection.

The motor car is just now again to the front, and we wish it better success this time, for it deserves to be successful and can fill a marked want.

In the United States the Union Pacific, the Burlington, the Illinois Central and the Lake Erie & Western are a few of the steam railroads now experimenting with [illegible]. In Great Britain the Great Central Railroad Co. [illegible] on a section of its line in Wales, it being estimated that the cost of operation will be from 9 to 14 cents per mile, as against 24 cents per mile for the trains now in service, and the London, Brighton & South Coast Railroad Co. has [illegible] for electrical operation on the [illegible], and is considering self-propelled motor cars as another possible means of meeting tramway competition.

The oil or gasoline driven car [illegible] the electric motor car, but has its own particular field—on the branch lines of steam roads, on construction work, on newly built roads where the traffic now in the territory would not justify the more expensive electric power equipment, and for the emergency cars on electric roads.

CONCRETE-BEAM CONSTRUCTION.

The question of concrete-beam track construction is one which has had its details considered in many forms by construction engineers, and yet on no two roads has the same set of details been followed. Although the burying of the rail in the mass of concrete does lessen the distortion effect due to changes of temperature, yet this expansion and contraction is not entirely absent in any form of track construction, and for this reason it has been found necessary to anchor rails when placed in concrete beams, not only with the usual form of tie rods to hold them in proper gage, but with some type of metal anchor which would hook over the base of the rail and remain buried in the beam, thus restraining the rail from any tendency to lift from its bed when a wave motion is imparted to it by the wheels of heavy cars. There have been many different devices used for this purpose, some elaborate, some simple. The use of the ordinary 5½ x 9-16-in. railway spike for this purpose is indeed a novel one, but has been found to accomplish the purpose satisfactorily in Minneapolis, and is now being used in reconstruction work in Austin, Tex. The method is to make an excavation for the usual form used for concrete trench work, block the rail up to gage and line by means of the ordinary wooden blocking, and when the concrete has been tamped in the trench up to the level of the base of the rail, ordinary railroad spikes are sunk in the concrete, as in the usual form of the wooden tie construction. After the wooden blocking has been removed, the concrete work is completed in the usual manner.

The reason for this detail of construction being successful depends directly upon the shrinking force which displays itself when concrete sets. This is not a new use for this characteristic of concrete. Several of the forms of concrete-steel reinforcing used in bridge and floor construction depend upon this same shrinkage characteristic of the material for their existence, and their success has proved this method to be a safe one.

CORRECT ACCOUNTING.

The theory that publicity in the affairs of business concerns is a safeguard for the investors in its securities and is in the long run the best thing for all concerned, especially for the so-called public utility corporations, is generally accepted. In practice, however, some concerns feel that any considerable degree of publicity as to the earnings and expenses of their business would affect them unfavorably, not because they have any results to be ashamed of or apologize for, but because complete statements made in good faith would be garbled by the public press and demagogues and made to misrepresent the situation. There is now in various parts of the country a noisy if not strong agitation for the municipalization of railway and lighting undertakings, and a wise decision as to the policies to be adopted by these different cities depends upon the education of the public. The most used arguments and those which probably affect the greatest number of voters are based upon reports of municipal undertakings, whereof the accounts have not been properly audited. Instead of showing the situation as it exists, the reports most quoted are cleverly designed to show only the features it is desired shall be seen.

There came to hand recently the report of an electric railway and lighting company which would be an excellent guide for our municipal friends to follow. This company has been through some trying times. Although the president was able to state that a small

surplus over operating expenses and fixed charges had been earned during the concluding months of the year covered by the report, and that a conservative estimate for the coming year indicated there would be no deficit, there had been a large deficit for the year covered by the report.

The frankness of the management in including in its published report a criticism from the auditors who passed upon the accounts as to the faults of the company's former accounting methods, is much to be commended. The statement of the auditors included the following:

"The general condition of the accounts was somewhat remarkable in that the financial standing of not one of the six companies was correctly stated on the books, and it required a careful analysis, running back several years, of many ledger accounts to determine their relative place in the system or to find out whether they belonged there at all.

"It is hardly necessary to state that each account in your books should either mean exactly what its caption and balance indicate or else it should be at once eliminated.

"As a matter of fact, the laxity in your bookkeeping department has been so great that in our opinion there has never been a time in the history of the property as a whole, when a consolidated balance sheet or profit and loss account could have been prepared without an exhaustive examination and adjustment of the principal accounts in each set of books. A result of this kind flows from carelessness on the part of the bookkeeping staff or from their inability to secure the necessary information to write up the books. From the appearance of a number of entries made months and in some cases years after the transactions had taken place, the inference is forced upon us that the information was not in the possession of the clerks at the time the transactions took place.

"The inevitable result has been to render correct financial statements impossible because it is obvious that no one can make a mere guess as to the earnings and expenses of a number or even of one large undertaking, and we are prepared to state, after mature deliberation that no statement of earnings and expenses for any given period embracing more than two of your properties has, if prepared, been correct, and without regard to the responsibility for such a state of affairs we can only say that your stockholders and any others who may have been entitled thereto have by reason of the condition of the books been deprived of any means of getting at the facts short of a laborious readjustment and writing up of the accounts."

Doubtless the financial troubles in which this company has been entangled, and from which the management has now determined it shall emerge, were in great measure, if not entirely, due to the fact that its accounting system was so poorly organized that the management could not tell what were paying departments and policies.

Success in any business is largely dependent upon correct accounting, but correct accounting is most important in public undertakings in order that the public may know how its money has been used or wasted.

STREET RAILWAY PENSIONS IN AMERICA.

In the "Review" for September, 1904, we gave, in connection with a discussion of the value and cost of pensions, data as to the experience of three of the four American street railways which have established the policy of providing pensions for the support of superannuated employes and faithful men injured in the service of the company.

The four American street railways having pension funds or making similar provision, with the dates when pension orders became effective, are:

Rhode Island Co., Providence	Nov. 1, 1901
New York City Railway Co. (Metropolitan)	July 1, 1902
Boston Elevated Railway Co	Jan. 1, 1903
Denver City Tramway Co	July 1, 1903

In response to inquiries made in July, 1904, Mr. Robert I. Todd, general manager of the Rhode Island Co., gave the estimated annual charge for 1904 as $2,408.63, and Mr. C. S. Sergeant, vice-president of the Boston Elevated Ry., stated that on the basis of the number of pensioners at that time, 26, the annual charge would be $5,400.

More recent data as to costs of pensions are given herewith:

Rhode Island Co.

	Nov., '01, to Dec., '02.	1903.	1904.
Paid to pensioners	$2,031.18	$1,754.80	$2,396.50
Retired on pensions during period	4	....	4
Age at retirement	70 to 73	....	70
Pensioners, close of period	4	4	7
Average number of pensioners	4	4	7
Average monthly payment to each	$36.27	$36.56	$28.53

Boston Elevated Railway Co.

	Fiscal year ending Sept. 30, 1904.
Paid to pensioners	$4,731.50
Persons given allowances during year	11
Age at date of allowance	50 to 75
No. receiving allowances	26
Usual monthly allowance	$25.00

The Boston Elevated Ry. makes contributions for the support of blue uniformed employes who in the judgment of the management of the company are unfit to perform any duty and who have been constantly employed by the company for a period of 25 years, or who have reached the age of 60 years and have been continuously employed for a period of 15 years. The number of blue uniformed employes in the service of the company Mar. 1, 1905, was about 5,100, of whom 605 had been employed for 15 years or more.

Mr. John A. Beeler, vice-president of the Denver City Tramway Co., advises that up to March 1, 1905, it had received no applications for pensions from its employes.

Iowa State Association.

The second annual convention of the Iowa Street and Interurban Railway Association will be held at Dubuque, Ia., April 20-21, 1905, headquarters being at the Hotel Julian.

The program is as follows:

Thursday, April 20, 1905—10 a. m.

Address of Welcome, Mr. J. R. Lindsay.

Reading of Minutes.

Address of the President.

Report of Secretary and Treasurer.

Paper: "Handling Freight by Interurban and Interchange of Business with Steam Railroads," H. H. Polk, Des Moines.

Thursday Afternoon.

Visit Central Station Union Electric Co.

Attend in a body afternoon session Iowa Electrical Association and hear reading of Mr. W. E. Boileau's paper on "Steam Turbines."

Friday, April 21, 1905.

Paper: "Accounting as an Aid to the Operating Department," R. A. Leussler, Council Bluffs.

Paper: "Car Shop Methods," John D. Fish, Davenport.

Paper: "Rural Railways," F. McDonald, Waterloo.

Friday Afternoon.

Paper: "The Adoption of Gasoline Motors for Street and Interurban Service."

Executive Session.

The officers of the Iowa association are: President, George B. Hippe, Des Moines; vice-president, James F. Lardner, Davenport; secretary and treasurer, L. D. Mathes, Dubuque.

Chicago Election.

Judge Edward F. Dunne was, on April 4th, elected mayor of Chicago on an "immediate municipal ownership" platform. The city council has a majority opposed to the new mayor in politics, the city has no money to buy the street railways, the "Mueller law certificates," which are the only obligations it would be authorized to issue in payment of the railways, are of doubtful value, and the companies have rights which cannot be ignored, so that the election of an immediate municipal ownership mayor will probably mean only increased difficulty in negotiating franchise renewals. It is possible that the railway stockholders would accept Mueller law certificates with the expectation of having to foreclose within a short period, and thus recover their properties with such additions as the city might have made in the interim.

Tramway System at Chesterfield, England.

The pleasant town of Chesterfield, in Derbyshire, is situated between Derby and Sheffield. It claims distinction in two ways—the famous crooked spire of its church is a well-known landmark for many miles around, and is annually visited by large numbers of people, who form various conjectures as to its origin and purpose. Then in the second place, Chesterfield was the first town in England to have a public electric light service, the streets and some of the principal buildings being lighted with arc and incandescent lamps so long ago as 1881, the venture being one of Mr. Robert Hammond's earliest schemes. It is true that the installation was of a temporary nature, the generating plant being portable, and the distributing network being suspended overhead in a very primitive manner, but the fact remains, and Chesterfield is proud of its record.

The town has now come into line with other municipalities by the introduction of an electric tramway system, and this was opened to the public quite recently.

A short horse tramway, owned by a private company, and running through a portion of the town, had been in existence since 1880, but in 1897 it was bought by the corporation for a very low price, and under municipal control proved commercially successful. The tramways which have lately been put down cover a very much larger area, and traverse the principal streets and extend well into neighboring districts.

The whole of the work has been carried out by the British Insulated & Helsby Cables, Ltd., of Prescot, under the able supervision of Mr. A. E. Grant, M. I. E. E. The system is single track throughout most of its length, although in several of the streets in the center of the town a double track is made use of. The gage is 4 ft. 8½ in. and the length of route about 3¾ miles.

CAR SHED OF TRAMWAY SYSTEM AT CHESTERFIELD.

It is interesting to add some details as to this early plant. In October, 1881, Mr. Robert Hammond constructed a small central electric supply station at Chesterfield to deal with the public lighting of the town. This provided the first example of the supply of current for arc and incandescent lamps on the same circuit. The generators at full speed gave 10 amperes at 2,000 volts, the arc lamps being run in series and incandescent lamps in series-parallel of eight lamps. The speed of the generator was varied according to the number of arcs or of groups of incandescent lamps on the circuits. This was one of the very earliest public electric supply undertakings of the country, and for some time it did useful work in lighting the Chesterfield streets. But the difficulties which were encountered in those early days were enormous, and when the business was finally closed down the pockets of its promoter were considerably lighter, though, as we know today, his faith in electric supply never failed.

The rails are laid on an unusually solid foundation, the depth of concrete being 9 in. The rails are of the British Standard No. 2. in 45-ft. lengths, and weigh 96 lb. per yard. All special track work, points, crossings, etc., was supplied by Hadfield's Steel Foundry Co., Ltd., of Sheffield, and are of its patent "Era" manganese steel. Fig. 2 shows the fan at the entrance to the car shed. The Forest City Electric Co., of Manchester, supplied its well-known "Protected" type of rail bond, and the Cooper patent Anchor joint has been used throughout.

In the center of the town the streets have been entirely repaved with hard-wood blocks, while in other parts granite sets have been used. Although some of the streets are only 20 ft. wide, in the

busiest parts of the town two tracks have been squeezed in, in view of the better service which can thus be given. In some places there is only a space of 3 ft. 4 in. between the outer rail and the curb, and this, of course, does not allow room for tradesmen's carts to stand at the side of the road, which is all to the good from the public point of view. There are few sharp curves in the Chesterfield system, and with the exception of one gradient of 1 in 20 for a distance of 150 yd. the line is practically level. The sharpest curve has a radius of 48 ft. 6 in., and is that which is shown in Fig. 3.

FIG. 2. CAR SHED FAN, CHESTERFIELD

The overhead equipment has been carried out with side poles and brackets, and with span wires, a few rosettes being used in one or two places. The poles are 31 ft. long, of which 25 ft. is above the ground level, and are placed at intervals of 40 yards. All the poles are bonded to the rails, and the guard wires are earthed at every pole. They are made up of three sections, and were supplied by Messrs. John Spencer, Ltd., of Wednesbury. The bracket arms vary in length from 6 to 20 ft. Fig. 4 shows the side pole construction at Wittington, while Fig. 5 shows the span wire equipment on the Chatsworth Road at Brampton.

FIG. 3. SHARP CURVE ON SHEFFIELD ROAD.

The trolley wire is grooved throughout, and mechanical ears have been employed in every case. When it is considered how easy the mechanical ears and grooved wire can be erected, it is evident that this form of construction will become increasingly popular as engineers appreciate its advantages. The wire is of No. 0000 gauge, and is at an average height of 21 ft. 6 in. from the ground. The span and guard wires are of seven strand No. 12 and seven strand No. 14 respectively. The feeders are of the British Insulated lead-covered and armored type, the positive leads having a section of .15 to .4 and the return leads .4 to .2.

The armored cables are laid direct in the ground, the plain lead-covered feeders being drawn into Sykes' conduits. Figs. 6 and 8 show respectively front and back views of one of the feeder pillars, which are of the British Insulated Co.'s own manufacture. They

FIG. 4. BRACKETT ARM WORK AT WITTINGTON.

are equipped with the usual fuses and switch gear, and with Wurtz lighting arresters. At intervals telephone boxes, with magneto instruments communicating with the power house, are attached to the poles, and one of these with its door open can be seen in Fig. 6.

The power house is about one mile from the end of the line on the Chatsworth Road. It is used both for lighting and traction, most of the sets being designed to work on either service.

Fig. 7 shows the new unit which has recently been put in especially to take the traction load. The engine was built by Bellis & Morcom, and runs at 300 to 320 r. p. m. The generator was supplied by the British Westinghouse Co., and is a six-pole machine, coupled direct to the engine shaft. Its capacity is 400 kw., current being generated

FIG. 5. SPAN WORK, CHATTSWORTH ROAD

at 500 to 550 volts. Although compound wound, it is arranged so that the series field can be cut out, so that the machine can be run on a lighting load as a shunt wound generator. Before the purchase of this unit, two 100-kw. units and two 200-kw. units had been installed, these also consisting of Belliss engines and Westinghouse generators. The last 200-kw. generator had been built shunt wound with a view to traction work later, and the two 100-kw. machines

were altered from shunt to shunt compound wound, so that at the present time there is available in the Chesterfield station for traction work two units of 100 kw. set, one of 200 kw. set and one of 400 kw.

The boiler plant consists of six Babcock & Wilcox water tube boilers, having a total heating surface of 10,645 sq. ft., and working

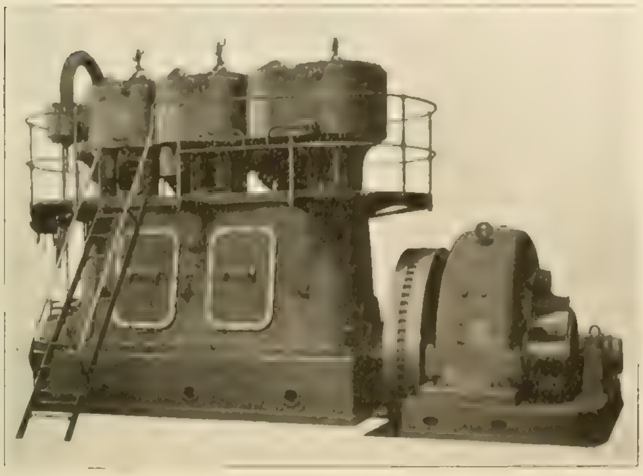


FIG. 7. BELLIS-WESTINGHOUSE TRACTION SET.

at a pressure of 150 lb. They are all fired by hand. Being within easy reach of collieries, and adjoining part of the Midland Railway Co.'s system, coal is very cheap, and a low grade of coal being employed, the cost per ton delivered at the bunkers works out at not more than 4s. A private siding is now being built from the Midland company's lines so that coal can be dumped from the railway trucks direct into the bunkers, and this will effect a substantial saving in cost of handling the coal. Feed water for the boilers, and condensing water, is taken from the river which adjoins the power house, and a plentiful supply can always be obtained, although a large storage tank is available in case of necessity.

Economizers are fitted to the boilers, and are motor driven. They

FIG. 6.

FIG. 8.

were supplied both by E. Green & Sons, of Manchester and by the Clay Cross Co.

The condensing plant is of the Worthington jet type, while Worthington feed water pumps and Berryman feed water heaters have also been installed.

Both the lighting and traction switchboards were supplied by the Westinghouse company, and are arranged in a gallery at the end and at the side of the station. The traction switchboard consists of nine panels of standard Westinghouse type, and is made up of four generator panels for controlling the four generators that can be run on traction load, one load panel, one B. O. T. panel, and three two-circuit feeder panels. There was also installed in connection with the traction switchboard a two-panel throw-over board. The leads from the four traction generators come direct to this throw-over board, and the machines can either be switched through this board on to the lighting switchboard in the station, or on to the traction board.

The car shed adjoins the power house and was built by corporation

R. L. ACLAND,
Tramways Manager.

A. E. GRANT.
Resident Engineer.

workmen. It measures 120 ft. by 46 ft., and is capable of considerable extension. It has four tracks with pits 4 ft. 6 in. deep. At present it will accommodate 16 cars. Repair shops and stores are now being built and equipped at the side of the car shed.

The roof glazing, which can be seen in the illustration, is on the patent "Eclipse" system, and consists of steel T's completely enveloped in a lead cover, the ends of which are soldered so that the steel bar is entirely protected from atmospheric effects. As there is no paint, putty, asbestos, nor jointing of any description, the glazing never requires any maintenance, and as the materials exposed to the atmosphere are absolutely imperishable the glazing will last the life of the car shed.

The rolling stock consists at present of 12 cars supplied by the Brush Electrical Engineering Co., of Loughborough. They have a seating capacity for 56 passengers, of whom 34 can be accommodated inside. The cars are mounted upon Brush-Conaty radial trucks with a wheel base of 8 ft. 6 in., and a spring base of 16 ft. The wheels were supplied by Hadfield's Steel Foundry Co., and have steel tires. The cars are equipped with two No. 45 M Westinghouse motors, and with two No. 90 M. controllers with Westinghouse standard canopy switches and the usual accessories.

In addition to the usual hand brakes, they have been equipped with Westinghouse magnetic track brakes. These powerful brakes enable the cars to be stopped very rapidly, and save the motormen much work. Before the motormen and passengers had become accustomed to the magnetic brakes they were inclined to complain of their rapid action, which sometimes took them unawares, but now everyone has become accustomed to their action, and the additional safety which they give to passengers is generally appreciated.

During the busy hours a five minutes' service is given, while at other times a seven or eight minutes' service is found sufficient.

Mr. R. L. Acland, who acted as engineer during the construction of the electric tramways, has now been appointed tramways manager as well as resident engineer, and under his management there can be little doubt as to the success of the undertaking.

A New York subway employe who recently was in danger of being run down by an express train, saved his life by lying flat on the track between the rails while the five-car train passed over him.

Arrangements are under way for providing cars suitable for carrying fire apparatus between St. Paul and Minneapolis. It is stated that 35 minutes will suffice for one department to place its apparatus at the service of the other.

The Strength of Timber Treated with Preservatives.*

Effect of Preliminary Steaming and of Different Preservative Chemicals and Processes Upon Both Green and Seasoned Lumber.

With the increasing use of timber, preserved in one way or another against decay and fire, it is important to determine the effect which the preserving process has upon the strength of the preserved timber. Many engineers believe that creosoted timber is more brittle and less capable of withstanding strains than the same timber before being treated with creosote. This is particularly true with bridge timbers and piling.

Actual tests are necessary to determine what relationship exists between the preservative process and the strength of the timber. Most of the tests hitherto made with preserved timber were made by comparing results of tests on treated sticks with results on untreated sticks. In many instances these turned out in favor of the untreated timber. The reason why such tests are unfair to the preservative is that in the process of preservation two factors enter: The actual process of impregnation with a preserving substance, and the preliminary processes of steam seasoning, in the majority of treating plants in the United States. A piece of timber subsequently treated with creosote may be steamed to such an extent that the timber becomes exceedingly brittle. This, obviously, will be the fault of the steaming and not of the creosote.

Timber preservation divides itself broadly into three stages: First, the preliminary preparation; second, the actual preservative process; and, third, the treatment of timber following preservation. The final strength of the timber may be influenced materially by each of the stages.

The Bureau of Forestry erected an extensive plant on the grounds of the St. Louis Exposition for carrying on a series of investigations of the methods for preserving timber, and of the influence various preservative processes have upon the strength of the timber. These investigations have been organized and outlined by Doctors von Schrenk and Hatt of the Bureau of Forestry.

This general plan was pursued during the last few months at the timber treating and testing station at St. Louis in accordance with the following outline:

(1) To determine the effect of the preliminary processes, such as steaming, on the mechanical properties of the timber.

(2) To determine the effect of preservatives on the strength of timber, eliminating the effect of the preliminary processes.

In order to determine the effect of these factors, the programme was divided into two parts—part 1, the effect of the preliminary process, and part 2, the effect of preservatives.

The effects of the preliminary process were determined only on loblolly pine. Both green and seasoned timber was used in determining the effect of preservatives. The preservative fluids investigated included only creosote and zinc chloride.

In making comparative strength tests of treated and untreated timbers, it is necessary to eliminate as far as possible the variations due to the great differences in quality of individual pieces of wood. This was accomplished in this case by using 11-ft. timbers cut at the same time from one forest site. In testing the influence of preliminary processes of seasoning, a 3-ft. section was cut from one end of each timber and sawed up into test pieces, which furnished a basis of comparison between (1) the results of tests on these "control" pieces, and (2) the results on test pieces taken from the remaining 8-ft. section after the latter had been subjected to the various perliminary seasoning processes in the treating cylinder.

In testing the effect of preservatives themselves the entire 11-ft. timber was subjected to the preliminary seasoning processes, after which a 3-ft. section was cut from the end of each timber. The 3-ft. section thus having been subjected to the preliminary seasoning processes formed a basis of comparison with the remaining 8-ft. section, which was treated with preservatives. In this way the separate effects of the preliminary processes and the effects of the preservatives could be isolated and determined.

Because of an apprehension that defects of brittleness of treated timbers might not be evidenced by the ordinary tests under slowly applied loads, provision was made for both static tests and impact tests. The test pieces were subjected to crossbending strain, compression along the grain under both static and impact conditions, and under shearing parallel to the grain and compression at right angles to the grain under static conditions. The data taken include the moisture conditions, specific gravity, and rate of growth. During the treating operations, records were kept of the temperature to which the timbers were subjected at all stages, the amount of water lost or gained, and of the amount of preservatives absorbed, as indicated by gross weight and subsequent chemical analyses of the test pieces.

Ordinarily the strength tests were made immediately after treatment in the cylinder. In order, however, to determine what weakness might be introduced by changes in the physical condition of the preservatives in the wood through lapse of time, a complete series has been set aside for subsequent operations. An additional set of test pieces has been loaded with different percentages of the strength, as exhibited under the ordinary tests, and this load allowed to act for long periods of time, the deflections being measured from day to day.

While this program is not sufficiently advanced to allow the drawing of final conclusions, yet the preliminary results are fairly indicative of what may be expected. It is found that the steaming process weakens the resistance of the wood fiber to both static and impact loadings. It may be stated that this diminution of strength is very nearly in direct proportion to the length of time that any given steam pressure is applied. The diminution of strength was found to be 25 per cent after a pressure of 20 lb. was applied for ten hours to green loblolly pine, and 10 per cent when a pressure of 20 lb. was applied for four hours. This diminution of strength increased very rapidly when the pressure rose above 20 lb., and amounted to about 25 per cent when a pressure of 50 lb. was applied for four hours.

It will be easily seen that when the conditions of time and pressure are made very severe, the conditions prevailing in a pulp mill industry will be approximated. Evidently it is well to avoid when possible the use of these preliminary steaming operations in the wood preserving industry.

With relation to the effect of preservatives themselves, the latter is distinct from the preliminary process. It may be said that the treatment with zinc chloride does not seem to further reduce the strength of timber beyond the effect of the steaming process. This might have been expected when it is considered that the strength of the zinc chloride solution ordinarily used does not exceed 2½ per cent. The strength of timber that had been treated with the 2½ per cent solution of zinc chloride after having been steamed four hours at 20 lb. pressure was the same as that of timber which had been steamed without the subsequent application of zinc chloride. The same statement may be made of timber treated with an 8½ per cent solution of zinc chloride. It may be that subsequently the crystallization of the zinc chloride will weaken the wood fiber. This remains to be determined.

The effect of the creosote appears to be the same as that of an equal amount of water in weakening the fiber. That is to say, the strength of creosoted timber is that of green timber. The difference is that while green timber gains strength upon seasoning, the creosote oil remains in the wood, and, it appears from analysis of a pile 35 years old, that the oil remains in a liquid condition. Consequently, comparison between seasoned timber and creosoted timber will always result to the disadvantage of the latter as far as its strength is concerned. In the case of creosoted wood, it also remains to be determined what changes in the wood fiber take place through lapse of time in the presence of creosote oil.

It is expected that a bulletin will be issued upon the results of these investigations when the tests are completed. This bulletin will also contain the results of the investigations to determine the best methods of preserving wood so that the maximum impregnation may be obtained with the least expenditure of oil per cubic foot of timber.

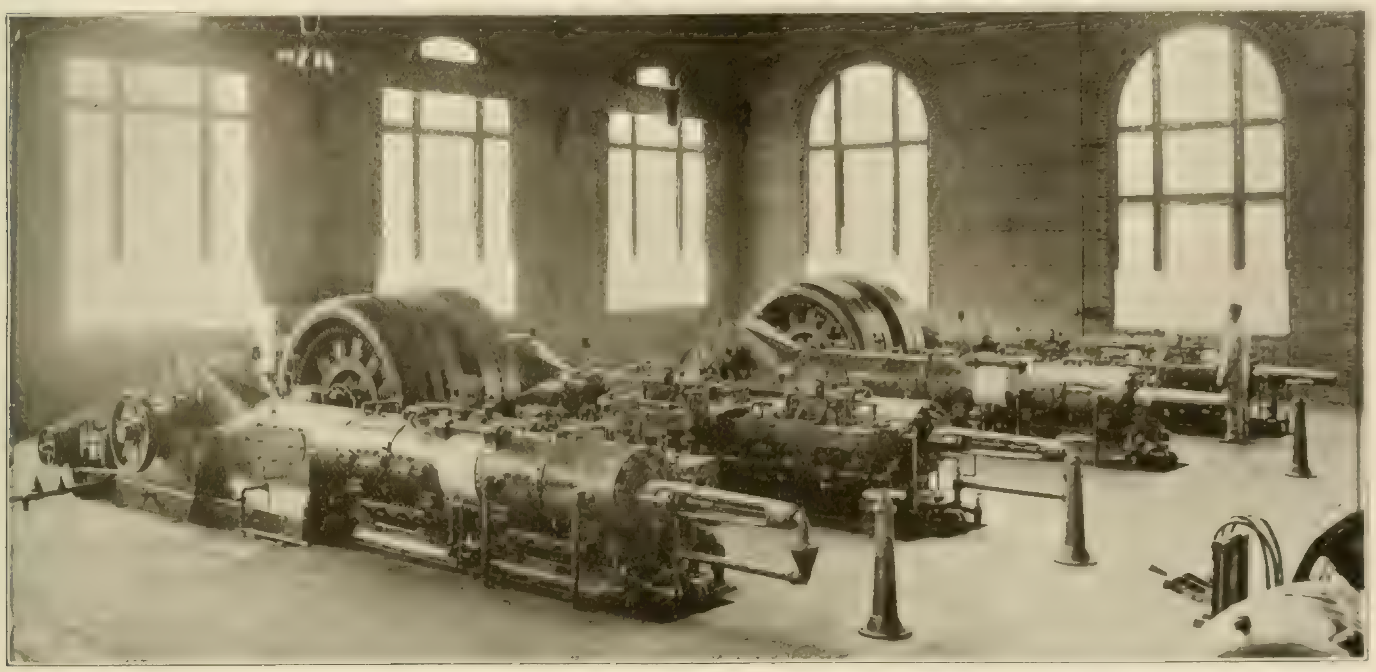
*From Bulletin No. 62, Bureau of Forestry, U. S. Department of Agriculture.

A current newspaper paragraph tells of a "motor-car savings bank" which makes journeys in the north of France, stopping in villages on stated days to receive such sums as thrifty country people, having saved, may be desirous of depositing in a savings bank. The motor car, which is electrically driven, carries a small safe, a desk with folding shelves for the depositors, with accommodations for two clerks and a cashier and a seat for the driver.

Gas Engines for Railway and Power Service.

A distinctive development of recent engineering practice is the high power internal combustion engine suitable for direct connection to electric generators for lighting, power, railway, pumping and industrial purposes. Two types of gas engines have been developed by the Westinghouse company, both of which types were exhibited at the St. Louis Exposition—one a vertical single acting engine with three cylinders, and the other a horizontal double acting engine with two cylinders arranged in tandem—direct connected to engine type generators. Both of these machines were shown in comparatively small sizes, as being somewhat better adapted for the varied work desired for the purposes of demonstration.

The horizontal engine consists essentially of two water jacketed double-acting cylinders arranged in tandem with distance pieces providing space for access to the packing boxes between cylinders. Distance pieces are also used between the forward cylinder and crosshead guide for a similar purpose. The frame comprises the housing for the crosshead guide, two main bearings and a bed plate; the two cylinders and all the valve mechanism are supported by a bed plate extension bolted to the bed of the engine frame, both of which are grouted with concrete to the foundation.



1,000 H. P. HORIZONTAL ENGINES—ALTERNATING CURRENT POWER LOAD

A noticeable feature of the general design of the engine is its resemblance to a modern high speed tandem compound steam engine. This resemblance is particularly noticeable in the case of the main engine frame, shaft and cranks, fly wheels, bearings, connecting rods and arrangement of generator. A more generous proportioning of parts has of course been necessary to accommodate the increased pressures resulting from the rapid combustion of highly compressed gases.

The Beau de Rochas or four-stroke cycle is exclusively employed in both the double and the single acting type of engine. This four-stroke cycle involves the following sequence of operation:

1. Induction: The piston in moving forward draws into the cylinder at approximately atmospheric pressure the mixture of gas and air previously proportioned for the best efficiency of combustion with the particular gas used.

2. Compression: At the end of the first stroke the inlet valve closes, and the piston upon its return compresses the mixture to as high a pressure as may be safely carried without danger of spontaneous ignition.

3. Expansion: At approximately the end of the previous stroke the mixture under compression is ignited by an electric spark, and the heat due to combustion rapidly expands the gases and increases the internal pressure. As the piston recedes, due to the pressure exerted by the expanding gases, the pressure decreases progressively, owing partly to the increase in cylinder volume and partly to the conversion of heat into work.

4. Exhaust: At the end of the expansion stroke the exhaust valve opens, allowing the burned gases to expel themselves. This occurs almost instantly, and the piston upon its return stroke expels further the remaining gases at atmospheric pressure, which action is known as scavenging, and in this case is positive. This completes the working cycle, and the operations are repeated in sequence in each end of each cylinder. By proper timing of the valve motions one power impulse is secured at each forward and backward stroke of the engine, thus resembling the operation of a single cylinder double acting steam engine.

An important source of economy lies in the method of controlling the combustible mixture. As the quality of gas does not ordinarily vary widely, a most efficient proportion, once obtained, enables the engine to operate thereafter with maximum economy, since the governing is then very effectively accomplished by varying the quantity of mixture admitted to the engine according to the load to be carried. As the mixture is of constant quality, and as positive scavenging prevents it from becoming vitiated upon its admission to the cylinder, the maximum duty per unit of gas used is secured.

The shaft is constructed of open-hearth forged steel built up, with two cylindrical crank disks with smooth exterior face, but cored out in the rear with suitable pockets for counterbalancing with lead. The proper speed of rotation is communicated to the cam shaft by a spiral gear split in two halves and secured to the shaft close to the engine frame by key and bolts. The lay or cam shaft, which extends along the entire length of the engine and at 90° to the main shaft, is thus positively driven at one-half the speed of the engine, this relation being necessary to obtain the proper valve movement in a four-cycle engine.

In the main bearings, a four-part or quarter-box arrangement is used, the bearings being adjustable horizontally by wedges set up by bolts extending through the caps. The upper quarter of the bearing and the cap are cast integral, the latter being provided with lips which overhang the vertical sides of the bearing, thus contributing greatly to its rigidity.

The crosshead and connecting rod are typical of modern steam engine construction. The former has removable babbited shoes overlapping the ends of the crosshead and adjustable by wedges. Both ends of the connecting rod have split bronze boxes and are adjustable by means of wedges, the crosshead end being of the solid, and the crank end of the strap type.

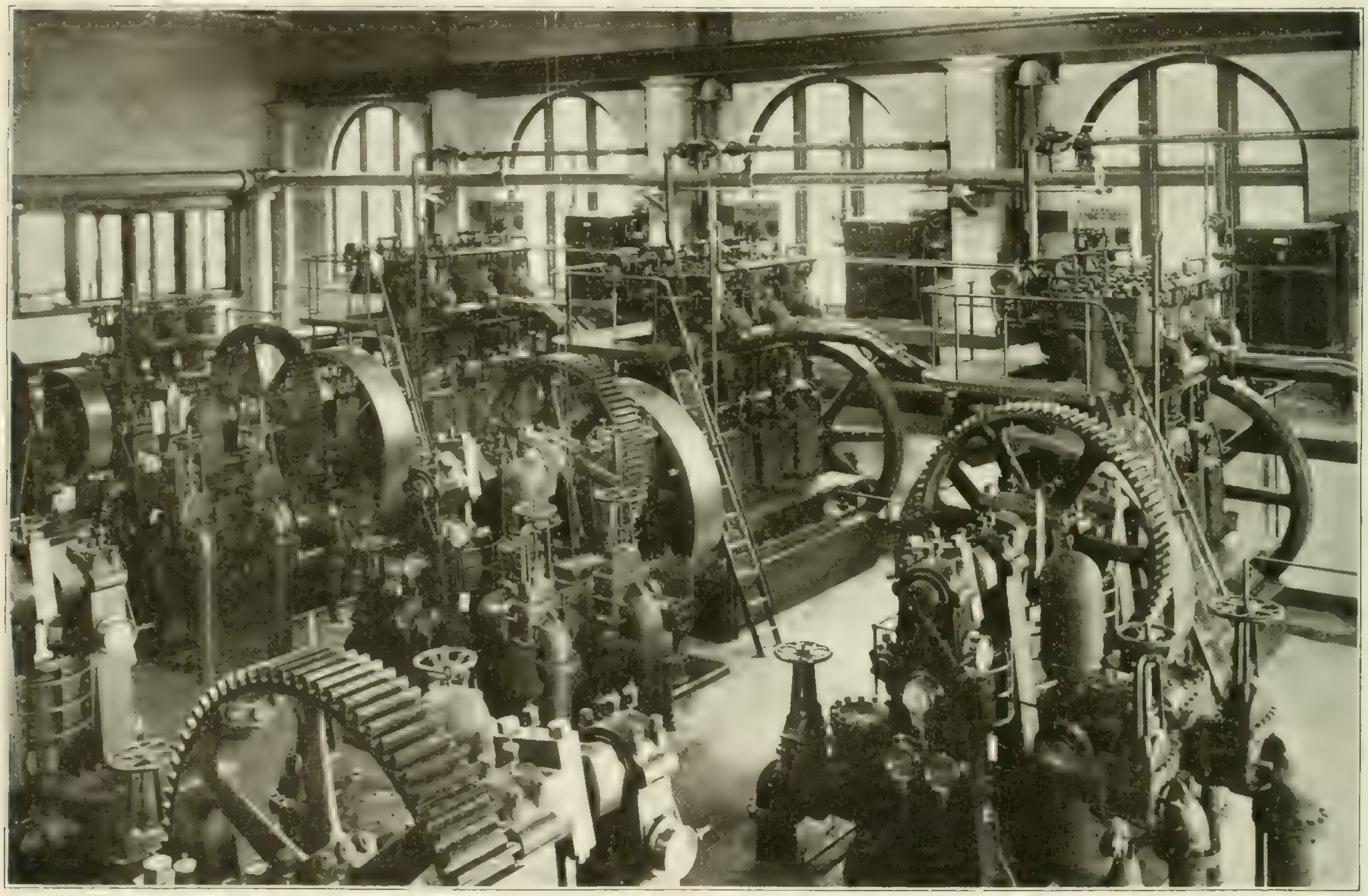
The cylinder, combustion chamber, ignition and exhaust ports, together with the water jackets for the respective parts, are made in one casting. In order to reduce the strains in the metal of the jackets while cooling, the jacket wall is split around the periphery, the opening being closed by a steel tension band and a strip of rubber packing. Suitable hand holes are provided at various points in the water jackets for examining the interior and to remove sediment which might be precipitated in case very dirty water were used in the jackets. The cylinder heads are made long to accommodate the packing gland and to provide for adequate water cooling passages. The heads are slightly tapered where they enter the cylinder bore, and starting screws are provided around the flanges, so as to facilitate the removal of the heads.

The combustion chamber is approximately circular in horizontal section and is closed by the admission valve above and the exhaust valve below. Both valves are of the single-beat poppet or mushroom type, and seat vertically along the same axis, but in opposite directions, the admission valve opening downward and the exhaust upward. In the case of the admission valve, a separate bonnet is employed, which, together with the valve, may be readily removed without dismantling any parts of the engine other than the tappet lever, through which cam motion is imparted to the valve. Both admission and exhaust valves are of steel, and are held to their seats by spiral springs. The exhaust valve alone is water cooled. It is bored hollow throughout its length, this bore conveying cooling water to the head of the valve, the water returning in the opposite direction through an inner concentric tube, finally emerging at the lower end. Flexible rubber tubes convey the water to and from the opening provided, and it is finally turned into the jackets. By spraying a small part of the jacket water into the exhaust pipes the temperature of the pipe may be kept at a comfortable point through the absorption of the latent heat of evaporation of the water used.

Both pistons and the piston rod are water cooled, as well as other parts subjected to internal heat. An effective means of introducing the cooling water is secured by a telescopic pipe connection bolted to the inside of the crosshead guide. The inner tube of this telescoping joint is attached to the crosshead at such a point as to convey the cooling water to the end of the piston rod bore, whence it proceeds in succession through the two pistons, emerging through a bronze tail rod extending through the rear cylinder head. Each piston is a one-piece casting, cored hollow to accommodate the circulating water, and packed by numerous cast iron packing rings set out with flat steel springs. In order to convey the water in and out of the piston, deflecting plugs are inserted at the proper point in the rod bore. A cast iron jacket surrounds the tail rod and receives the water emerging from it, whence it is drained away. The glands for the cylinder heads have a simple metallic packing similar in some respects to that used on high pressure steam engines. It is compact, may be easily removed without dismantling the engine, and is capable of being made as tight as desirable without introducing friction to a noticeable degree.

The one lay shaft paralleling the cylinders operates, through cams, all of the valve movements of the engine. Independent cams are provided for inlet valves, exhaust valves and igniters, so that the action of each valve may be timed in order to secure the maximum efficiency of the cycle. The main cams are all of cast iron with working surfaces chilled and ground. Each has a throw of one inch, which is communicated to the valve spindle by levers, fitted at one end with hardened steel rollers engaging the cams, and at the other adjustable steel tappet pins engaging the ends of the valve stems. The igniters are of the standard Westinghouse make-and-break type, and are operated by a quick drop cam, which is mounted in such a manner as to enable the ignition point to be varied any number of degrees in advance or following dead center, as may be most suited to the gas used.

Close and sensitive regulation is secured through a spring-weighted fly ball governor mounted upon a vertical shaft geared to the lay shaft. This governor is in many respects similar to that employed in the Westinghouse-Parsons steam turbine, and consists of bell crank ball levers swung on knife edges and encased in neat and substantial iron housings. By means of a special spring external to the governor the speed of the engine may be changed within small limits, this expedient being found quite necessary in synchronizing alternating current generators and in distributing the



300-H. P. VERTICAL GAS ENGINES DRIVING PUMPS.

load between them after having been thrown in parallel. The governor mechanism is easily kept lubricated by an oil cup at the top of the spindle.

The governor controls the speed of the engine by varying the quantity of mixture admitted at each induction stroke. The proper proportioning of air and gas, as well as the controlling of quantity to suit the load, is accomplished by means of a two-part valve. Each part is rotatable by means of an external lever moving over a graduated arc, and the proper proportioning of air and gas may be readily ascertained while the engine is in operation. Independently of this operation, however, the vertical movement of the governor valve as it receives its motion directly from the governor determines the quantity of mixture passing into the gas boxes, which extend in either direction from the mixing chamber to the four cylinder admission ports. Gas and air are admitted to the mixing valve at atmospheric pressure, secured in the case of the gas inlet by an automatic diaphragm pressure regulator located in the basement. With proper adjustment, whatever the pressure of the gas on the supply main, gas is always delivered to the engine at atmospheric pressure.

One of the difficulties formerly encountered in gas engine work was the provision of a convenient and reliable means of starting the engine. This is done in the Westinghouse engines by the use of compressed air. In this case the rear cylinder is used for this purpose, and is provided at each end with small spring-backed poppet valves opening only with the air pressure. This cylinder is for the time being converted into a simple compressed air motor by throwing out of service the main admission cams and throwing in two auxiliary cams, which engage the exhaust valves in a double-throw instead of a single-throw movement. Two additional double-throw cams, permanently mounted at right angles upon the lay shaft, serve to admit compressed air at the proper moment to the starting cylinder. These operations are simple in practice and involve only the temporary alteration of the cam movement by means of convenient levers and the admission of the compressed air, which is controlled by a single plug valve. One attendant standing at the rear cylinder can readily start the engine without changing his position. After one or two strokes by compressed air the regular combustion cycle in the forward cylinder commences, and the supply of compressed air may then be cut off, the cam mechanism returned to its normal position, and the rear cylinder then comes into regular service. The entire operation of starting may be readily accomplished within one minute, and the fact is on record that with the vertical single-acting type of engine a number of 300-h. p. units have been started cold, run to full speed within a period of 25 seconds, and full load applied within 40 seconds. Compressed air for starting is stored at about 150 lb. pressure in steel tanks.

Lubrication of the cylinders is automatically accomplished by two reciprocating sight feed oil pumps operated from two of the cam levers. The principal difference in construction of the vertical engine, outside of the different arrangement of cylinders, results from the employment of the single-acting principle, in which only the upper side of the piston receives the pressure of the expanding gases. A long trunk piston is therefore made use of, thus dispensing with the crosshead.

The distinguishing characteristic of the vertical engine is its self-contained construction, all the main moving parts being enclosed in a cast iron casing which is filled with oil up to the shaft. The cranks during their revolution dip into this oil and furnish splash lubrication to all the internal parts, including connecting rods and pins and cam shaft, which is also mounted inside the crank case. The construction of the engine in other particulars and its operation resembles closely that of the horizontal engine, and needs no further description.

The performance of the vertical type is, furthermore, approximately the same when the difference in their size and construction is taken into consideration, this fact resulting from the employment of the same working cycle in the two types of engines.

The accompanying illustrations show two gas engine installations made by the Westinghouse company. One is of two 1,000-h. p. twin tandem units at Point Breeze, Philadelphia, with alternators on a power load. The second engraving shows the interior of a high pressure service pumping station at Philadelphia in which are Westing house 300-h. p. vertical gas engine units. This plant is liable to be called upon at any time for the full duty.

The Westinghouse company [illegible] crank double acting 500-h. p. gas engines for the Warren (Pa.) & Jamestown Street Railway Co., for installation at Stoneham, Pa., where they will be [illegible] pressor.

Graphical Mathematics.- VI.

[illegible]

In the rectangular charts thus far considered the values upon the vertical and horizontal scales have represented similar values, [illegible] means restricted to these conditions.

Time Charts.

An example of a chart [illegible] shown in Fig. 34. Although not bearing directly upon engineering problems it well illustrates a general principle which may suggest other applications. This sketch indicates roughly a method of making up railway time-tables. The vertical line AE represents distances and the graduations divide this line into spaces of ten miles each. The entire railway line shown is therefore 80 miles

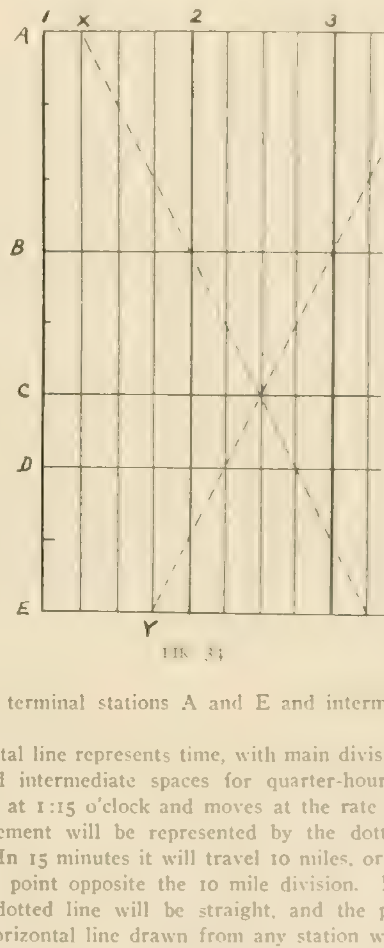


Fig. 34

long with the terminal stations A and E and intermediate stations B, C and D.

The horizontal line represents time, with main divisions at 2 and 3 for hours and intermediate spaces for quarter-hours. If a train starts from X at 1:15 o'clock and moves at the rate of 40 miles an hour its movement will be represented by the dotted line, starting from X. In 15 minutes it will travel 10 miles, or cross the next time line at a point opposite the 10 mile division. If the speed is uniform the dotted line will be straight, and the point at which it crosses a horizontal line drawn from any station will indicate the time at which the train will reach that station. If it is required to find the time at which a train must start from E in order to meet train X at station C, all that is necessary is to draw a line Y from the intersection of X and C at the proper angle to represent the speed, and the point Y, where it intersects horizontal line drawn from E will indicate the required time of starting. In the figure the speed of Y is supposed to be 40 miles per hour, the same as X, and the time is 1:45. It is evident that different speeds, a number of trains in each direction, and any length of road can be represented by a suitable board blocked off for distance and time and cords of different colors used to represent the trains. The scale and width of the chart can be proportioned to extend over as many hours as necessary, and the height of chart to cover any extent of road. The train lines may start from any point and may extend

either up or down according to the direction of the train. The train lines will always be straight lines to represent an average uniform velocity and they will always be inclined in the same direction. Trains can run either way but no method has yet been devised for reversing the march of time.

Hyperbolic Charts.

In Fig. 35 is shown a chart laid out upon a rectangular space, in which the combining of values upon the horizontal and vertical sides results in the production of curves instead of straight lines upon the chart.

On the side O L a series of equal spaces is laid off, and on the side OS another series of equal spaces. These points of division are numbered regularly from one upward, as shown, beginning on each line at the point next to O. If it is required to find points on the chart so located that the product of the numbers opposite these points, horizontally and vertically shall always equal the same number, it can be readily done. For instance, if the required product is 5, one point would be at intersection of 5 L and 1 S. Another would be 10 L and ½ S and another at 1 L and 5 S. Intermediate points can be found if necessary and through these points a curve is drawn, marked 5 on the column of figures above P. In the same manner curves can be plotted for 10, 15 and 20 as shown and for any other values greater or less. A curve having the properties here described is called a Hyperbola and the diagram containing a series of these curves may be called Hyperbolic Chart.

Applications of Hyperbolic Chart.

The conditions mentioned, that a series of products shall be equal, are found in connection with many frequently recurring problems in engineering. It can be applied in all cases where the required quantity is the result of the multiplication of two other quantities. For example, the horse power of a steam engine may be found by multiplying the total pressure upon the piston by the number of feet piston travel per minute. Therefore if the spaces on O S, Fig. 35, are taken to represent speed in hundreds, 1 S will be 100, 2 S will be 200, and so on. Also if the graduations on O L are taken to represent total pressure and each space is called 330 lbs., then 10 L will be 3,300 lbs., and this multiplied by 1 L, or 100 ft., will be 330,000 ft. lbs. or 10 h. p.

Hence the curve passing through 10 P represents 10 h. p., and the other curves are 5, 15 and 20 h. p. respectively. If speed and total pressure are known the horse power can be at once determined

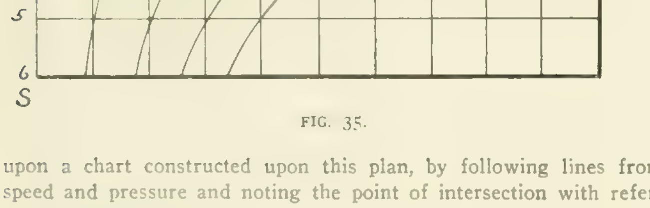


FIG. 35.

upon a chart constructed upon this plan, by following lines from speed and pressure and noting the point of intersection with reference to the curves.

In a similar manner, if the scale L is taken to represent cubic feet of water and S for feet head, the theoretical horse power of a water wheel with any given consumption of water and under a given head can be found. Or with L for gallons per minute and S for height of discharge, the horse power required for pumping can be ascertained. In each case the scales should be properly laid out and marked to conform to the special class of problems.

It is the purpose of these articles to suggest the method of constructing working charts, rather than to furnish the charts themselves. Any single plate is comparatively limited in its applications, but a principle can be fitted into the special requirements of any business.

Efficiency Deductions.

In charts for reading off power of water wheels, power required for pumping water, etc., as just suggested, it has been assumed that the theoretical power would be read from the chart, because the full value of the factors was to be used. But it will be seen that any desired percentage may be allowed for loss by friction, etc., in laying out the curves. For example, if the chart is for water wheels with 80 per cent efficiency, a deduction of 20 per cent can be made in the factors upon one side when plotting the curves, and then the result in accordance with this layout can be taken directly from the chart.

In the same manner a pump chart could add a proper allowance, so that the horse power given by its deductions would be sufficiently large to cover frictional losses in the machine and the fluid.

Combination Charts.

It will be noted that rectangular charts like that suggested in Fig. 35, or the radial line percentage chart in the preceding chapter, deal with but two factors.

Hence if a problem contains a number of factors, more than one chart is needed. But the operation may be simplified by locating the several diagrams so that the results from one can be carried directly to the next as a geographical operation.

(To be Continued.)

Rapid Transit Between Berlin and Hamburg.

The daily and technical press of Germany are now earnestly discussing the question of a high speed railway between Berlin and Hamburg. Ever since the Berlin-Zossen tests were made in 1902-3 and their satisfactory results given to the world at large, the patriotism of the Germans has made them feel that it would be an unworthy sacrifice to permit other nations to step to the front and first utilize what German experiment has made definite and plain. The Zossen experiments demonstrated that with a well built and carefully surfaced track, having no curves sharper than 1°, a speed of 120 miles an hour was not only possible, but safe. The rolling stock for such a high speed must be skillfully designed with a view to slurring over any slight irregularities in the surface or alignment of the track. In these tests the motor cars, whose center of gravity was necessarily low on account of the heavy electrical apparatus, rode with safety and ease, but the action of the unequipped trail-cars at speeds greater than 80 miles an hour was not only uncomfortable, but dangerous. At a speed of 110 miles an hour 1,300 h. p. was developed by the motors, and at 120 miles an hour the energy consumption was increased to 2,000 h. p. At the latter velocity the head end air resistance alone consumed about 1,100 h. p.

With the results of these experiments clearly established, the public and technical interest has been concentrated on a high speed electric railway between Berlin and Hamburg. The distance by the present steam railway route is 177 miles, but this could be shortened by a re-survey to about 155 miles. Between these two cities the country is as well adapted to the construction of a high speed line as any part of Europe. The average traffic between Berlin and Hamburg now includes about 1,200 fares per day, or 438,000 per year, the average fare being $3.80 each. The fastest steam train makes the distance in 3 hr. 32 min.

Two propositions have been submitted for the construction and equipment of the proposed line, one by the Siemens & Halske Co., the other by the Allgemeine Elektricitaets Co. These companies furnished the two motor cars used in the special tests between Berlin and Zossen. The Siemens & Halske Co. proposes a single track line, on which a train would be dispatched from either terminus every two hours or oftener, if found necessary, the two meeting and passing each other at the midway station of Wittenberg, and making the through run in 1 hr. 55 min. Such a line would cost, according to the estimates, $16,660,000, and by carrying 520,000 passengers a year, each paying $3.57 for a uniform first-class fare, would earn a profit above interest and working expenses.

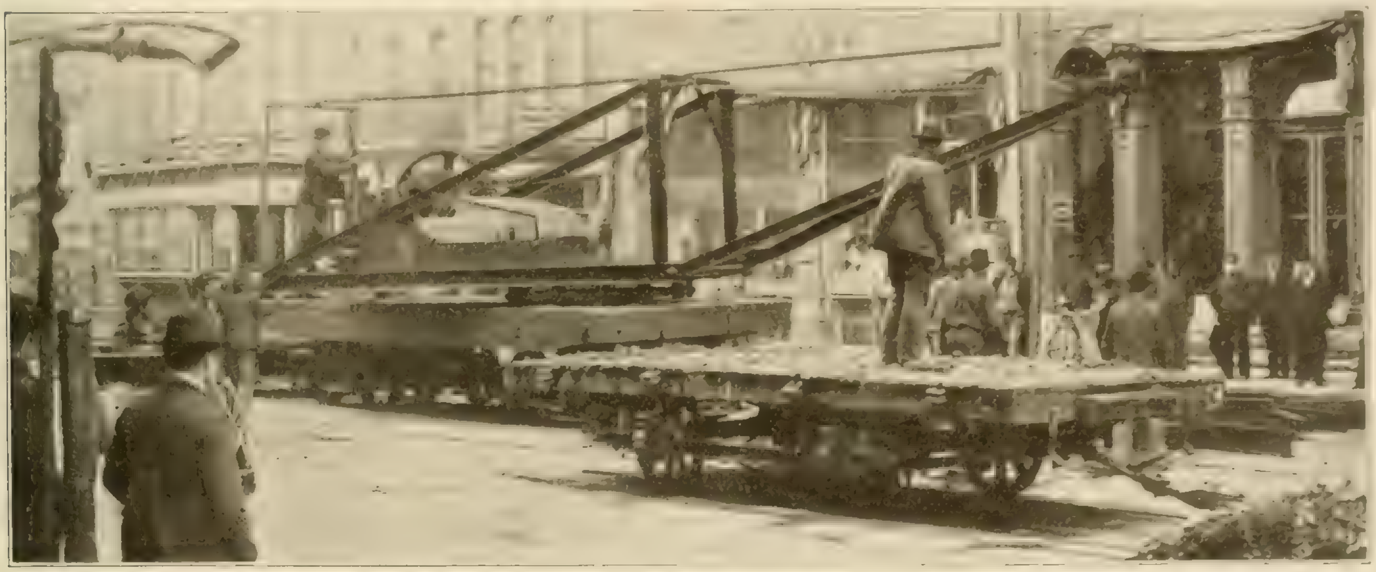
The Allgemeine Elektricitaets Co. proposes a double track line, over which the trains running at a speed of 100 miles an hour would make the through trip in 1 hr. 25 min. For that speed the road could be built and equipped for $29,750,000, but if a speed of 125 miles an hour were to be maintained the cost would be $35,-

700,000, and at the proposed rates of fare of $3.57 for an ordinary seat, and $1.19 extra for a section de luxe, a passenger traffic of 850,000 fares per year would be necessary to earn a profit over interest and operation cost. This proposition contemplates multiple unit trains of from 2 to 4 cars.

Popular opinion is very strong toward the promotion and construction of such a high speed line, but a question of doubt enters when it is seen that such a road would parallel the present first-class double track trunk line now owned by the Kingdom of Prussia and would undoubtedly take away the express passenger business, thus reducing the road to the basis of a through freight line. There are many who gravely doubt that the Prussian Government will consent to the sacrificing of the bulk of its passenger business on an important trunk line, and encourage the expenditure of from $16,000,000 to $30,000,000 in order that the public may save from 1½ to 2 hours in making the trip between Berlin and Hamburg.

Convenient Crane Car.

The accompanying illustration shows a crane car designed by Mr. T. B. McMath, civil engineer for the Indianapolis Traction & Terminal Co., and for the Indiana Co., which carries out the construction work for the former. The car is a double-track flat car 24 ft. long with the crane mounted at one end of the car over one of the trucks. The crane structure is mounted on a turntable



CRANE CAR, INDIANAPOLIS TRACTION & TERMINAL CO.

which has twelve 6-in. wheels spaced at equal intervals apart around the circumference of a circle 7 ft. 6 in. in diameter, the crane frame being secured to the car proper by a king bolt. The horizontal side members of the frame are 8-in. I-beams 16 ft. long, spaced 8 ft. apart. The posts are 6-in. I-beams 7 ft. high; the braces of the frame are 6-in. I-beams. The boom is made of two 6-in. beams braced with diagonal stiffeners and is 18 ft. long. At the rear of the crane frame is mounted an electric hoist driven by a 6-h. p. motor. The capacity of the crane is a load of 2 tons supported at a distance of 18 ft. from the pivot.

This crane car has been found especially convenient in reconstructing old track and in building new work, as a switch or crossing or other piece of special work can be lifted bodily and deposited in place in the track, thus enabling special work to be laid at the same time as the track rails without requiring a large force of men to be kept in order to handle the heavy pieces.

Another use for which this car has been found both convenient and economical is in loading car wheels and other scrap. When used for such purposes a spring balance of 600 or 800 lb. capacity is inserted above the lifting hook and scrap can thus be weighed and checked off as it is loaded, avoiding the delay and trouble of running the car on the scales or placing the pieces on the scales separately.

Tramway Car Wheels.*

[illegible]

In a paper [illegible] and the chilled cast iron wheel, Mr. Banister states that until recently the only possible wheel was the cast iron, but during the past few years, however, they have been run very close, and in many cases surpassed by the steel tired wheel, either with cast steel or forged iron centers. This result is due to the fact that the price at which they can now be produced is about 25 per cent less than it was five or six years ago and the wearing qualities have been greatly improved. Steel wheels a few years ago cost from [illegible] per set, whereas they can now be purchased at from [illegible] per set, and while at the same time the price of the cast iron wheel has been reduced it is not to a proportionate extent. The latter can now be bought at 28s. The chipping of flanges seems to be the most frequent cause of trouble with the cast iron wheel, due to the narrow groove rail required by the Board of Trade, the flange of the wheel being of necessity so thin that the metal is chilled completely through in casting and consequently becoming too brittle to long withstand the continued shocks received in passing over points and crossings. Flattening of wheels is another trouble which is frequently experienced with cast wheels; however, this can be practically eliminated by the careful training and discipline of the motormen. Flanges do not chip, flats are almost unknown and cars run smoother and quieter with the steel tired wheels, and, it is claimed by the manufacturers, with less wear on the wheel, although this latter point is by no means established. The life of the steel tired wheel is very often shortened owing to the amount turned off in re-turning of wheels due to the flanges wearing completely off and the cost of returning adds considerable to the original cost. Another disadvantage of the steel wheels is the varying size through their life-time and consequent variation in the height of the car body from the rails, which interferes with the arrangement of the slipper brakes and life guards, this variation amounting from 1¾ in. to 2 in. The following table shows the results of two experimental sets of steel tired wheels, having cast iron centers, and bought on a basis of 1s. 8d. per 1,000 miles run, to which figure must be added the cost of:

			Per set of 4		
	s.	d.	[illegible]	[illegible]	[illegible]
Boring out and pressing on.....	11	[illegible]			
Cutting off tires when worn out.	1	[illegible]			
Taking out of car and replacing..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Less scrap value, 3s per set of 4..			[illegible]	[illegible]	[illegible]
Total per set of four.			[illegible]	[illegible]	[illegible]

*Abstract [illegible] before the Association [illegible] (England) by A. N. Banister [illegible]

The mileage obtained was 47,000, making the cost per 1,000 miles per wheel for the above work 1.4d., making the total cost per wheel per 1,000 miles 21.4d.

Cast iron wheels at this time cost 30s. and ran 14,000 miles. Allowing for the value of scrap, this works out at:

Cost per 1,000 miles per wheel	24d	
Cost of boring out, etc.	4d.	
Total cost per 1,000 miles		28d.
Total cost per 1,000 miles steel tired wheel		21.4d.
Saving by the steel wheels per 1,000 miles		6.6d.

The accompanying tables show conditions of these wheels at frequent intervals during the time they were in use:

Steel Wheels

Car 12, July 14, 1902				Car 11, July 9, 1902.			
New wheel Diameter 31¼ in				New Wheel Diameter 31¾ in			
10,227	Miles	"	31	12,844	Miles	"	31
16,478	"	"	30½	10,142	"	"	30⅜
21,544	"	"	30 1-16	23,780			30⅛
27,110	"	"	29⅞	26,070	"	"	29 15-16
30,147	"	"	29¾	28,464	"		29 13-16
32,680	"	"	29 11-16	31,036			29 11-16
37,173	"	"	29½	33,816			29½
38,218	"		29¼	37,772			29 5-16
40,484	"	"	29 1-16	40,965			29 1-16
42,081	"	"	28 11-16	43,287		"	28⅝
45,413	"	"	28⅝	46,220	"	"	28 5-16
45,980	"	"	28⅜	48,061	"	"	28

Ground five times; worn out Feb. 20, 1904.

Ground seven times; worn out March 19, 1904.

Cast Iron Wheels.

Car No. 3, May 26, 1904.
New Wheel Diameter 30¼ in.

4,148	"	"	30⅛
5,816	"	"	30
7,065	"	"	30
10,357	"	"	29 15-16

Still running Nov. 2, 1904.

With regard to the maintenance of wheels, Mr. Banister stated that great care should be taken to have all wheels pressed on to their axles to the same gage, the practice in Norwich being ⅛ in. narrower than the track gage at a pressure up to from 30 to 35 tons, giving 1-16 in. clearing to each wheel. This pressure should increase steadily from zero to the total amount; if the pressure is unequal, it indicates a bad fit, and there is danger of the wheel coming loose on the axle in service. It is also the company's practice to caliper the wheels once a fortnight, and if the variation in diameter in one pair amounts to 1-16 in. the wheels are ground to size; at the same time the depth of the flanges is noted, and if necessary they are ground to the original depths. Flats are ground out immediately after they are reported, and any motorman who makes two flats in six months for which he can give no satisfactory explanation is punished, as well as being punished for neglect to report a flat as soon as it is made. The result of this discipline has been very satisfactory and the number of flats reduced from two to three a week to about one a month. The time required for grinding all four wheels of one car averages 2½ hours, which includes the time taken in moving the car from the running shed to the grinding machine and back again to the shed, the wheels not being removed for grinding. It has been the experience of this company that for grinding carborundum wheels are the best and cheapest in the end, although the first cost is more than twice as much as ordinary emery wheels. In Norwich, the system is such that the cars are turned automatically, insuring an equal wear on the wheels, otherwise this should be done. If there are no diagonal braces the trucks are liable to get out of square and should therefore be tested occasionally. Considerable trouble is often the result of the brake grinding away the wheel flanges; to remedy this the company has altered the pattern of brake blocks to do away with the lip on the flange side, which also reduced the weight and consequent cost of the blocks, the saving in weight being about 5 lb. per block.

In conclusion, with regard to the maintenance of wheels, Mr. Banister said: "The average mileage of chilled wheels obtained on the Norwich tramways from date of opening, July 30, 1900, to June 30, 1903, was 14,000; from July 30, 1900, to June 30, 1904, 15,000; and last year, June 30, 1903, to June 30, 1904, 19,000. This improved result he attributed entirely to extra care and attention to the wheels and rails. Nearly all wheels having come from the same makers, it can hardly be attributed to improvement in quality; further, with this improvement comes also a reduction in price from 30s. to 28s."

Discussion.

In the discussion which followed the reading of this paper, Mr. Coutts, Ayr, stated his company had been troubled with the wheel on the pinioned end wearing more than the other, which was thought to be due from sanding only one track, the flanges wearing on the inside of one wheel and the outside of the other. In regard to punishing drivers for flat wheels, his company had considerable difficulty in finding the right man, in some instances the flats being so small at first that they were not noticed until some few days later. His experience with steel tired wheels was that they had a very short life, and he considered it a very good idea to purchase them at so much per 1,000 miles, as it gave the manufacturer an interest in producing a good article. Chilled wheels were of no use to his company, as they were continually knocking pieces off them and they were as likely to take the wrong as the right road when coming down hill.

Mr. Spencer, Halifax, stated that his company had tried cast iron wheels with very unsatisfactory results; while they had very little trouble with chipped flanges, they experienced no amount of difficulty with flats, regardless of the punishment meted out to the men. In his opinion tired wheels were the best.

Mr. Hamilton, Leeds, stated he did not agree with Mr. Banister in his opinion that chilled wheels were preferable for his purpose, and that while it might be that different qualities of rail demanded different wheels, if such were the case it seemed to him that the advantages were all in favor of the steel tired wheel. He further stated that they got an average of 21,715 miles on chilled wheels, on 20 cars, and on steel tired wheels 56,297 miles, with the cost of the former for 21,000 miles at £6 and the latter for 56,297 at £6 17s. 4d.

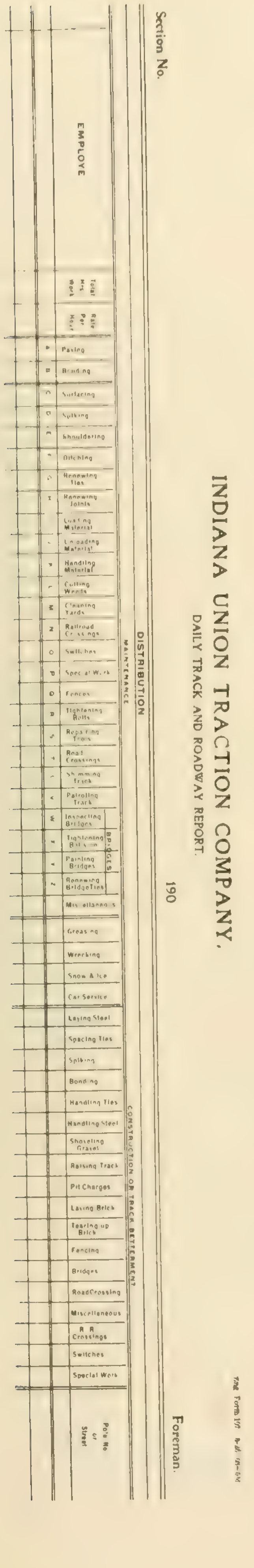
Mr. Hartly, Darlaston, observed that he had met with similar experience to that of Mr. Hamilton in regard to the steel tired wheel, the steel tired wheel in many cases reaching 76,000 miles, and 68,000 miles were common. He found that they got, approximately, about 5,000 miles at a reduction of ⅛ in. in the tire and could generally wear the tires down to ⅝ in. Regarding the brake gear coming down to the ground as the tires wore down, that was so on certain kinds of trucks, but the adjustment of the truck was such that it could be easily raised bodily, except the wheels.

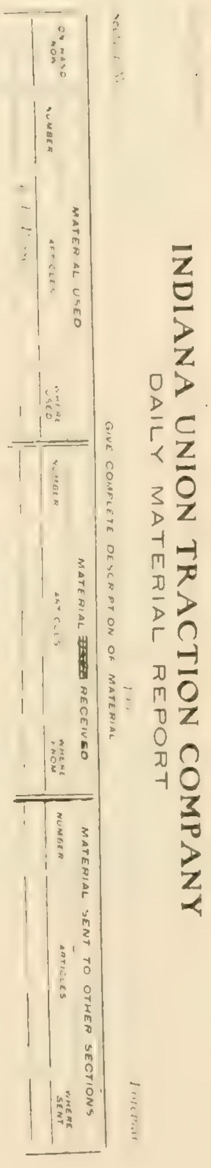
Mr. White, Grimsby, said that his company had used steel tired wheels for a little over three years, securing them at the present time fitted on wrought iron wheels, carriage paid both ways, for £2, whereas the cost of chilled wheels delivered at Grimsby was formerly £2. The results obtained from the steel tired wheel were certainly far better than the chilled wheel, the mileage of the former being from 55,000 to 60,000 as against 16,000 to 29,000.

Major Green, Wallasey, stated they had been experimenting with steel tired wheels satisfactorily. However, they had not been troubled with flats on the chilled wheels and corrugation had occurred on curves only. The practice mentioned by Mr. Banister of pressing the wheels on to a gage of ⅛ in. under the gage of the rail had been tried by them with satisfactory results.

Mr. Banister, in replying, stated that his company had reduced the grinding of wheels to a minimum, it taking 2½ hours to grind them, with a man at 5d. per hour; that through the punishment of the men they had practically stopped flats and there was no difficulty experienced in detecting the flats and finding the guilty employe. As to which was the better, his mind was quite open as to chilled wheels and steel tired wheels. He had 25 per cent of the cars fitted with steel wheels, but whether it would be a saving or not it was yet too soon to say, and that each place must be taken on its merits, as local conditions differ so much.

It is stated the Ft. Wayne & Wabash Valley Traction Co. has decided to go into the electric lighting business, and representatives of the company are visiting various towns along the line relative to this matter.





Reports for Track Department.

While [illegible] Union Traction Co., Mr. W. H. [illegible] for use in recording the work of the maintenance of way department which will be found interesting and can be followed to advantage by other engineers who have not developed for themselves forms that serve the same purpose.

The "Daily Track and Roadway Report" [illegible] of employes, the total hours worked, rates per hour and the distribution of time between the maintenance account and the construction or track betterment account. The various kinds of work performed under maintenance are 26 in number, indicated by the letters of the alphabet, besides which classification there are extraordinary items such as wrecking, snow work, car service, etc. Betterment is similarly subdivided, but there not being the same need for reference to expense accounts, these are indicated by name only.

The "Daily Material Report" is a blank 13 x 5½ in. and is ruled to show a complete description of the material mentioned on it. Foremen report on this form every day the amount of material on hand, the number of articles used and place used, the number of articles received and from where, and the number of articles sent to other sections and where sent.

Two other useful forms of engineering departments are the "Report of Track Material" and the "Report of Tools and Material Used on Track and Roadway." These cover one month. The former is 25½ x 14½ in. ruled for 31 horizontal lines with spaces at the bottom for showing the total received, total on hand last month, total used, and total on hand at date of report. Separate columns are provided for each rail section, for each dimension of ties used, for each kind of rail joint and angle bar, and for the principal special work parts, with a number of blank columns for entering material out of the ordinary. It may be mentioned that on this form are columns for 15 types of rail, 30 different dimensions for ties, 15 types of rail joints and splice bars, and 17 special work parts.

The "Report of Tools and Material Used" which is 36½ x 14½ in. is similarly ruled horizontally, but has column headings provided for all the different tools and supplies as follows:

Hand Cars, (6 columns for parts).

Push Cars, (6 columns for parts).

Lining Bars, Claw Bars, Spike Mauls, Maul Handles, Track Chisels, Track Gage, Level Board.

Track Wrenches, (4 columns for parts).

Monkey Wrench, Ax, Ax Handles, Adz and Adz Handles, (1 column blank).

Track Drills, (5 columns for parts).

Drill Bitts, (4 columns for different sizes).

Pad Locks, Keys, Shovels, Long Handle Shovels, Handles, Picks, Pick Handles, Hand Saws, Cross-cut Saws, Hand Ax.

Bolts, (6 columns for sizes).

Nut Locks, (3 columns for sizes).

Spikes, Bonds, 80D Nails.

Fence Posts, (2 columns for cedar and chestnut).

Staples, Wire Fence, Red Lanterns, White Lanterns, Lantern Holders, Red Flags, White Flags, Rail Tongs.

Track Jacks, (4 columns for parts).

Brush Scythe, (2 columns for parts).

Water Pail, Dipper, Broom, Track Broom, Snow Shovel, Tape Line, Tamping Bars, Spike Puller, Rail Curver, Jim Crow, Switch Locks, Block Filler, Raising Plates for Guard Rail, Reamers, Braces, Maddocks, End Tampers, Side Tampers, Brick Hammers, Center Punch, Rakes, Oil Cans, Grease, Lantern Oil, Machine Oil, Bench Vise, Wheeler No. 1, Wheeler No. 2, Slip Scoops, Neck Yokes, Plows No. 1, Plows No. 2, Rooters, Log Chains, Clevices, Crossing Planks (4 blank columns), Fence Braces, Br. Guard Rail, ¾ in. Wooden Washers, Cant Hooks, Wheel Barrows, ¾ in. Flat Washers.

Hack Saws, Hack Saw Frames, (3 columns for parts).

Post Hole Diggers, Grind Stone, Frame, Claw Hammer, Tile Spades, and 14 blank columns for Miscellaneous.

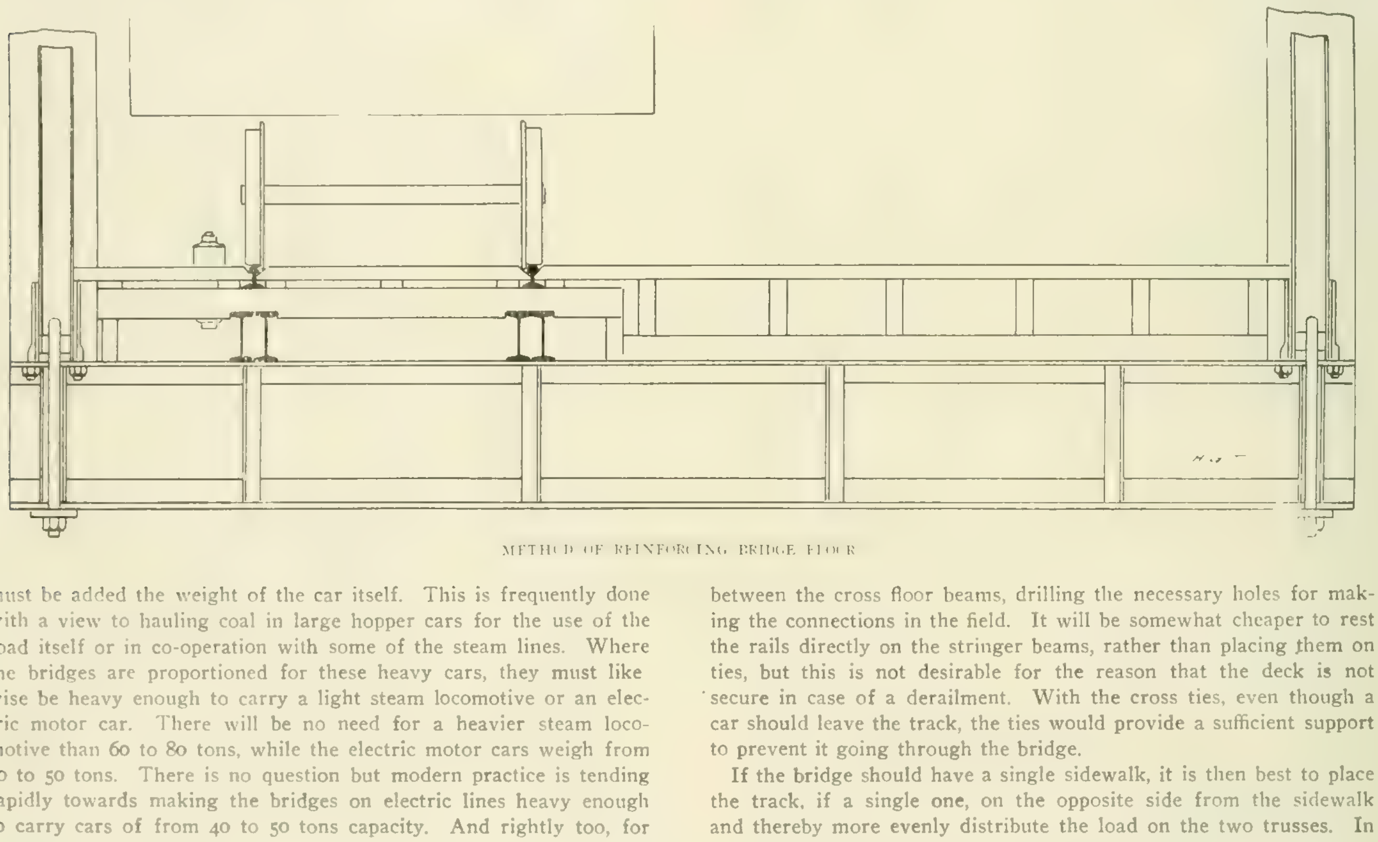
The new management of the Memphis Street Railway Co. has raised the scale of wages of motormen and conductors in long, continuous employment of the company in recognition of faithful service.

Strengthening Traction Bridges.

BY H. G. TYRRELL, C. E., CINCINNATI

One of the most serious problems confronting the engineer on street railway and traction work is the strengthening of his bridges. These bridges were built for ordinary town or city travel, and have now to sustain the weight of electric cars or be removed. In some cases the bridges are so light that the matter of strengthening them need not be considered. But in other cases the bridges in the main are heavy enough and only need reinforcing. Where the location will permit it will sometimes be cheaper to divert the line to one side of the road or highway, and build a new and separate bridge for the exclusive use of the railway. This cannot always be done. In cities and towns where the position of the tracks is necessarily in or near the middle of the street, the matter of diverting the line cannot be considered. But in rural districts it can frequently be done to advantage.

The amount of reinforcement will depend principally on the weight of the cars to be carried. In reference to the loads there is little or no uniformity. While the ordinary single truck electric street car filled with passengers will not weigh over 15 tons, and the large double trucks cars for city service only 18 to 20 tons, many roads are building their bridges to carry freight cars weighing when loaded 65 tons. These cars have a nominal capacity of 50 tons and to this



METHOD OF REINFORCING BRIDGE FLOOR

must be added the weight of the car itself. This is frequently done with a view to hauling coal in large hopper cars for the use of the road itself or in co-operation with some of the steam lines. Where the bridges are proportioned for these heavy cars, they must likewise be heavy enough to carry a light steam locomotive or an electric motor car. There will be no need for a heavier steam locomotive than 60 to 80 tons, while the electric motor cars weigh from 40 to 50 tons. There is no question but modern practice is tending rapidly towards making the bridges on electric lines heavy enough to carry cars of from 40 to 50 tons capacity. And rightly too, for the increase in loadings has gradually but surely increased and will doubtless continue to do so. But this consideration applies more particularly to new bridges than to those that must be reinforced. Generally speaking it will be impracticable to reinforce an ordinary town or city bridge sufficiently to carry heavy coal cars. If this is absolutely required it will be economical to remove the old bridge, and replace it with a heavier one. But where it becomes necessary to carry ordinary street cars only, weighing from 15 to 18 tons, then the bridge can frequently be strengthened. As a general rule, if the trusses are too light to carry the car load, it will then again be economical to replace it with a heavier one. Strengthening old trusses is a very expensive and unsatisfactory undertaking. It is difficult to add new material in such a way that it as a part of the member will take its portion of the load, and even where this can be accomplished the labor is very expensive. It must be done mostly if not entirely by hand labor on the ground and without the assistance of shop tools, and the probability is that many of the pins will be found too small. If they should be renewed with larger ones it would then be necessary to make new bottom chord eye-bars, for the size of heads would not permit of boring them out to a larger size. Such a procedure would seriously weaken the heads.

But where the trusses are strong enough, it then becomes necessary to reinforce the floor system only. This is the case where reinforcement becomes economical and practicable. In deciding on the matter of what parts must be strengthened, it is the practice of the writer to reinforce such parts as show a greater stress per square inch in the metal than 15,000 lb. for iron in tension and 20,000 lb. for steel. These figures are for the direct stresses only without impact. Where impact is considered these figures may be increased to 18,000 lb. for iron and 22,000 lb. for steel. If the tension stresses per square inch exceed these units the parts are then too light and must be renewed.

In reinforcing floor systems the points to be especially considered are the following: Size and capacity of stringer and floor beams. Strength of radical members such as floor beam hangers or long hip verticals. Number and size of rivets on the stringer and floor beam connections, and in the post plates that transmit the floor beam shear into the trusses.

The most desirable form of floor is a system of wood ties resting on double pairs of beam girders. Single girders are somewhat cheaper, but the structure is then lacking in lateral stiffness. The double beams, bolted together with separators are a much stiffer arrangement. It will generally be necessary to frame these beams in between the cross floor beams, drilling the necessary holes for making the connections in the field. It will be somewhat cheaper to rest the rails directly on the stringer beams, rather than placing them on ties, but this is not desirable for the reason that the deck is not secure in case of a derailment. With the cross ties, even though a car should leave the track, the ties would provide a sufficient support to prevent it going through the bridge.

If the bridge should have a single sidewalk, it is then best to place the track, if a single one, on the opposite side from the sidewalk and thereby more evenly distribute the load on the two trusses. In place of using a pair of double beams for a track stringer it is common practice to use a pair of steel channels under each rail, separating them either with a continuous channel or with numerous short pieces of say 10 or 12-in. channels. In the space between the two channel bars is placed a continuous piece of timber on which the rail is placed and spiked. This arrangement is preferable to bolting the rails directly to the steel stringer, for the cars run much smoother on a timber base than when placed on steel, even though there be a layer of some material such as rubber between the rail and the stringer. This arrangement however must always be used where ties or other timber is not provided.

In reinforcing the floor system a matter that is liable to cause trouble is the interference of the new stringers with the old lower lateral system. The stringers are liable to be in the way of these rods. The cheapest way of removing this difficulty is to lower the laterals, drilling new holes in the floor beam web for them if necessary.

If the bridge is a through one the overhead wires may be sus-

pended from the bridge frame. If it is a pony truss bridge or a half through girder bridge, it will then be necessary to erect poles for the support of the trolley wires.

Where the bridge floor is made of plank, it is usual to renew that portion at least that is cut by the rails.

It is not economical to expend valuable labor on relaying plank that is already half used or worn out.

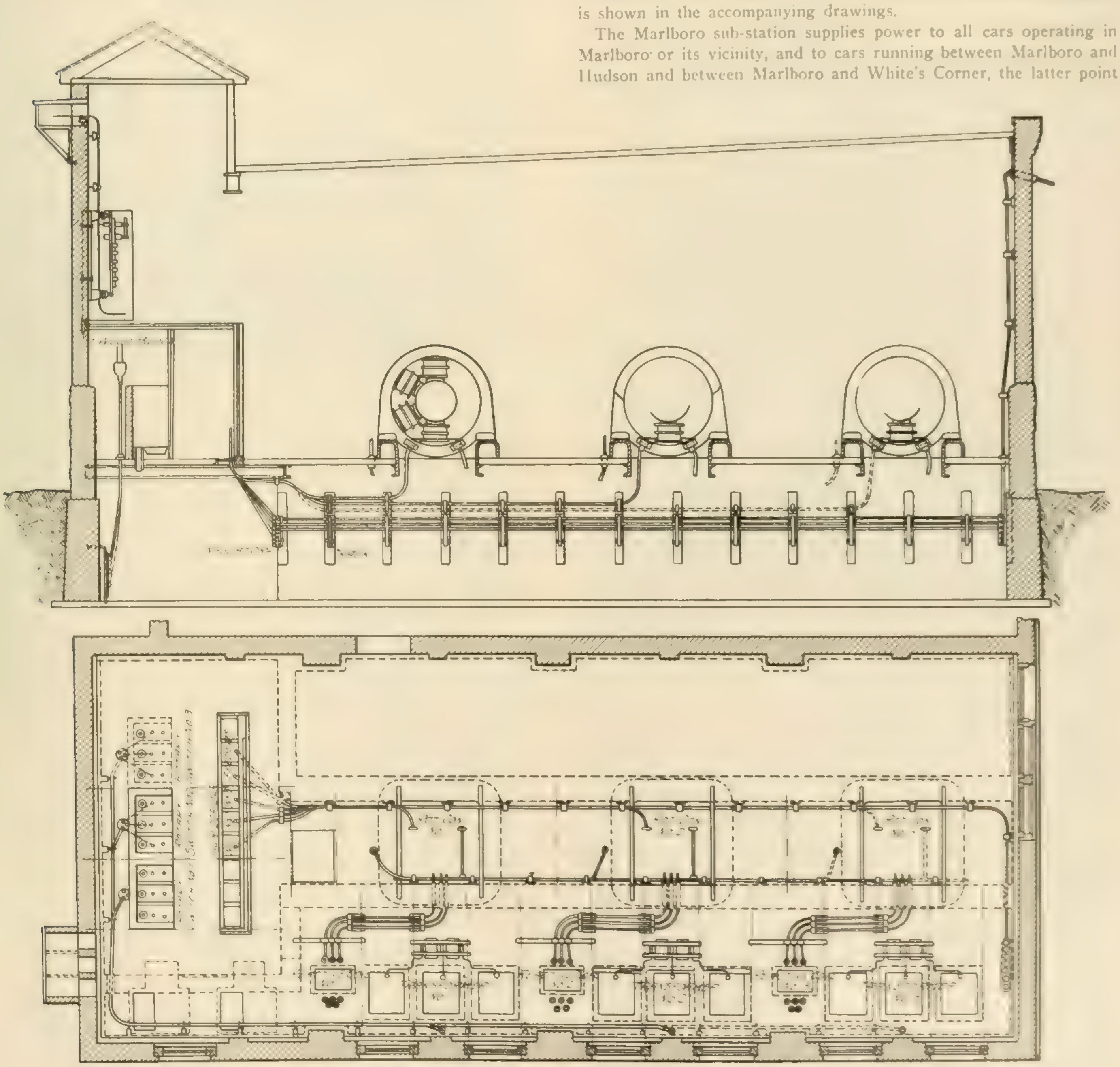
The accompanying sketch shows the most approved method of reinforcing the floor system. In this case double beam stringers are placed under each track or rail, and cross ties fastened to them. On these ties the rails are laid and spiked, and the flooring fitted in between and outside of the rails.

The Boston & Worcester New Sub-Station at Marlboro.

A new sub-station has recently been placed in operation by the Boston & Worcester Street Railway Co. at Marlboro, Mass. The equipment supplants an old belt-driven outfit consisting of a 200-kw Edison bipolar and a General Electric 200-kw. multipolar generator, the present rated capacity of the sub-station being 500 kw., with room for the addition of 250 kw. in the future.

The sub-station building is virtually an addition to the old plant and car house structure on Maple St., Marlboro, although a fire wall separates the two. The apparatus is all installed in a one-story brick building 55 ft. long [illegible] The height from the floor line to the top of the cornice is approximately 19 ft., and below the machinery room is a basement varying in depth from 7 ft. 6 in. to 7 ft. The foundations are of concrete, this material also being used in the main and basement floors. On the basis of ultimate capacity the sub-station main floor area figures approximately 1.5 sq. ft. per kw. The trimmings are of granite and the roof is of 6-ply tar and gravel construction. Inside, the roof is of slow burning or "mill" construction. The walls are 12 in. thick. An ample supply of daylight is made available by the provision of six large south windows, three east windows and three windows set in the Maple St. doors, in the east wall. A self-closing fire door (operated by gravity) faced with sheet iron, protects the door between the sub-station and the old plant, which is to be sold and the room used for storage and as a lobby for employes. A large skylight located directly over the machinery room furnishes additional illumination, and at night the sub-station is to be lighted, when fully completed, by fifteen 16-c. p. incandescent lamps arranged in three series groups of five each. Additional lights will be available in the basement when they are needed. The building was designed by Mr. E. H. Kitfield, of Boston, consulting engineer of the Boston & Worcester Street Railway Co. The arrangement of the equipment is shown in the accompanying drawings.

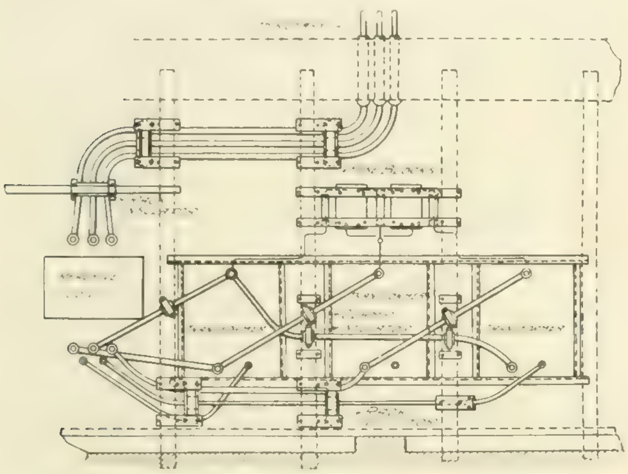
The Marlboro sub-station supplies power to all cars operating in Marlboro or its vicinity, and to cars running between Marlboro and Hudson and between Marlboro and White's Corner, the latter point



PLAN AND SECTION OF THE MARLBORO SUB-STATION

being the junction of the Boston and Worcester air line electric road with the Marlboro and Hudson branch. It also helps the Westboro sub-station and the Framingham power station of the air line in supplying power to cars in the vicinity of White's Corner, on account of its proximity to the junction point. The distance from the Marlboro sub-station to the main line at White's Corner is about 3.4 miles.

Current is supplied to the sub-station at 13,200 volts, three-phase, over a transmission line which taps the main transmission circuit of the Boston & Worcester at White's Corner. In the near future the line will be connected clear through to the Framingham power station separately from the present arrangement. Between White's Corner and the sub-station the line is divided into two sections. One of these consists of about 2¾ miles of three-phase aluminum circuit equivalent in carrying capacity to No. 2 B. & S. copper; the other section consists of about 3-5 mile of a three-phase lead covered, paper insulated cable running in Marlboro from the Southboro line to the sub-station. Two 500,000-cm. low-tension feeders for supplying the trolley with 600-volt current leave the Marlboro sub-station, one going to the Southboro line and the other northward towards Hudson. There are no lightning arresters in the sub-station, this apparatus being located at the Southboro line, where



TRANSFORMER CONNECTIONS, MARLBORO SUB-STATION.

the cable section begins. The cable was installed between the Southboro line and the sub-station because local political conditions rendered it inexpedient to run a three-phase circuit of the usual type within the municipal limits of Marlboro.

Upon the completion of the sub-station, knife switches will be installed to cut the high tension current off the wiring in case it is desired to make inspection or repairs. From the knife switches the current passes to the automatic oil switches mounted in the 2-in. soapstone barriers at the west end of the building. From the oil switches the circuits run in lead covered cables 2¼ in. in diameter through the basement on racks shown in the vertical section, to the transformers. These are installed in two groups of three 100-kw. transformers each, one group feeding each rotary, there being two 250-kw. rotaries in the sub-station. The transformers are all of the air-blast type, the primary and secondary voltages being 13,200 and 380 respectively. The air pressure is ⅜ ounces. The portion of the basement beneath the transformers is laid out as an air duct. There are two Buffalo Forge Co's. fans, each direct driven by a 4-pole, 2-h. p., 380-volt induction motor at 750 r. p. m. These are located together at the west end of the rotary room, and beside each induction motor is a switch panel carrying a triple-pole double-throw switch which enables the motor to be thrown upon either group of transformer secondaries.

The rotaries are started by connecting them with the alternating current transformer supply through reactive coils; 190 volts is the potential used in bringing the rotaries well up to speed from a standstill, after which full potential is thrown on. Each rotary is provided with a double-throw switch for this purpose. There are two reactive coils, each being rated at 32.5 volts at 420 amperes. The rotaries are 6-pole 25-cycle machines, making therefore 500 r. p. m. At 50 per cent overload capacity for two hours each gives an output of 375 kw. Momentary overloads of about 90 per cent have been handled without the slightest trouble. The full load voltage is 600.

The switch board is of black enamelled slate and consists of nine panels, three of which are blank. Each unit has an a. c. and a d. c. control panel, and there are two feeder panels. The a. c. panels carry the usual standard equipment of power factor indicators, ammeters, voltmeters, oil switch release coils and manual lever switches for opening the oil switches. Each d. c. rotary panel is equipped with a recording wattmeter having a cyclometer dial, an ammeter with a range of 800 amperes, and the usual positive switch, etc. The station lighting switches are installed single-pole double-throw, so that the lights may be thrown upon either the rotary or the direct current bus-bars. The feeder panels are each equipped with a 1,500-ampere ammeter, circuit breaker and switch. The d. c. voltmeter is mounted on a bracket so that it can be easily seen from the rotaries.

Practically all the wiring is run in the basement, which has concrete walls and ample room in which to work. The negative circuit comes directly from the track in a straight line through the basement in the form of six No. 0000 B. & S. trolley wires bunched together. Four of these wires are continued to the second rotary. The oil switch trips are also mounted on the basement ceiling. The most striking feature of the new sub-station is its compactness and the care which has been given to the design of the basement and its layout of wiring. Good light and liberal elbow room, with plenty of fresh air abound. The improvement in street railway service which has resulted from the opening of the sub-station for business is most evident throughout the territory which it supplies with power. The installation has been made under the general oversight of Mr. M. V. Ayres, electrical engineer of the Boston & Worcester Street Railway Co.

Street Sprinkling by Street Railways.

In the Review for June, 1904, we called attention to the arrangements that had been made by several street railway companies whereby they were able to derive substantial profits from the sprinkling of streets in the respective cities where they operated, and more than offset the cost of sprinkling their tracks, a burden imposed by the franchise. For this work the roads mentioned use the McGuire-Cummings compressed air sprinkling car. The compensation received for sprinkling varies in different places. One company receives 60 cents per mile for each trip of the sprinkling car; another gets $200 per year per mile of track sprinkled; others receive from 75 cents to one dollar per mile of street per day. In one case the street railway company is sprinkling the street from curb to curb for 15 cents per linear foot of street, a service for which the property owners formerly paid 26 cents per foot.

It seems to be generally considered that there is no better way of making friends for the railway than by sprinkling the streets at the proper time. In some places it is the practice to begin sprinkling in the early morning, getting the streets wet down before the sun is up, thus enabling the men to cover a greater surface in a given time, as they are not delayed by team traffic during those early hours. As sprinkling will wash the rails clean and reduce the amount of power required to operate cars, a considerable saving may be counted upon in this respect. Pleasure riding is increased to a marked degree when patrons can rely upon the road being free from the dust nuisance.

To do street sprinkling in a satisfactory manner it is necessary to have sprinkling cars of large capacity, and equipped with apparatus that will enable the water to be thrown from curb to curb of the widest streets. The McGuire-Cummings Manufacturing Co's. pneumatic sprinkler is provided with an independent electric motor driven air compressor, controlled by an automatic governor, stopping the motor as soon as the maximum pressure is reached, and starting automatically when air is used. It embodies the well-known and well tried plan of the air brake system. Either or both sides of the street may be sprinkled as desired, and the stream is readily controlled from maximum to quick shut-off.

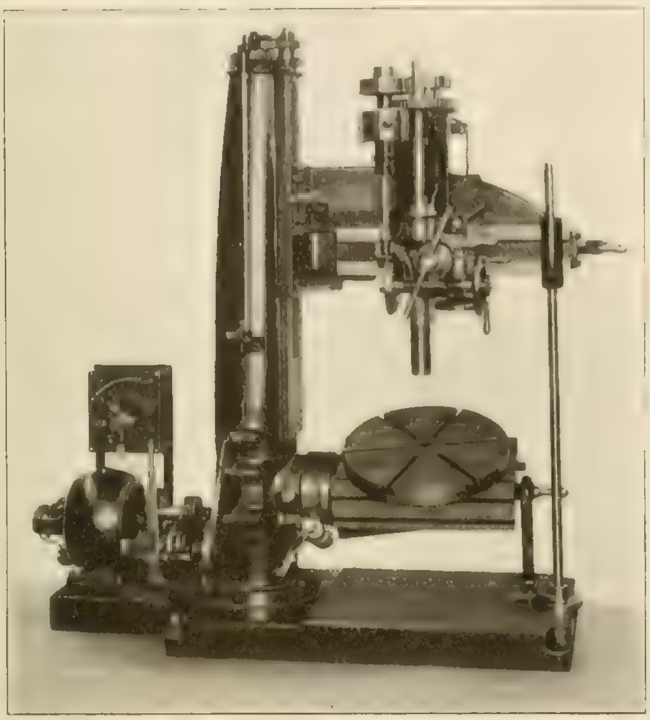
It is stated that the Old Colony Street Railway Co. contemplates the introduction of a freight business over its direct line from Middleboro, Mass., to Boston, in response to the demands of shoe manufacturers along the line.

Modern Machine Tools.

Radial Drill With Motor Drive.

The accompanying illustration was taken from a 2½-ft. radial drill manufactured by the Hamilton Machine Tool Co., of Hamilton, O., driven by a direct connected variable speed motor.

The motor is of 1½ h. p. capacity for 220 volt direct current, and has a speed variation of from 800 to 1,600 r. p. m., the connecting



"HAMILTON" 2½-FT. RADIAL DRILL.

gearing being arranged to double the number of speeds afforded by the motor itself. As will be noted, the motor and two-speed connecting gearing are located on the base of the machine, the starting box and gear controlling lever being placed adjacent to each other so that it is an easy matter to obtain any required speed.

In other respects the machine is a standard "Hamilton" radial drill with 2½-ft. arm, one of three sizes manufactured by the company, the others having 3½ and 5-ft. arms respectively. The 2½-ft. radial will drill to the center of a circle 62 in. in diameter, takes 41 in. between spindle and base, and 31 in. between spindle and top of table.

These radials are prominent on account of their stiff and powerful design and by virtue of combining so many labor-saving features with a simple and mechanical construction. The tapping device, for example, instead of being an extra attachment to be tacked on when wanted at any point most convenient for the builder, is incorporated into the original design and made a part of the machine itself. It has a powerful friction drive, insuring easy operation, backs out the tap at increased speed, and works equally well with either right or left hand taps.

The geared power feed is another improvement that is greatly appreciated. Six feeds are provided for each spindle speed, those on the larger sizes being entirely gear driven, with an automatic safety release to prevent breakage under excessive strain, and the smaller size having a combined belt and gear feed.

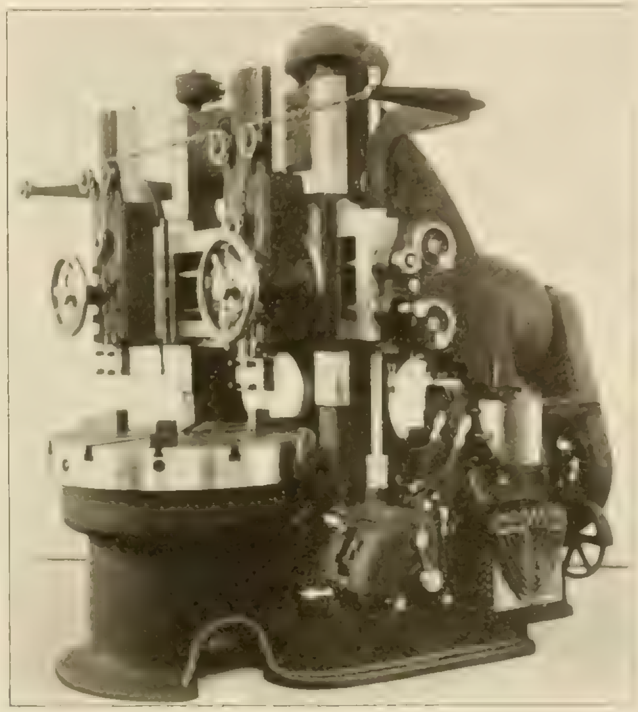
The machines are complete with back gears, power feed, automatic trip and tapping device; the arm is raised and lowered by power; ball bearings are used on the column, the spindle and the arm elevating screw. The tables provided are of various styles, the machine shown in the illustration being equipped with worm swiveling and round tables.

The workmanship and materials throughout are of the best, all [illegible] accurately cut from the solid. Wherever severe stress occurs the gears are made either of cast steel or hard phosphor-bronze, and all exposed gears are protected by [illegible].

"Gisholt" Boring Mill.

The distinguishing features of the "Gisholt" boring mill, manufactured by the Gisholt Machine Co., Madison, Wis., and which is shown in the accompanying illustration, are the powerful friction back geared headstock, the convenient position of all operating levers, the positive automatic trips for all feeds, feed dials which may be set to trip any feed at any predetermined point, the micrometer index dials on all feed screws reading to .0010 in., making the machine practically self-calculating, the single pulley drive, giving a constant belt feed, the ease of adaption to motor drive and the encasement of all gears.

To speak more in detail, the application of the friction headstock in the boring mill is a decidedly unique idea and the installation and successful operation of this feature in the large machines is due



GISHOLT BORING MILL.

largely to the efforts of the Gisholt company. Although the headstock and all driving mechanism are located at the rear of the machine, which keeps it well out of the way, levers are placed in such position as to be within easy reach of the operator. The headstock is self oiling, and being of the friction type, there is no necessity for starting or stopping the motor or shifting the belt in order to set the table in full operation or to move it but a fraction of a revolution. It is further claimed that this form of headstock also reduces the cost of motor equipment, inasmuch as a variable speed motor will give a very good arrangement of speeds. Six mechanical changes of speed are provided in the headstock, and there are twelve speeds to the table.

All feeds are provided with positive automatic stops and it is only necessary to set the feed tripping index dials at the point desired and the tool stops accurately at that point. Micrometer dials indexed to .0010 in., as previously stated, are provided on both feed rods and feed screws, thereby reducing the amount of necessary measuring and calipering to a minimum. Two heads are provided, independent in their action and controllable from either side of the machine. All

[illegible] operated either by power or by hand and a range of ten feeds is given. A turret head may be substituted for the right hand head and either the turret head or the ordinary head may be fitted for screw cutting. The cross rail is provided with large bearing surfaces, is of very rigid construction and is raised or lowered by power. The table may be a universal combination chuck, fitted with three movable top jaws, or a face plate with independent jaws may be substituted if desired.

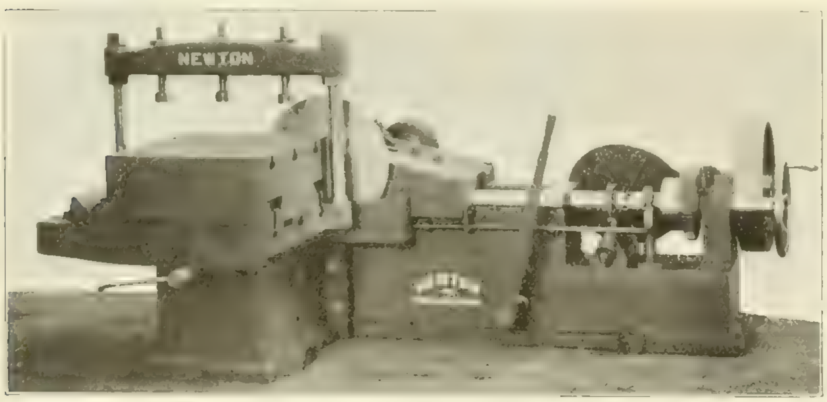
The machine is of massive design, with the metal distributed so as to minimize the strains attending work at high speed and with heavy cuts. The machine requires no foundation, being practically self contained. These mills are manufactured in six sizes, viz.: 34-in., 42-in., 54-in., 60-in., 64-in., and 74-in., respectively.

Newton Cold Saw Cutting Off Machines.

To meet the increasing demand for a machine to rapidly cut off metal of different shapes, the tools manufactured by the Newton Machine Tool Works, Philadelphia, Pa., have recently been redesigned. We illustrate herewith the No. 1 combination cold saw cutting off machine manufactured by this company, which type of machine is best adapted for street railway repair shops on account of the wide range of work that can be cut on it.

The saw, which is 20 in. in diameter, is driven through the gearing by a phosphor bronze worm wheel and hardened steel worm of steep lead. The carriage has a wide range of variable automatic feeds and power quick return to carriage, both movements being controlled with automatic stops.

The engraving shows the machine belt driven; it is however, adapted to direct motor drive. The work table is fitted with a V-block and auxiliary or top table, both of which are removable. The V-block is used in cutting off round or square stock up to 5 in. in diameter, and the top table can be used for clamping any sections 5 in. high by 16 in. long, which is the capacity of the machine. The V-block can be removed and the top table moved to one side to facilitate the mitering of beams, channels, T and girder rails, etc. The machine also has a capacity for I-beams up to 10 in. The machines are furnished with one saw, independent saw-sharpening machine, five-gallon keg of lubricant, countershaft and wrenches for the machine. The machines are very heavy and rigid, are powerfully driven, and are adapted to the heaviest work within the capacity of the tool.

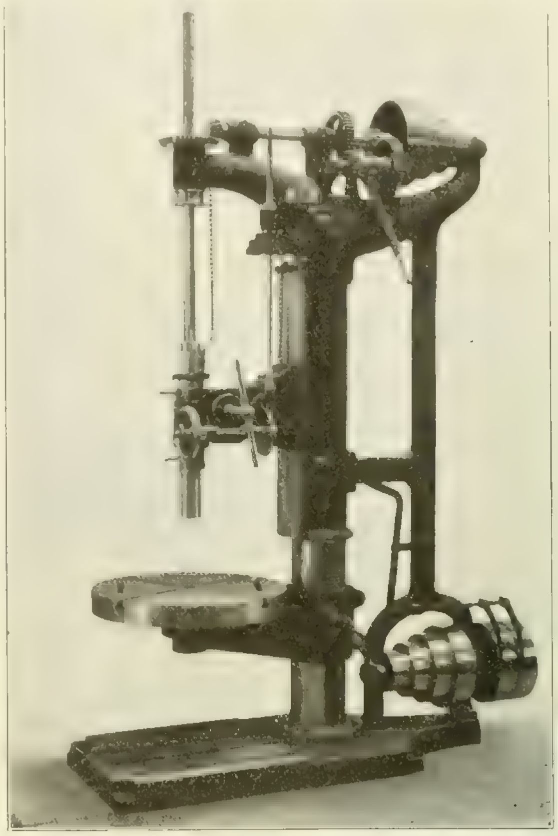


"NEWTON" COLD SAW CUTTING OFF MACHINE NO. 1.

"Hamilton" Upright Drill Presses.

Herewith is illustrated the "Hamilton" 32-in. upright drill press, one of an improved pattern made by the Hamilton Machine Tool Co., of Hamilton, O. These drills have been entirely redesigned and in addition to being heavier and more powerful than formerly made, contain such improvements as the company's long experience has proved to be desirable. The 32-in. drill shown illustrates the appearance and general design of the five sizes of which a specialty is made.

The base is deep, heavy and strongly braced by transverse and fan-shaped ribbing, so as to prevent springing when under heavy work. It is accurately placed and amply provided with large T-slots for clamping down work. The column is of large diameter and has a wide bearing for the sliding head. It is firmly supported by a strong back brace.



"HAMILTON" UPRIGHT DRILL PRESS.

The sliding head has a long bearing on the column and can be firmly locked in position by large bolts having case-hardened heads. The clamping device takes up the wear automatically, no loose gib being required. The sliding head is counterbalanced by a weight in the column and can be easily raised and lowered by means of a rack and pinion. The spindle is also counterbalanced.

The spindle is made from a crucible steel forging of best quality and is of large size. It is provided with quick approach and return by means of a rack and pinion operated by a lever. The spindle has both hand and power feed for each feed. Ball bearings are used to take up the end thrust of the spindle.

The back gears can be instantly engaged or disengaged by means of a lever descending parallel to the column, no wrench being required. The bearings for the back gear shaft and top shaft are planed at one setting, so as to bring them into correct alignment. The top shaft runs in split bearings lined with high-grade babbitt metal.

The power feed will commend it self as being unusually convenient. Instead of cone pulleys, the various feeds are produced by means of two cones or gears, the changes being made while the machine is in motion by simply shifting the sliding shaft or pull-pin placed just beneath the gears, within easy reach. This arrangement permits the use of an unusually wide feed belt which requires no changing.

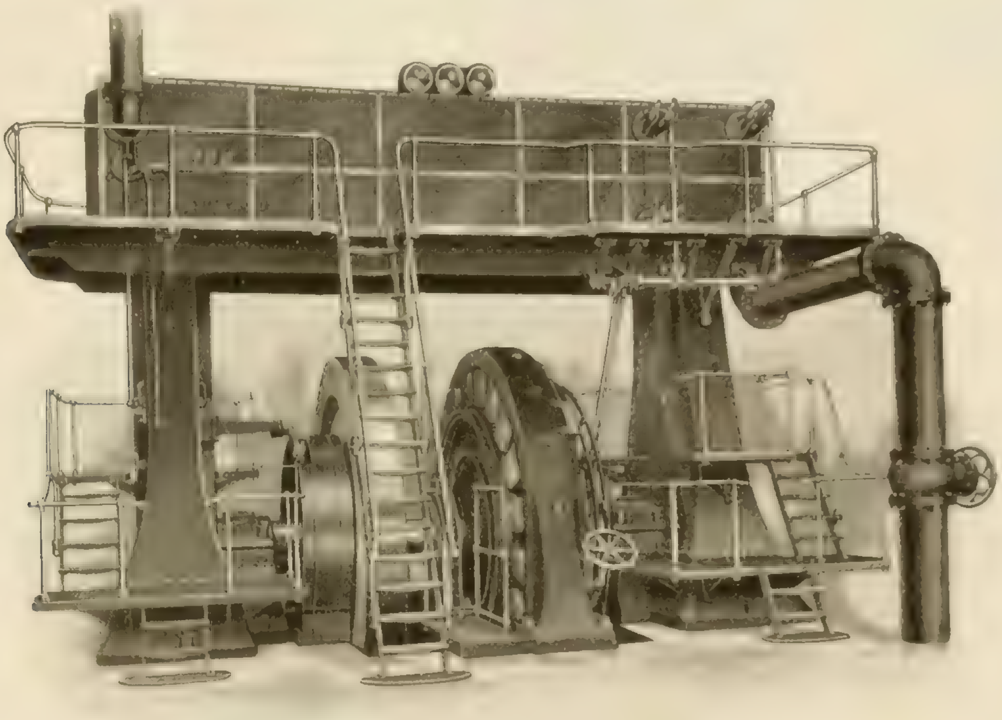
The friction feed mechanism is efficient. The steel worm-shaft is bored its entire length, allowing the knurled nut for tightening the friction to be conveniently placed at the front of the drill. The worm wheel is in one piece and is made of the best phosphor bronze.

The automatic stop is simple, substantial and positive in action. The movable collar can be instantly set by the graduations on the spindle sleeve and trips the feed instantly when the required depth is reached, without attention from the operator. The table arm is adjustable on the column and can be swung around clear of the base. The table can be turned in its socket and is provided with numerous slots for receiving clamping bolts.

McKinley Syndicate Properties of Northern Illinois. II.

Power Plant of the Illinois Valley Railway Co.

The power house is located on the bank of the Illinois & Michigan Canal basin in LaSalle, and is a brick building [illegible] It is divided near the center by a brick partition wall into an engine room and a boiler room. Along the north side of the building, on which side the boiler room lies, is a spur track upon which coal for the boilers is delivered in carload lots, and is discharged through doors onto the boiler room floor. The boiler room contains four 300-h. p. Heine boilers, of which three are set in one battery and one alone, with sufficient space alongside the latter for eventually adding two more units of the same capacity. Two of these boilers are supplied with Green chain grate stokers which are driven by means of a variable speed motor with a rheostat control. This device, which was designed by Mr. H. E. Chubbuck, general manager of the Illinois Valley Railway Co., who also designed all of the



500-KW. [illegible]

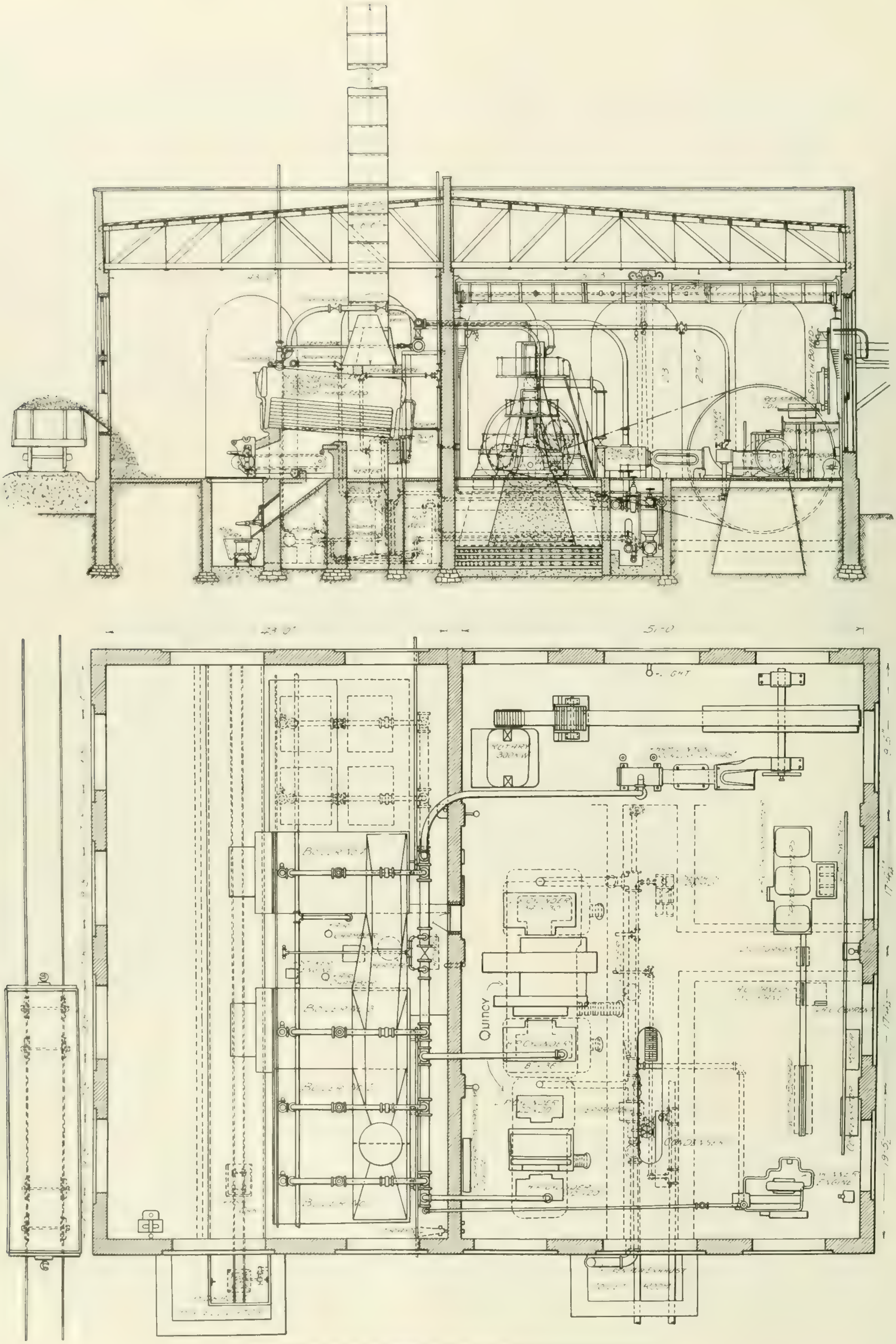
engineering features of this plant, operates entirely automatically and maintains the boiler pressure constant with great efficiency. A Locke damper regulator is installed in the engine room, the movable lever of which has a chain attached to it which operates the handle of the rheostat controlling the chain grate motor. When the steam pressure in the boiler rises a pound or two above the pressure for which the apparatus is set, the regulator acts to close the dampers and at the same time the rheostat is moved so as to slow down the motor and reduce the speed of the stoker travel. Should the steam pressure fall this action is reversed, and the regulation is so close that the variation in pressure is confined to one or two pounds. For boiler feeding there are two Knowles pumps, one 12 x 8 x 12 in. and the other 10 x 6 x 9 in. in size. A hot well is located between the two batteries of boilers, collecting all the drips, and from the hot well water is pumped to a Worthington closed heater. Draft for the boilers is provided by a 5-ft. 6-in. steel stack, 150 ft. high.

A 14-in. steam header is located above and at the rear of the boilers near the partition wall. The boilers are connected to the header by means of long bends in each of which is an automatic check valve.

A [illegible] arrangement has been provided for disposing of the [illegible] boilers; in the tunnel is laid a track over which hand cars can be operated. [illegible] A car on the tunnel track is brought directly under one of the chutes leading from each ash pocket and the ash from each boiler is thus discharged directly into the car. At one end of the building is a small elevator on which the ash cars are raised from the tunnel to the street level, and the ashes are then carried away and distributed.

This power plant was designed to furnish current for both the Illinois Valley Railway Co. and the Citizens' Lighting Co., which are two distinct but closely allied corporations controlled by the same interests and operated under the same management. The engine room contains one 500-kw. General Electric double current machine which is direct connected to a "Quincy" compound vertical engine built by the Quincy Engine Works, Quincy Ill. There is also a Western Electric Co. 120-kw., 220-volt generator direct connected to a smaller "Quincy" engine, and a 300-kw. double current Stanley generator belt driven from a 20 x 48 in. Hamilton-Corliss simple engine. The "Quincy" engines, as will be seen from the plan and elevation drawings of the station, are of the vertical type with the generators mounted between the high and low pressure cylinders. The larger engine has [illegible] at 150 r. p. m.; its nominal rating is 670 h. p. with a maximum capacity of 1,100 h. p. The smaller "Quincy" engine has cylinders 12 and 22 by 20 in. and runs at a speed of 180 r. p. m. The initial steam pressure is 145 lb. The regulation on these engines is guaranteed within 2 per cent on the normal load and 2½ per cent on the maximum load.

Space has been left in the engine room for the addition of another similar railway unit, and provision has been made for (when the new unit shall be installed) a system of electrical control which will be governed from the switchboard to vary the speed of the



SECTION AND PLAN OF POWER HOUSE, ILLINOIS VALLEY RAILWAY CO.

engines at will, 2 per cent either way from normal, for the purpose of synchronizing.

All the bearings on the engines and generators are ... lubricated by means of a gravity oiling system, with ... pipe and sight feed valves at each bearing. The steam ... cylinders are lubricated by three automatic oil pumps. ... separator is used on the exhaust line.

The direct current from the railway generator ... at standard voltage and feeds directly into the trolley line. The 370-volt alternating current from the other side of this generator is fed to three 150-kw. General Electric oil-cooled transformers, which step the current up to 13,000 volts, at which pressure it is transmitted to the sub-station.

The high-tension transmission line is 13 miles long. About one-third of the capacity of the generator is utilized for alternating current and two-thirds for direct current.

In addition to the strictly railway equipment, this station contains a National Electric Co. air compressor, of the same type as used for the air-brake equipment on cars. This is used for pumping oil,

Citizens Lighting Co. Plants at La Salle, Ill.

H. L. Chubbuck,
General Manager.

L. W. Bedard,
Superintendent.

and for supplying compressed air for cleaning, and is operated as needed, by hand.

There are also two balancing sets for the three-wire lighting system, one of which balances 5 kw., and the other 15 kw. The day lighting is supplied by a 60-kw. unit of the Western Electric Co. make, which generates at 220 volts, and is driven by a ... engine. A 10-ton hand crane spans the engine room.

The high-tension lines within the station are carried on Locke glass [illegible] bar to clear the hood, and thence out to the poles. This arrangement, while very simple, is of advantage for the reason that every [illegible] house the high-tension circuit has a 225-ft. span over the basin of the Illinois & Michigan canal, and for this span the wires are carried on 85-ft. poles, which may be seen in the illustration. This leaves a clearance of 65 ft. at high water.

Third-Rail Insulators.

The recent developments in heavy electric traction work and more particularly the equipping of the New York terminals of the great steam railway systems with electric locomotives are being watched with keen interest by many persons, both from an engineering and from a traffic manager's point of view. The heavy electric traction work in and about New York City will be used as an example in much similar work which is sure to follow both in the East and other parts of the country. The several systems which have been equipped for excessively heavy traffic, all have been fitted with the third-rail as their working conductor. It therefore seems appropriate to enter into a close study of this part of the distribution system and its essential details.

After having chosen the form of conductor rail which is best suited to meet the conditions under consideration and after having detailed the plans for the cable work which will connect the different sections of this rail, there remains the choosing of a suitable support for the conductor rail.

A third-rail insulator in order to serve its purpose well must have certain essential characteristics: It must be a mechanically strong column that it may safely hold a heavy rail to proper gage and elevation; it must have a sufficiently large creepage surface of well sheltered insulation to furnish an insulation resistance so high that there will be practically no leakage between the third-rail and the tie; it must furnish a strong seat which will retain the rail from any lateral movement yet allow it to move freely along its longitudinal axis, and it must be provided with an ample base by which it can be so securely fastened to the tie that any local movement of the tie or rail will not disturb the relative position of the third-rail and track rails. These general requirements are approached by all the successful third-rail insulators on the market.

[illegible] as an insulating medium for third-rail insulators and which in its several different forms is now used by a large percentage of the third-rail roads, both in this country and abroad. For making insulators a class of granite is selected which has crystals of a very [illegible]

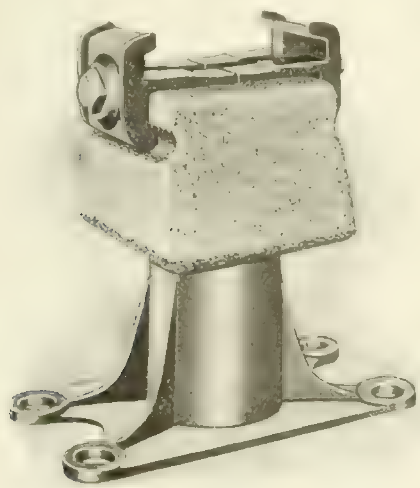
COURTENAY TYPE OF INSULATOR.

into the desired form under heavy pressure and then fused into a solid mass at a temperature approximating 3,000° F. When used for insulating purposes reconstructed granite is highly glazed to prevent any accumulation of dirt. This glazing process insures a long life for the high resistance qualities of the block. The reconstructed granite differs from natural stone in many important respects, namely:

1. Being vitreous it does not contain or absorb moisture, hence, it can be heated red hot and dropped into water without cracking.

2. It is of unlimited durability, not being affected by heat or any commercial acids.

3. It is exceedingly strong, its crushing strength ranging from



INTERBOROUGH RAPID TRANSIT CO. THIRD-RAIL INSULATOR.

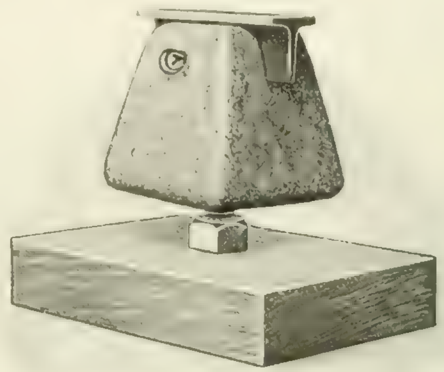
12,000 to 15,000 lb. per sq. in. and its tensile strength from 800 to 1,000 lb. per sq. in. of cross section.

4. It possesses high ohmic resistance.

These essential properties of an insulating medium have after many years of severe tests in all sorts of climatic conditions placed it in high regard as an ideal material for third-rail insulators and similarly constructed articles. The accompanying illustrations show several types of the product of the Reconstructed Granite Co., of No. 14 Dey St., New York City.

The Courtenay type of insulator is one which because of its simple, substantial design and high insulating qualities combined with low cost has been installed on many miles of the more important third-rail systems. All parts of this insulator are easily separated and can easily be removed from the track without disturbing the third-rail. The same body can be used to support contact rails of varying widths of base by merely changing the size of rail clips.

The General Electric Co's. standard type third-rail insulator with reconstructed granite insulation consists of three parts. A cap protects the insulating block and has cast upon it lugs for holding the rail in place and bosses which lessen any friction due to the sliding of the third-rail from the cause of expansion or contraction. The



SPECIAL DESIGN INSULATOR FOR T-BAR SECTIONS.

reconstructed granite block and its protecting cap of this insulator are mounted upon a three-footed malleable iron pedestal by means of which the insulator is bolted to the tie.

The type of insulator used throughout the Brooklyn elevated system is known as the Martin patent type, the general design of which is similar to the General Electric type, except that no bosses are provided to lessen the friction. The retaining lugs on the malleable iron cap are designed for being bent over the base of the rail. This cap is loose from the rest of the insulator which permits vertical play to accommodate the motion of the track under wheel loads.

The reconstructed granite third-rail insulators which were furnished the Interborough Rapid Transit Co. in connection with the New York subway consist of a broad four-footed malleable base, upon which is mounted a rectangular block of reconstructed granite, but differing from the other insulators which have just been de-

GENERAL ELECTRIC TYPE.

scribed; these subway insulators have no protecting cap, because the entire track is underground and is not subject to the effects of weather. The insulating block of this insulator is surmounted by a pair of malleable iron clamps, which bolt together and tightly clamp the base of the rail to the top of the reconstructed granite block.

For "pony" feed rails, which are used for signal systems, traveling cranes, scenic railways, etc., a reconstructed granite block is made in the form shown in the accompanying illustration. This block is so arranged that it provides a secure seat for T-bars of small sections, and is of such proportion and so designed that it may be placed either vertically or horizontally.

Recent Street Railway Decisions.

EDITED BY L. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1892 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible] to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V [illegible] 1905. Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $[illegible]; single volume, $2.00.]

RUNNING DOWN VEHICLE FROM BEHIND.

Richmond Passenger & Power Co. vs. Allen (Va.), 49 S. E. Rep. 656. Feb. 2, 1905.

A street car company operating its railway upon a public street, the supreme court of appeals of Virginia holds, cannot run down a vehicle from behind, under any ordinary circumstances, without negligence or willful wrong. It further holds that it is not negligence to drive a vehicle, with curtains down on sides and rear, upon the tracks of a street railway in a public street. It says that the duty the party injured in this case owed the car coming up behind her was to get off the track when she knew of its approach. She did not know of it. If the gong was sounded, or any other warning given, neither she nor her companion heard it. They were not bound to keep an impossible watch to the rear to avoid an injury which, under any ordinary circumstances, could only result from culpable negligence or willful wrong on the part of the company.

DUTY OF PERSON PASSING BEHIND CAR AND STEPPING ONTO OTHER TRACK.

Reed vs. Metropolitan Street Railway Co. (N. Y.), 73 N. E. Rep. 41. Jan. 24, 1905.

A person passing behind the rear of a car, and stepping onto the track where a car may be approaching from the opposite direction, the court of appeals of New York holds, is bound to satisfy himself that the way is clear.

INJURY TO PERSON ATTEMPTING TO BOARD MOVING CAR.

Boulfrois vs. United Traction Co. (Pa.), 59 Atl. Rep. 1007. Dec. 31, 1904.

As to one who gets on or off a moving car, and is injured by so doing, the supreme court of Pennsylvania says, the standard does not shift; he is negligent per se. But if he escaped injury by that act of his own, yet subsequently, no matter how short the time, from his own first act, by the distinct act of negligence on the part of the conductor, he was injured, he can recover damages.

QUESTION OF NEGLIGENCE IN STEPPING FROM MOVING CAR DEPENDENT UPON ITS SPEED.

Cody vs. Duluth Street Railway Co. (Minn.), 102 N. W. Rep. 397. Dec. 30, 1904.

In an action against a street railway company for injuries to a passenger, the supreme court of Minnesota holds that a request to charge that, if the plaintiff jumped or stepped off the car while in motion, she could not recover, was properly refused, because it was indefinite as to the speed of the car on which the question of negligence in stepping therefrom would depend.

NOTICE DUE PASSENGER WHERE TRANSFERS ARE GIVEN ONLY ON CERTAIN ROUTE.

Holmes vs. Interurban Street Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 57. Feb. 16, 1905.

The appellate term of the supreme court of New York maintains that, even if it assumes—but without deciding—that the defendant may lawfully select one of two or more alternative routes upon which it will give transfers, it certainly is bound to take some steps to notify the passenger before he began his journey and before he reached a point where the alternative route will be no longer available.

STEPPING ON FARTHER TRACK WITHOUT LOOKING FOR CAR CONTRIBUTORY NEGLIGENCE.

Gurdiner vs. St. Louis & Meramec River Railroad Co. (Mo.), [illegible] S. W. Rep., 928. Dec. 22, 1904.

The plaintiff ran across the company's north track to where an eastbound car had stopped on the south track, and handed his brother, who had just got on the car, a key. Then he turned to go back on the way he came, stepped on or near the north track, and was struck by a west-bound car on that track, which dragged him 100 feet, and then ran 100 feet farther before it stopped. There was no gong sounded or other signal of this car's approach. The supreme court of Missouri, division No. 1, holds that the trial court did right to direct a verdict for the defendant on the plaintiff's evidence, as his act in stepping on or near the north track without looking for the west-bound car was negligence which contributed to cause the accident.

TIMELY NOTICE REQUIRED OF DISCONTINUANCE OF TRANSFERS OVER ONE OF TWO ALTERNATIVE ROUTES.

Freeman vs. New York City Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 47. Feb. 16, 1905.

The proof showed that the plaintiff could have traveled to his point of destination by pursuing another route, over which, as he knew, the defendant issued transfers. It also showed that he had frequently traveled over the route he selected, and had always theretofore been given a transfer. There was no evidence that any notice of the discontinuance of the issue of such transfers was given to him when he boarded the car, or until it had traveled some blocks. At that time no alternative continuous route was available. In affirming a judgment in favor of the plaintiff the appellate term of the supreme court of New York holds that, even if it be conceded that where there are two alternative routes between the same points the defendant has the right to grant transfers over only one and refuse it over the other, timely notice should in some manner be given to the passenger while it is still open to him to use either route.

REFUSAL TO ACCEPT TRANSFER EQUIVALENT TO REFUSAL TO GIVE ONE—TRANSFERS AS EVIDENCE OF COMPANY OPERATING LINE.

Harris vs. Interurban Street Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 42. Jan. 30, 1905.

There being no testimony showing that the plaintiff failed to take the proper car when required to make a transfer, nor any reason advanced for the refusal of the second conductor to honor the transfers given by the first conductor, the appellate term of the supreme court of New York holds that under such circumstances it might well be held that a refusal to accept a transfer was equivalent to a refusal to give one, and thereby rendered the company liable to the statutory penalty provided for failure to give transfers. But it was shown that there were at least two lines of cars running over the same tracks at the place of transfer in this case, and the court holds that while the transfers given to the plaintiff, and admitted in evidence, might be taken as showing that the defendant controlled and operated one of the lines, in the absence of other evidence the court could not determine whether or not the car

[illegible] by the plaintiff ran over a line controlled and operated by [illegible] that such was the fact it could not assume

NOT ENTITLED TO QUESTION USE AND OCCUPATION OF RIGHT OF WAY.

Robertson Mortgage Co. vs. Seattle, Renton & Southern Railway Co. (Wash.), 79 Pac. Rep. 610. Feb. 21, 1905.

This was an action in equity instituted for the purpose of requiring the railway company to condemn and pay for a strip of land occupied and used by it as a right of way, or to vacate the same in the event of its failure to condemn. It appeared that in 1896 a party who then owned all the capital stock of the plaintiff and controlled the plaintiff corporation delivered to the manager of the railway company the following written instrument: "Dear Sir: In consideration of the benefits to accrue to me by the building of an electric railway from Seattle to Renton, I agree to give you the use of a right of way for said railway over all the lands owned or controlled by me in what is known as Bryn Mawr Park, * * * the location of the same through said Bryn Mawr Park to be subject to my approval and acceptance," etc. After the execution and delivery of this instrument the railway company accepted the same, and relying upon its terms, proceeded to procure additional right of way for its line, incurred a large amount of additional expense and outlay, entered upon lands of the plaintiff, and constructed and operated its line thereon with the plaintiff's consent. The supreme court of Washington thinks that the railway company's contention that the plaintiff was and should be estopped from interfering with its possession and use of said right of way should be sustained. It says that there was some conflict of evidence as to whether the plaintiff actually agreed or assented to the exact line of the right of way as now occupied by the railway company, but that it is satisfied with the finding of the trial court that such agreement or assent had been made. It being true, therefore, that plaintiff had consented to the right of way now occupied by the railway company, and the latter having accepted the plaintiff's written agreement above set forth, and having entered into the possession of said right of way after the execution of said agreement with the consent and acquiescence of the plaintiff, and the plaintiff having failed to question such use or occupation for a period of more than seven years, the plaintiff surely should be, and was, estopped from questioning such use or occupation of said right of way, or from disturbing the railway company's possession thereof.

NOT SUFFICIENT EVIDENCE OF INJURY.

Heltzen vs. Union Railroad Co. (R. I.). 59 Atl. Rep. 918. Jan. 24, 1905.

It has been held, the supreme court of Rhode Island says, that a verdict for a plaintiff will be sustained, if supported as to the main issue only by the plaintiff's own testimony, providing that is definite, consistent and intrinsically reasonable. In this case the plaintiff testified that she was riding as a passenger on the defendant's electric car in the forenoon of August 9th; that she signaled the conductor to stop the car at the entrance to a certain store; that the car stopped there, and she started to get out; that when she was about half out, with her left foot on the running board of the car and her right foot nearly to the ground, the car suddenly started up in response to a signal from the conductor; that she grasped with her right hand a support on the seat in front of her seat, in order to prevent being thrown to the ground; that she was jerked violently back and forth, and struck her side against the support in front; that the strain on her hand was so great, and the pain so severe, that she had to let go, and somehow got to the ground upon her feet; that her thumb was badly hurt, and her whole right arm very painful; and that she sustained severe and permanent injuries in consequence of the accident. Although there were a number of passengers on the car, including a lady acquaintance of the plaintiff, who sat on the seat beside her, and alighted just before her, the plaintiff was the only witness to testify concerning the accident. She obtained a judgment for damages.

In granting the defendant's petition for a new trial, the supreme court of Rhode Island says that it seems remarkable, if not incredible, that the plaintiff could have been the victim of an accident at the time, place and in the manner she described, which inflicted such severe and lasting injury upon her, without in some way, directly or indirectly, consciously or unconsciously, voluntarily or involuntarily, by act or outcry, word or deed, attracting the attention of one other person to the fact that she was injured. From the testimony it appeared that nobody upon or in the vicinity of the car knew that anything of the sort was transpiring, but, on the contrary, the conductor, motorman and such passengers as were called at witnesses positively denied it. In such circumstances the court was unable to say that the verdict was sustained by the evidence.

RELATIVE RIGHTS AND DUTIES OF STREET CARS AND OTHER VEHICLES.

Greene vs. Louisville Railway Co. (Ky.). 84 S. W. Rep. 1154. Feb. 16, 1905.

It is incumbent on all travelers on the highway, the court of appeals of Kentucky says, to exercise ordinary care for the safety of others using the highway. The operators of street cars are bound by this rule no less than other persons on the highway. The only difference between a street car and other vehicle is that it cannot turn aside as other vehicles, but must stay on the track, and it is entitled to the use of the track without obstruction from other vehicles; but it can no more run down another vehicle by negligence than any other traveler on the highway may do so, although the vehicle may be upon its track. In operating in public streets rapidly moving cars propelled by electricity it is incumbent on those having charge of them in the crowded highway to exercise care commensurate with the circumstances for the protection of others, and to this end they must keep a lookout ahead of the car.

If the plaintiff was obstructing with his wagon the railway track, he might be punished for this under the city ordinance; but he was lawfully upon the highway, and had the right to use one part of it no less than another, although occupied by the track of the street railway. If, while on the street car tracks, he was struck by the car without negligence on the part of those in charge of the car, when his presence on the track could not be discovered by them in the exercise of ordinary care in time to avert the injury, he could not recover. But he was not a trespasser on the track, and he had the right to anticipate that a proper lookout would be kept by those in charge of the cars, and that ordinary care would be exercised by them as in the case of other vehicles to avoid running into him.

Again, the court says, that in lieu of certain other instructions the jury should have been told that the plaintiff was lawfully upon the street, and had the right to use any part of it; that the defendant was entitled to the use of its tracks for the free passage of its cars; that it was the duty of those in charge of the defendant's car to keep a lookout for persons and vehicles upon the track and to exercise ordinary care to discover and avoid injuring them; and that it was the duty of the plaintiff in using the street to exercise ordinary care for his own safety and the safety of others. As the words "reasonable diligence" and "reasonable care" were used in an instruction with regard to the care required of the defendant, the jury should have been told that reasonable diligence or reasonable care was ordinary care.

CITY WITHOUT AUTHORITY TO ASSESS STREET RAILWAY FOR BENEFIT FROM ELIMINATING GRADE CROSSING.

Fair Haven & Westville Railroad Co. vs. City of New Haven (Conn.), 59 Atl. Rep. 737. Jan. 31, 1905.

A city charter made the city a highway district, over the streets and highways of which the court of common council was given "sole and exclusive authority and control." It also empowered the common council to order, lay out, construct, repair and alter streets, highways, bridges, etc., except as otherwise provided, whenever and wherever, in its opinion, the public good should so require. And it provided that the court of common council might, upon the execution of any order for the paving, macadamizing or other improvement of any street or highway within the city, or upon the construction or alteration of any public work, assess upon the persons whose property was, in the judgment of said court, especially benefited thereby, a proportional and reasonable part thereof.

The principal question in this case was whether the city had the power to assess benefits against a street railway company where

the work in question was the elimination of a grade crossing, which had become a dangerous one. The supreme court of errors of Connecticut says that it was a work which the city, under the provisions of its charter, was not obliged to do. Indeed, it was one which, upon its own initiation, it had no power to do. It was a work of more than local concern, and for that reason the power to order it to be done did not rest with the city, but almost exclusively with the railroad commissioners. It was a work ordered to be done by the state, in the exercise of its police power, through its agent, the board of railroad commissioners, to whom it gave almost plenary power to order what should be done, and how, and by whom, and at whose expense it should be done, and within what time it should be completed. It was ordered to be done by the state, through its agent, the railroad commissioners, and the work was done by the state through its agents, the city and the railroad company. The city was compelled to do its part of the work whether its officers and agents voted to do so or not, and without regard to the question whether the work would be an improvement to the street or of the slightest benefit to the city; and if it had finally refused to do the work, the state might have done it through some other agent, and imposed the cost of so doing it upon the city. It was true that the city ultimately performed its part of this work through the ordinary agencies provided for in its charter; but this did not change the essential nature of the work, or make it any the less a special, limited burden imposed upon the city for a limited time, outside of its charter duties and obligations. The court is of the opinion that no such work as the one here in question was contemplated or provided for in the charter, and consequently that the city had no power under its said charter to assess benefits against the street railway company.

With regard to state statutes, there were in force when the city began to perform the order only three which had any direct bearing upon the question under consideration. One provided, in substance, that where a town, city or borough changed the grade of a highway, damages and benefits might be assessed by the municipality to and against owners of land adjoining the highway. Clearly, this provision, limiting as it did the power to assess benefits to cases where the property benefited adjoined the highway, the court says, gave the city no power to make the assessment here in question.

A second statutory provision was: "The proper authorities of any city or borough, unless otherwise provided in its charter, may assess * * * the benefits accruing to any person by the layout, grading or alteration of any highway," etc. But this, the court says, must be read in connection with the third statutory provision above referred to, which provided, in effect, that the railroad commissioners might, in a case like the present, order the street railway company to pay such reasonable part of the expense of eliminating a grade crossing as they might deem proper. This act, the court thinks, put the whole matter of benefits to be paid by a street railway company in a case like the present one into the hands of the railroad commissioners; and its provisions were inconsistent with the existence of a power in the city to assess benefits against the street railway company in a case of this kind. In brief, the court thinks that the statutory and charter provisions upon which the city relied, when read in the light of the legislation in reference to grade crossings and street railways, failed to show that the city had the power to make the assessment here in question.

LIABILITY FOR SHOOTING OF PASSENGER BY CONDUCTOR AFTER ALIGHTING FROM CAR.

O'Brien vs. St. Louis Transit Co. (Mo.), 84 S. W. Rep. 939. Dec. 22, 1904.

The plaintiff's evidence tended to prove that her husband (Michael O'Brien) was a passenger on one of the defendant's street cars, and was carried a block beyond his destination, for which he had signaled the conductor to stop. Provoked at it, he spoke angrily to the conductor about it, and a quarrel of words between them ensued. During the quarrel he was getting off the platform backwards, facing the conductor, who was striking him, or striking at him, with the butt end of a pistol. When he stepped down from the platform the conductor followed him to the sidewalk, holding to him, and beating him with the pistol. Arriving on the sidewalk, the two men clinched. O'Brien got behind the conductor, threw his arms around him, holding his (the conductor's) arms down by his side, and in the struggle the conductor pointed his pistol around and fired, inflicting a fatal wound.

It is the duty of the carrier [illegible] care to carry the passenger safely to his destination, but also to [illegible] in the carrier's vehicle he is entitled to protection from assault, even from strangers, if, by the exercise of the degree of care de[illegible] treat him by the hands of its own servants. If it be conceded, therefore, that under the law of master and servant the conductor was outside of the field of his employment when he followed (if he did so) this man to the sidewalk and assaulted him, still, under the law of carrier and passenger, the man was under the care and entitled to the protection of the carrier, not only while he was in the car, but while he was alighting, and until the act of alighting had been entirely accomplished. Whilst it is true a conductor is not employed to follow passengers out to the sidewalk and beat or shoot them, yet they are employed to protect them from assault while they are leaving the car and to see that they alight in safety. If a stranger on the car had done to this man what the evidence for the plaintiff tends to show the conductor did, and if the conductor could have prevented the wrong by the exercise of a very high degree of care, and failed to do so, the defendant would have been liable. With what stronger reason, therefore, is the defendant liable when the conductor himself is the offender?

But whilst care on the part of the carrier for the safety and kind treatment of the passenger are required, yet so, also, are required care on the part of the passenger for his own safety and decent behavior. If the passenger assaults the conductor, the latter has a right to defend himself, and if in a personal combat between the passenger and the conductor, brought on by the passenger's wrongful assault, the latter is injured, the carrier is not liable. If, as the defendant's evidence tended to prove, O'Brien struck the conductor, and then seized him and dragged him off the car to the sidewalk, it was then an affair between man and man, and the defendant was not liable for what happened on the sidewalk. It was a fair case, under the evidence, for the jury, if the instructions had been right

From the principles above laid down the court concludes that there was no error in the following instruction: "The court instructs the jury that if they believe from the evidence that plaintiff's husband, just before alighting from said car at Thirteenth and Hebert, called the conductor thereof vile names, and struck said conductor, and that said conductor, in resenting said insult and repelling said assault, then struck plaintiff's husband, and that he dragged said conductor from said car, and that a fight then ensued on the ground, off of said car, between him and said conductor, in which said plaintiff's husband was shot, and that as a result of said shooting he died, then said plaintiff is not entitled to recover, and your verdict must be for the defendant." This instruction, the court says, supposed a case in which the plaintiff's husband was the assailant, and instead of being interfered with in leaving the car, he dragged the conductor to the sidewalk, and the combat there was the natural result of his own conduct.

But the following instruction, the court holds, was erroneous: "The court instructs the jury that if they believe from the evidence that plaintiff's husband cursed the conductor on said car, and called him vile names, while in the act of alighting from said car, and that at that time said conductor had neither struck plaintiff's said husband nor cursed him, such conduct on the part of said plaintiff's husband was disorderly, and constituted a breach of the peace; and if they further believe from said evidence that said conductor, in resenting said insult, engaged in a fight with said plaintiff's husband on the street off of said car, but not upon said car, in the course of which said plaintiff's husband was shot and that he died from said injuries, then said plaintiff is not entitled to recover, and your verdict must be for the defendant." The court says that this instruction supposed the case of the passenger's disorderly conduct while in the act of alighting in cursing and calling the conductor a vile name, thereby causing a breach of the peace, and the conductor, resenting the insult, engaged in a fight with him on the street, off the car, in which fight the passenger was shot. The writer of that instruction had in mind the authority of the conductor to preserve the peace. A conductor is charged, for the protection of his passengers,

with the duty of preserving the peace on the car of which he is in control. But in this instruction the duty of the conductor to preserve the peace in the interest of his passengers is merged in his own right to resent an insult. The instruction drops out of view, as if it were immaterial, the question of whether the conductor was dragged off the car, as defendant's evidence tended to prove, or voluntarily followed the plaintiff's husband to the sidewalk, and there undertook to preserve the peace. It would be an extraordinary case (of which no example now occurs to the court) that would justify a conductor, in his capacity as a preserver of the peace, to follow the offender to the sidewalk. And even in suppressing violent conduct to preserve the peace the question of whether unnecessary force was used should be considered, and that question was omitted in the instruction.

Another instruction was to the effect that if O'Brien struck the conductor before the latter had made any assault on him, and a fight ensued on the street, off the car, during which the conductor shot and killed O'Brien, the defendant was not liable. Suppose it had all happened on the car; suppose O'Brien struck the conductor, and a fight ensued, and in the course of the fight the conductor drew his pistol and shot him—could the court say with those facts, and nothing more, that the company was not liable? The law does not degrade the manhood of a conductor. He is entitled to resent an insult or an assault; but an insult or a blow does not, under all circumstances, justify the killing of the assailant. Even if the slayer was answering to an indictment in such case, he would have to show something more than that he had been insulted or struck, in order to be entirely acquitted. But here we are supposing a man who, although, it may be, was misbehaving, yet still was in a measure under the care and protection of this conductor, who was then and there pro hac vice (for this turn) the carrier itself. Can it be said that because the man was abusive in his language, and struck the conductor, the latter had the right to shoot him down? If the company would be liable under those facts if the killing occurred on the car, then it might or might not, according to circumstances, be liable if the killing occurred off the car. If, after striking the conductor, the man seized him and pulled him off the car to the sidewalk, and the fight there ensued, the defendant would not be liable. But if, after striking the conductor, the man was trying to get off the car, and the conductor was holding him and beating him, and thus followed him to the sidewalk, and killed him, the company would be liable. This instruction was therefore erroneous.

WHEN COURT MAY DECLARE AS TO CONTRIBUTORY NEGLIGENCE AS MATTER OF LAW IN CROSSING ACCIDENTS—RIGHTS IN USE OF PUBLIC HIGHWAY—APPLICATION OF PRINCIPLES TO ACCIDENT CASES—CONSIDERATION TO BE GIVEN POSITION AND SPEED OF CAR—DUTY OF DRIVER OF VEHICLE AS TO WATCHING FOR CARS—SPEED AS AFFECTED BY LOCALITY—MEASURE OF CARE REQUIRED AT ALL TIMES.

Indianapolis Street Railway Co. vs. O'Donnell (Ind. App.), 73 N. E. Rep. 163. Jan. 27, 1905.

When the established facts of a given case show, without room for diverse inference, that the plaintiff did not have reasonable ground for believing that he could cross without danger, then his contributory negligence, the appellate court of Indiana says, may be declared by the court. If one deliberately or indifferently cast himself under the wheels of a street car, or those of any other vehicle, the lack of room for the inference of ordinary care upon his part enables the court to adjudge contributory negligence as a matter of law. The facts may also be of such a character that the court may adjudge absence of contributory negligence as matter of law. They are rarely called upon to do so. But if, when the plaintiff started to cross the track, he had seen a street car half a mile away, which, contrary to any reasonable expectation, was brought in collision with him before he could clear the track, in the absence of further notice of the impending danger than the mere presence of the car at the distance named could give, it might be decleared as a matter of law that he was not contributorily negligent.

In the actual use of a public highway every person has an equal right to use it for his own best advantage, to suit his own convenience or pleasure, but at all times with a just regard to the like rights of every other person. If the facts exhibited come short of what is required to enable the court to declare contributory negligence, it is the misfortune of the defendant, the defense being an affirmative one by statute. If the existence of certain facts is inconsistent with such declaration, their absence must appear from the evidence in order that it may be made.

There is constant difficulty in the application of the foregoing well-established doctrine, due to the variety of facts connected with the different occurrences which come before the courts for examination. The main features of many accidents have a general likeness to each other in that injuries are suffered through collision, but the details which give character to the conduct of the parties are not twice alike. Unanimity of decision is therefore attained when the same principles are applied in every case. Unanimity of result in upholding or overthrowing judgments rendered against street car companies for damages on account of such collisions is neither possible nor desirable. Each case must be determined upon its own facts. The language of different opinions cannot be disassociated from the facts before and considered by the court.

When the plaintiff in this case started to drive across the tracks, the car which subsequently collided with his wagon was some distance away. What that distance was was one relevant fact. It might be of predominating importance, and it might be of very minor consequence. If the car had been stationary, its mere presence on the track would not be a menace. If its movement was such as to indicate an intention to stop or so moderate as to suggest no likelihood of a collision, he could not, in proceeding upon his way, be held blamable because of its mere presence. So that the rate of speed at which a car moves, the measure of control apparently exercised over it, as well as that actually maintained, must always be taken into account in connection with the fact of its presence, and it is necessarily true that no court can set up a standard of distance and say that one who attempts to cross a street car track when a car is within that distance is guilty of negligence. Much less can it be said that one who attempts to cross in front of an approaching street car irrespective of distance is guilty of negligence.

Where there is nothing to prevent a traveler from seeing an approaching car, it must be presumed that he did see it, or that he did not look. Whether his action in view of what he saw was negligent, and whether he was negligent in not looking, must depend upon all the attendant relevant circumstances, part of which are found in the necessity of his position. The driver of a vehicle has other duties than watching for street cars. He must keep a lookout to avoid being struck by other vehicles of other qualities and kind, and must, before all, be vigilant to himself avoid colliding with and inflicting injuries upon others. When the evidence shows that he was in no wise constrained, knowledge of what he might have seen will be attributed to him, and knowledge or lack of knowledge as to the distance of the car, its condition as to being in motion or stationary, and if in motion, its rate of speed, the apparent purpose of the motorman to check or increase speed, and many other facts, are necessarily relevant and of differing importance. In determining the quality of the action taken by an individual in a certain juncture, his environment must be considered, and it is to be observed that the traveler is not required to anticipate negligence on the part of those in charge of an approaching car, but, on the contrary, has the right to presume that reasonable care will be exercised by them.

Ordinarily, contributory negligence, when its existence depends upon so many elements and circumstances the weight of which depends upon their relation to each other, will be for the jury, whose judgment as to what a reasonable man should do in view of the circumstances, which cannot be classified, it is the constant effort of the law to obtain. When the conditions existing are such as cannot consist with injury while the injured part is exercising ordinary care, the courts will not indulge the idle formality of submitting such issues to a jury, but will dispose of the issue in accordance with the rule heretofore stated.

The statement in an instruction that "a car may be run at a higher rate of speed in the suburbs, or in sparsely settled parts of the city, than it may be in the thickly settled, populous or crowded portion thereof," is the statement of a fact which it is the province of the jury to determine, and which may not properly be stated by the court as a matter of law. The measure of care required is at all times the same—i. e., ordinary and reasonable care.

Rail Bonding on the Brooklyn Heights Railroad.

BY HOWARD C. FORBES, [illegible]

In the operation of electric cars the subject of rail bonding, always one of great importance, has become within the past few years more complicated than ever. In heavy traction work on elevated lines the requirements have increased to such an extent that greater capacity is now demanded in the return circuit than can be furnished by the rails themselves. It has become necessary, therefore, to use the metal of the elevated structure to supplement the rails for the purpose of conducting the current back to the power station. As a practical solution of this problem of heavy bonding the work now in progress on the elevated structure of the Brooklyn Heights R. R. is very interesting. The purpose here was not only to use the track rails for the return circuit but to increase this circuit by utilizing the longitudinal girders of the elevated structure, bonding these girders at every joint and connecting between them and the track rail by means of equalizer bonds at frequent intervals.

This modern practice necessitates the use of copper rail bonds of enormous capacity, and it becomes difficult and expensive to secure

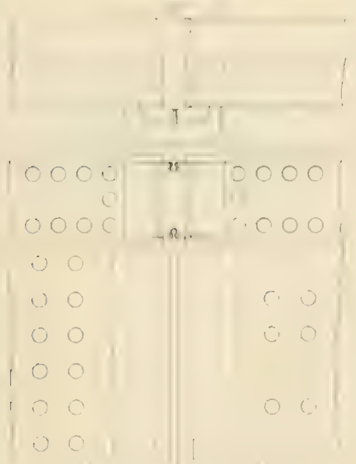


FIG. 1

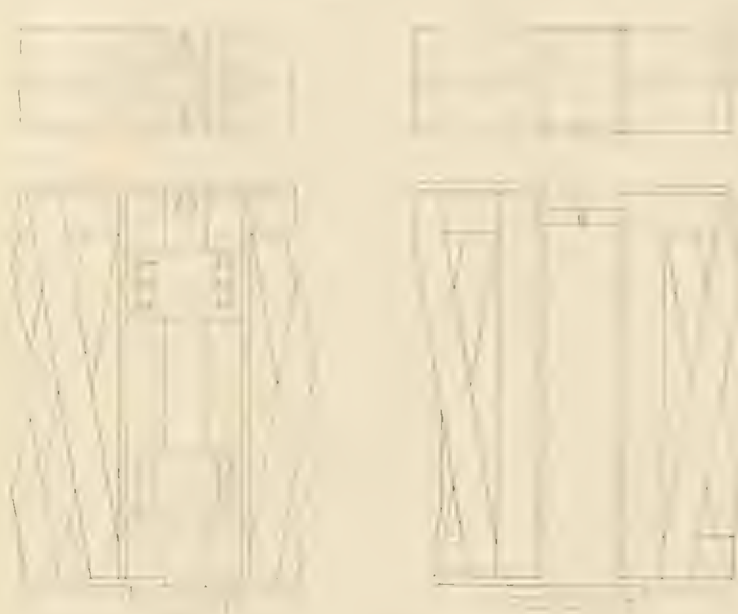


FIG. 2.

such a return circuit by means of any of the so-called plug terminal or riveted terminal rail bonds. In the installation of plug terminal bonds the first difficulty is in securing contact terminals comparable with the cross section of the bond itself. Such terminals should have an area equivalent to at least ten times the cross section of the bond. The physical conditions as to thickness of rail web and flange, the size of terminal which can be expanded or compressed, and the injury to the girder, make this impossible except on the smaller sizes of bonds. The second important difficulty in the application of this type of bond is in securing a permanent mechanical and electrical contact between the terminal and rail. In the manufacture of the plug type of rail bonds it is of prime importance to secure a perfect union between the several strips or laminations at the terminal and to secure this union without the application of excessive heat. It is practically impossible to successfully weld these laminations, which consist of thin strips of copper, because at high temperature the surface of the copper rapidly oxidizes, preventing an electrical contact between the layers, shortening the active life of the metal at or near the terminal and affording opportunity for the destructive action of moisture.

Within the past 18 months soldered rail bonds have been rapidly attracting general attention, although they have been in practical and successful use for four years or more. With the soldered rail bond the difficulties of securing a permanent mechanical and electrical contact between the terminal of the bond and the rail are overcome. The soldered rail bond, carefully made and properly installed, will give the most perfect form of electrical contact, and [illegible] have yet seen upon the market.

[illegible] elevated structure, equivalent to 30 miles of single track, is to be bonded. The capacity of the bonds is to be one million to four million circular mills per joint. The type of bond used is known as the Thomas soldered rail bond, manufactured by the Lord company. The elevated structure in question is located on Broadway, Lexington Ave., Grand Ave., Myrtle Ave., Adams St., High St., Sands St. and a large part of Fulton St. in Brooklyn.

Fig. 1 shows the type of structure and bond used on Broadway, part of Fulton St., Lexington Ave., Adams St. and Myrtle Ave.

The longitudinal girders are to be bonded throughout in capacities ranging from 1,000,000 to 4,000,000 cm. per joint, depending upon the car service and the proximity to the sub-station. These bonds are all in units of 500,000 cm. In addition to this there is being installed on every third running rail of both tracks a No. 0000 equalizer bond connecting from the running rail to the longitudinal girder. The track rails themselves are being bonded with a No. 0000 bond at each joint and the third or service rail with a 750,000-cm. bond at each joint. These are replacing plug terminal bonds.

Fig. 2 illustrates the structure and bond used on Grand and Lexington Aves. and at the East New York Loop.

This very complete system of bonding so as to utilize the track rails and structure girders for a return circuit was decided upon after exhaustive tests by the Brooklyn Heights Railroad Co's. engineers.

Not all of the structure was built at the same time, consequently there are several types for which it was necessary to design special bonds. On portions of the structure the longitudinal girders are riveted to the transverse girders with expansion joints at frequent intervals, but in most cases the longitudinal girder rests on the transverse.

Fig. 3 shows expansion joints and type of bond used on Myrtle Ave. and Fulton St.

Before the work of bonding was begun drawings were prepared showing the several types of structure and the bonds for each, together with tabulated drawings showing the number of joints, the number of bonds per joint, the distances, and giving other necessary information so that the work could progress systematically and economically.

Fig. 4 is a view of the type A bond which is used on the track rail, third rail and several sections of structure.

The bonds are all made as short as possible but with ample provision for expansion and contraction. To any one acquainted with the Brooklyn Heights elevated structure it would be obvious that the problem of applying bonds to the members indicated is not an easy one. The use of a portable grinding machine or other equipment on the tracks is prohibited, and to scrape by hand the surface of the girders and remove the paint and rust would be a very slow and expensive process. The surfaces of the rail and structure are cleaned by means of a sand blast, the equipment being located in the street below. After these surfaces are cleaned and all traces of paint, rust and scale removed, they are heated by means of a gasoline torch, thoroughly tinned and the bond clamped in position and soldered. After the bonds have cooled and the clamp has been removed they are subjected to several tests, one of which is a strain test of several hundred pounds per bond. This test is made by means of a special lever and spring scale and is always under the supervision of the engineer of the railroad company.

Fig. 5 shows the type B bond which is used on the expansion joints.

Fig. 6 is a view of one of the two portable sand blast outfits used by the Lord Electric Co. in connection with this work. This outfit consists of one Westinghouse B-4 motor driven air compressor, mounted on a substantial platform truck between the two air reservoirs which are 24 x 48 in. This compressor is one of the types in general use with the Westinghouse air brakes where they are installed on electric cars. It consists of a duplex, horizontal, single-acting pump and a direct current series railway type motor mounted on a common bed plate. The compressor develops approximately [illegible] h. p. when pumping against [illegible] lb. air pressure, and has a capacity of 50 cu. ft. of free air per minute with 550 volts line current.

The positive lead to the motor is connected to the trolley wire of the surface road. Current is also taken from the trolley wire for light where occasion requires. The negative lead from the motor is connected directly to the base of one of the structure columns. On the front of the wagon is placed one of the Westinghouse form E electric pump governors and connected in the positive lead to the motor so that at the given maximum and minimum pressure in the reservoirs the motor compressor will be automatically started and stopped. The connection from the reservoirs to the governor is a small pipe and flexible hose running from the front

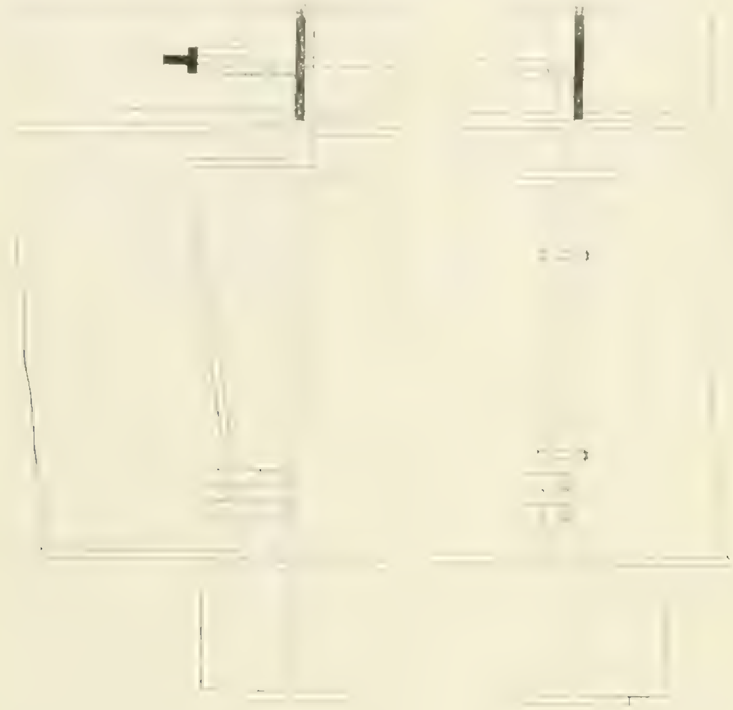


FIG. 3.

FIG. 4.

FIG. 5.

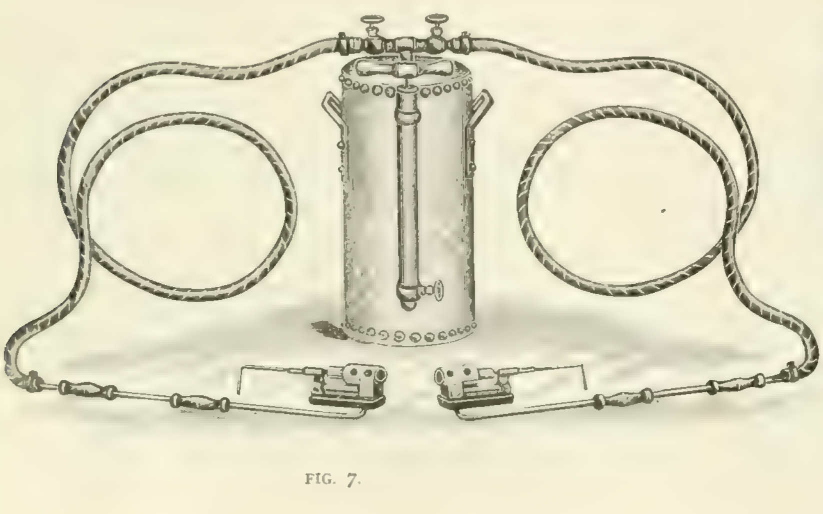


FIG. 7.

FIG. 6.

reservoir to the governor under the foot board. The supply of air and sand can be regulated independently of each other. The sand used is common beach sand.

The hose from the bottom of the sanding device is carried up onto the elevated structure and the blast applied through a suitable nozzle to the surface to be cleaned. The nozzles are of cast iron, having circular orifices about ⅛ in. in diameter. The life of these nozzles is comparatively short but they are very inexpensive, having no machine work of any kind expended upon them. The governor is set to cut the compressor out of action at 100 lb. and to cut it into action at 85 lb. The total weight of the complete outfit is 4,200 lb.

The second sand blast used in connection with this work is very similar to the one just described except that it has three reservoirs instead of two, and that the compressor is one size smaller.

The clamps used in clamping these bonds in position are specially designed to adapt them to the varying conditions to be met and are of sufficient capacity to draw the bonds into firm contact with the rail or structure.

The heat which is supplied from a gasoline torch is applied preferably to a part of the rail or structure opposite the cleaned surface to avoid the deposit of soot or carbon. When the rail has reached the required temperature the soldering flux is applied by means of a small brush and then the solder put in until the surface is thoroughly tinned, after which bonds are placed and secured by means of the clamp and heat again applied until the solder flows freely over the entire surface. After this the bonds are drawn tight and allowed to cool. The men placing and soldering the bonds follow closely those operating the sand blast and cleaning the surfaces.

After the bonds have been tested and approved they are painted with two coats of paint like that used on the structure.

Fig. 7 illustrates the gasoline torch with extension hose, couplings and burners.

The same objection that applied to having a grinding machine on the track also applies to the torch so that special torches had to be provided with a rubber hose, and the mixture of gasoline and air carried through this hose, as shown in Fig. 7. At the end of the hose is a piece of pipe about 2 ft. long placed between the hose and burner so as to prevent heating of the former. With this special equipment, which has been so carefully prepared, the work progresses as systematically and satisfactorily, if not as cheaply, as it would on a surface line.

"Come Along."

(The Detroit United Ry. Prize Song.)

Now we think with a smile
Of the old fashioned style
Of cars of a few years ago
When the patient old horse
Was the sole motive force
And we heard the loud "Git up" and "Whoa."
Now what pleasures we find
Both for body and mind
On a trolley car of today
And we pay our fare
With a satisfied air
As we're speedily carried away.

Chorus.

Come along, ding dong, hear the clanking gong
All aboard for a ride on the trolley,
Let us sing aloud with the merry crowd,
Come along, come a-long and be jolly.
The rich and poor are on a par
When riding on a trolley car.
Come a-long, ding dong, hear the clanking gong.
Come a-long, come a-long, come a-long.

For a day's sport or fun
Take your camera or gun
Or your rod and be free from all care
Board the fast trolley line;
There's enjoyment divine
Get your fill of the pure country air
Maybe you're called away
On business one day,
But arrived for your train too late.
Well, you need not despair
Your "Suburban" is there
With its comfort and speed up to date.

Leaving factory or store
When the day's work is o'er,
Then the thousands of toilers rejoice,
And with visions of ease
'Mong the flowers and trees
They escape from the heat, smoke and noise.
There's no sigh of regret
For that pinched little flat,
Where for sunshine we longed and air
Now we can live alone
In a place of our own
And the trolley car will bring us there.

Line Construction for High Pressure Railroads.*

[illegible]

[illegible] ductor by means of a moving contact has been fully demonstrated. It has required some time to show that there is a field for a single-phase traction motor sufficiently promising to justify its commercial development, but a number of motors of this type are now upon the market and within the last few weeks have been put in actual every-day operation.

[illegible] ent at once that the methods of installation which have become standard with the 500-volt system are inadequate for the new conditions. Several methods of supporting the high-pressure trolley wire have already been developed, and now the time has come to standardize the pressure and the location of the current conductor, as well as the method of current collection in order to provide for an interchange of equipment.

It is the object of this paper to present a brief record of what has already been accomplished in line construction, and to examine the requirements and difficulties of installation in order to obtain permanent insulation at reasonable cost, safety to the public, and reliability in service.

The successful use of a single high-pressure trolley wire will have a marked stimulus upon three distinct branches of the electric railroad art:

1. For moderate speed lines in the country districts, the full benefit of the high-pressure system will be obtained only when the first cost of such a road has been reduced to a minimum, consistent with good work. A study of the accompanying map, which shows the electric railway situation in the middle western states, will emphasize this point. It will be seen that nearly all the territory which promises even a fair return on the investment has been preempted and that some roads are even now being built where there may be some doubt as to their being able to stand the fixed charges resulting from the cost of the illogical synchronous converter substation system. There are still left whole sections of rich productive agricultural districts which will remain unserved by a trolley road until a system has been developed which is so simple in its requirements that it can be built and equipped complete for less than $15,000 per mile and operated on a basis equally economical. This class of installation means a trolley pressure as high as possible, as well as transformer sub-stations operating without attendance and working in parallel from one transmission line.

2. For high-speed interurban roads the high-pressure trolley opens up new possibilities. Roads of this character, with their better earning capacity, can afford such refinements in line construction as a sectionalized trolley, individual transmission lines to each substation, and separate pole lines for the trolley and the transmission systems.

3. The electrification of steam roads will present a different set of conditions. Here the steam locomotive will share the tracks with its electric successor for some time, and will do all it can with its acid charged gases to destroy the handiwork of the electrical engineer. This will make the installation of a contact wire anywhere except at the side of the track a doubtful matter, and thus calls attention more strongly to the statement that line-construction problems must be divided into classes.

Mr. Damon illustrated and described the details of construction of several existing high-pressure trolley lines in Europe and America.

The Valtellina system near Milan, Italy, which was described in the "Review" June, [illegible] with a trolley pressure of 3,000 volts at 15 cycles. The trolley wires are supported by the usual type of span wire construction attached to the poles by means of special porcelain insulators. The current

*Abstract [illegible] Electrical Engineers.

collector is a roller of electrolytic copper, fitted with rubbing contacts.

The Spindersfeld experimental electric line ("Street Railway Review," April, 1904, p. 247) operates with a trolley pressure of 6,000 volts at 25 cycles. The single-phase trolley wire is hung from two steel catenary wires with suspensions every 10 ft. The contact device is a sliding bow.

The Huber system, an experimental line which was described and illustrated in the "Review," June, 1904, page 356, was built by the Oerlikon Machine Works. The trolley pressure is 14,000 volts. The distinguishing characteristic of this system is its current collector. This collector is a curved metallic rod with its convex surface bearing lightly against the trolley wire. Normally the wire is located at the side of the car and on top of a saddle insulator placed about 15 ft. above the track. The collector rod has a rotary motion in a plane perpendicular to the track and its position is automatically regulated by the conductor wire.

The Lansing, St. Johns & St. Louis Electric Ry. ("Street Railway Review," Feb., 1902, p. 110) is a line in Michigan which has been operated as a single-phase road with 6,000 volts on the trolley wire. The line was the scene of the pioneer single-phase work done by Mr. B. J. Arnold in 1900-1904. The trolley on this road is hung from a special annealed glass hanger held in place on a flexible cross wire suspended between malleable iron brackets attached to a wooden cross-arm. The ordinary form of trolley wheel is used.

The Bloomington, Pontiac & Joliet Electric Ry. and the Indianapolis & Cincinnati Traction Co. ("Street Railway Review," Feb., 1905, p. 87) are two recently completed single-phase trolley lines which operate with a trolley pressure of 3,300 volts. On these roads the catenary form of suspension is used. This catenary is supported by grooved insulators mounted on iron pins in the ends of wooden bracket arms. Hangers with clips for the conductor wire support are spaced about 10 ft. apart.

Bearing in mind the distinct requirements of the three classes of roads already referred to, the problem of line construction may be discussed under the following heads:

1. Pressure and Insulation.—From present appearances 3,300 volts is to be the standard for interurban lines. It would be well, however, to consider just at this time whether with the catenary suspension and its high insulation possibilities a working pressure of 6,000 volts is not just as practicable as a lower one. For steam railroad conditions there seems to be no reason at this time why pressures of over 10,000 volts should not be considered.

The catenary form of suspension affords so convenient a method of insulation that it should become a standard practice for interurban electric lines, and as far as insulation is concerned, there is no reason why the catenary construction could not be operated at more than 30,000 volts if desired.

2. Location of the Conductor.—For roads with speeds not exceeding 40 to 50 miles an hour at trolley pressures up to 3,300 volts the natural tendency would be to have the trolley wire remain in its present location and use the present trolley harp and wheel. For higher speeds there will be little objection to the same overhead construction but the danger of the ordinary trolley wheel leaving the wire at high speeds will no doubt suggest the use of some form of collector other than the wheel.

For steam railroad work several objections are made to the placing of the wire over the center of the track and to avoid these it would seem to be imperative that the contact wire be placed at one side and as low as possible consistent with general safety.

The Huber system of conductor and collector construction appears at present to be the best suggestion for a solution of the line problems in connection with the electrically equipping of steam roads, but the contact wire, as carried from pole to pole, is liable to break, and some form of support should be devised to prevent the broken ends falling to the ground.

3. Requirements for Safety and Stability.—The catenary method of suspension and what is known as the "tower" method of construction using long spans and a double-catenary, spreading at the points of insulated support and converging at the center of the span, will be found desirable. The added factor of safety in using supporting clips every few feet is said to overweigh the disadvantages arising from the trolley wheel sparking at these points.

Mr. Damon states that there is no occasion to be alarmed at the possible danger arising from the arcs due to a coating of ice between the wire and the collector, because one 3,300-volt line has already passed through a hard siege of sleet with but very little damage.

For an economically constructed road a single set of transmission wires, serving all of the static transformer stations in parallel, would be sufficient. The next refinement would be to have a separate set of transmission lines from the power house to each sub-station and where the electric road is of the high-speed class two independent pole lines should be installed on the same right-of-way, and as an assurance of business safety, the high-pressure lines should be carried around the small towns and cities instead of through them. Wherever the high tension lines pass over other wires, there should be a cradle of grounded wires to prevent a broken transmission line from coming in contact with a foreign wire.

The first investment in the transmission line, the cost of maintenance, and the loss by leakage—all these can be cut in half by thoroughly grounding one side of the single-phase transmission line so as to use the earth as one leg of the circuit. An actual trial of this suggestion to further simplify the distribution system is under contemplation, and no doubt will furnish valuable information as to its effect on telephone and telegraph lines as well as data in connection with the resistance of the earth with alternating currents.

In order to encourage the discussion of the unsettled features of line construction for high-pressure electric railroads, Mr. Damon offered the following general conclusions:

1. There are no reasons why the standard pressures of the conductor wire for interurban electric lines should not be at least 6,000 volts; this is suggested as a standard in order to provide for interchange of equipment.

2. For the electrification of steam roads a pressure of about 15,000 volts on the conductor wire is desirable.

3. For electric interurban lines, the present tendency is toward the catenary form of suspension, with the trolley over the center of the track. A connection should be made about every 10 feet, between the steel catenary wire and the trolley wire.

4. For steam-railroad conditions a contact wire at the side of the track appears to offer the greatest advantages. Some form of construction should be adopted, however, to prevent the falling of the conductor in case it should break.

5. A successful bow collector for interurban work and a contact arm for steam-road installations similar to that in use by the Huber system would allow the location of the contact wire to be standardized.

6. A trolley wire 20 ft. above the center of the track is suggested for interurban roads. For steam-road electrification the height of the contact wire at the side of the track could be made standard at 16 ft.

Iowa Valley Interurban Railway Co.

Articles of incorporation have been filed by the Iowa Valley Interurban Railway Co., with principal offices at Belle Plaine, Ia. The company proposes to build an interurban railway from Belle Plaine to Vinton, Ia., the necessary franchises having been secured and ratified and two surveys having been made. The surveys have been made by Mr. F. C. French, of the Iowa State College; one line surveyed will pass through Keystone and Garrison and the other route will pass about two miles east of Keystone and Garrison, the former line having a larger population but is two or three miles longer and has several grades. Connection will be made at Belle Plaine with the proposed Grinnell Interurban Railway Co's. line between Grinnell and Belle Plaine, the Grinnell road connecting with the line of the Interurban Railway Co., of Des Moines, Ia. This would give an electric line from Belle Plaine to Des Moines, about 85 miles long, or about 25 miles shorter than the present steam road.

The incorporators of the Iowa Valley Interurban Railway Co. are: A. J. Hartman, W. A. Mall, F. H. Henry, Mac J. Randall, H. R. Mosnat, George W. Voss, T. H. Milner, W. A. Montgomery, C. J. Snitkay, Fred McCulloch, J. C. Milner, T. F. Murray and F. C. French. The following officers have been elected: President, George W. Voss; vice-president, Thomas F. Murray; treasurer, W. A. Mall; secretary and general manager, H. R. Mosnat.

MAP OF ELECTRIC RAILWAYS IN MIDDLE WESTERN STATES.

Ballasting.*

Definitions for Ballasting.

Ballast.—Selected material placed on the roadbed for the purpose of holding the track in line and surface.

Broken or Crushed Stone.—Stone broken by artificial means into small fragments of specified sizes.

Chats.—Tailings from mills in which zinc and lead ores are separated from the rocks in which they occur.

Gravel.—Small worn fragments of rock, coarser than sand, occurring in natural deposits.

Sand.—Any hard, granular, comminuted rock material, finer than gravel, and coarser than dust.

Chert.—An impure flint or hornstone, occurring in beds.

Cinders.—The residue from the fuel used in locomotives and other furnaces.

Slag.—The waste product, in a more or less vitrified form, of furnaces for the reduction of ore. Usually the product of a blast furnace.

Burnt Clay.—A clay or gumbo which has been burned into material for ballast.

Gumbo.—A term commonly used for a peculiarly tenacious clay, containing no sand.

The above are in accordance with amendments made by 1904 convention.

Conclusions Relative to Ballasting.

While there is great variation in the qualities of the different natural materials for ballast, the choice of these qualities is not usually left to the engineer, but has been made already by nature, and all that is left to decide is what is most available or most expedient. This each one must decide for himself in the light of his own circumstances. The question of finance may be a ruling consideration or there may be but one thing to be had, and he must take that or nothing.

In the case of crushed rock, however, the process of manufacture being under control, it is practicable to make the product conform to specifications. The following were adopted by the convention of 1904:

Specifications for Stone Ballast.

1. Quality.—a. Stone shall be durable enough to resist the disintegrating influences of the climate where it is used.

b. It shall be hard enough to prevent pulverizing under the treatment to which it is subjected.

c. It shall break in angular pieces when crushed.

2. Size.—a. The maximum size of ballast shall not exceed pieces which will pass through a screen having 2-in. holes.

b. The minimum size shall not pass through a screen having ¾-in. holes.

Your committee wishes to say at this point that following the instructions of the board to prepare concise general requirements or specifications with marginal index for various kinds of ballast, it sent out a circular asking for specifications of various roads covering crushed rock. The replies indicated that very few roads used specifications covering any more points than those given above. It seemed best to the committee to leave any other matters than those covered by the specifications to be considered in connection with recommended practice. As before mentioned, we hope to offer something further in this line later. It will be noted that the wording of the conclusion and the crushed rock specification has been changed slightly from that used by the convention of 1904 in its amendments. The committee thinks this wording somewhat more logical, and therefore submits it to the convention for approval. In line with the conclusions, no specifications are attempted for other ballast than crushed rock, but principles of recommended practice are submitted for gravel, cinders and burnt clay, as follows:

Gravel.

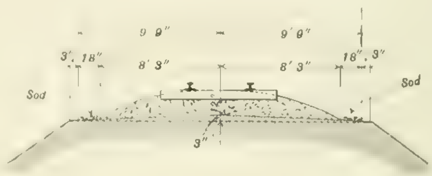
Gravel should be screened or washed where prevention of dust is an object, but this need not be done where the character of traffic is such that dust is not particularly objectionable. It is recommended that gravel be screened or washed where the proportion of sand or clay exceeds one-half. The minimum size should be such as is retained on screens of 12 meshes per in. By this is meant the size pebble that would be retained in a thorough, careful test. The committee does not feel warranted in recommending any particular size or design of screen or arrangement of plant for screening gravel for the reason that it has not sufficient information on those points. It is hoped that some member of the association can throw some light on this phase of the gravel question.

Cinders.

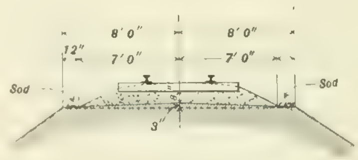
The use of cinders as ballast is recommended for the following situations: On branch lines with a light traffic; on sidings and yard tracks near point of production; as sub-ballast in wet, spongy places; in cuts and on fills; as sub-ballast on new work where dumps are settling, and at places where the track heaves from frost. It is recommended that provision be made for wetting down cinders immediately after being drawn.

Burnt Clay.

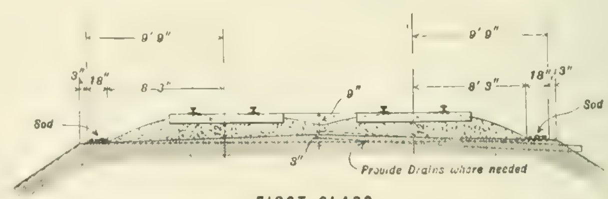
The material should be black gumbo or other suitable clay free from sand or silt. The suitability of the material should be determined by thorough testing in small test kilns before establishing a ballast kiln.



FIRST CLASS
Single Track, Cut or Fill



SECOND CLASS
Single Track, Cut or Fill



FIRST CLASS
Double Track, Cut or Fill

BALLAST SECTIONS RECOMMENDED BY COMMITTEE.

The material should be burned hard and thoroughly.

The fuel used must be fresh and clean enough to burn with a clean fire.

It is important that a sufficient supply be kept on hand to prevent interruption of the process of burning.

Burning should be done under the supervision of an experienced and competent burner.

Ballast should be allowed to cool before it is loaded out of the pit.

Absorption of water should not exceed 15 per cent.

The use of other kinds of ballast being governed so largely by local conditions, the committee feels that is is best to make no recommendations.

Ballast Cross-Sections.

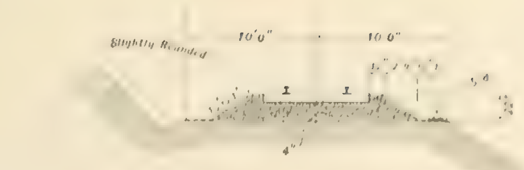
At the joint meeting with the Track Committee, November 29th, ballast cross-sections for two classes of track were agreed upon, and plates showing the same are inserted herein.

It was considered that a double track road would hardly be other than first-class and consequently a double track section is shown for first class only.

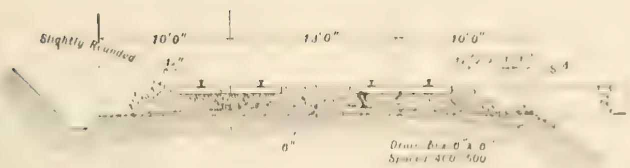
Oyster Shells.

As a matter which the committee thinks may be of interest, the

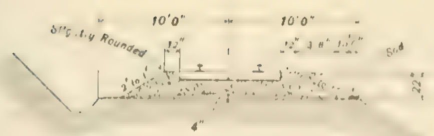
*Abstract of report presented at the annual meeting of the American Railway Engineering and Maintenance of Way Association, Chicago, Mar. 21-23, 1905.

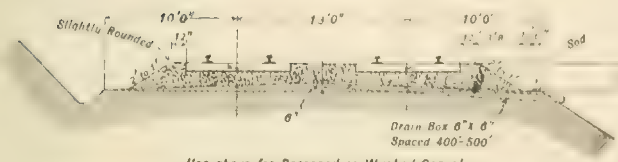


Crushed Rock, Single Track

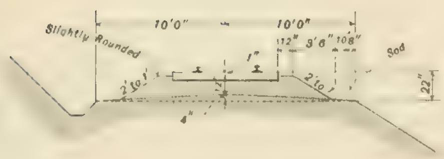


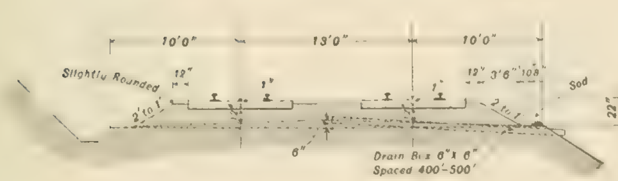
Use above Section for Crushed Rock Slag



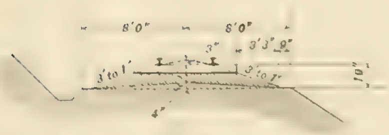


Use above for Screened or Washed Gravel, Burnt Clay and Chats





Use above Section for Engine Cinders



Use above Section for Cementing Gravel, Chert and Sand
Similar dressing for Earth

BALLAST SECTIONS RECOMMENDED BY MINORITY OF COMMITTEE

[illegible] R. R., are herewith submitted:

"We find that oyster shells are the best for our purpose; they are [illegible] dling ballast, they are loaded into gondolas and by opening the doors partially they are distributed on the track while the train is in motion.

"The drainage properties are almost perfect, therefore the life of the tie is extended—how much we are unable to say at this time.

"There is an entire absence of dust. They somewhat reduce vegetation, but do not entirely prevent it. There is always more or less dirt mixed with the shells, and this with the lime will support life in certain kinds of weeds, and these have to be pulled out by hand. We now have about 40 miles of track ballasted with oyster shells, and during the time we were ballasting there was on an average one high-speed train per hour on this track. The following is [illegible]

Averages.

Bushels oyster shells per mile	42,266
Cubic yards oyster shells per mile	2,113.3
[illegible]	.0274
Cost of shells per cubic yard	.5480
Cost of labor per cubic yard, shells	.1744
Cost per cubic yard in track	.7224
Cost per mile, labor	368.64
Cost per mile, oyster shells	1,158.62
Total cost per mile	$1,527.26

"We paid our foremen at the rate of $42 per month and laborers [illegible]

Granulated Slag.

The committee also submits, as a matter of interest and information, the following notes on granulated slag prepared by Mr. Samuel Rockwell, assistant chief engineer, Lake Shore & Michigan Southern Ry.

"Slag naturally falls under two heads: First, that which is hard and vitreous and that will not slake, and, second, that which will slake, the latter being due principally to an excess of calcium and deficiency of magnesium oxides.

"Vitreous slag broken in sizes similar to broken stone makes fair ballast, but the lime slag is not good, as after slaking it sets into a solid mass almost resembling concrete.

"In order to facilitate and cheapen the handling of slag many furnaces are now making it into 'granulated slag.'

"The molten slag is run into a large cistern, and as it pours into it from the end of a trough it is met by a stream of water forced under pressure through a flat nozzle, and the action causes the slag to fly into fine particles somewhat resembling coarse sand. It is then dug out of the water with a clam-shell dredge.

"The product varies from sharp, hard and heavy, resulting from vitreous slag operated on with an excess of water, to soft, light and pumice-like, resulting both from too little water in the treatment, and from lime slag.

"The former kind makes an excellent ballast for yard work and on any tracks with moderate travel. It is easily worked and stays where it is put and has little dust. The soft kinds, however, should be avoided as they are liable to set, although, to be sure, it will even then drain and do its full duty as ballast so long as it is not necessary to disturb it."

Committee.

John V. Hanna, St. Louis & San Francisco; C. A. Paquette, Big Four; C. H. Byers, Kansas City Southern; A. Q. Campbell; L. F. Goodale, C., B. & Q.; G. D. Hicks, N., C. & St. L.; B. C. Milner, Southern Ry.; J. O. Osgood, Central of N. J.; F. W. Ranno, Southern Indiana Ry.; Samuel Rockwell, Lake Shore; J. G. Sullivan, Canadian Pacific.

Messrs. John V. Hanna, C. H. Byers and L. F. Goodale filed a minority report stating they did not believe the ballast cross-sections approved by the committee were the best for general adoption and submitted the sections indicated.

Thermit Welding of Rail Joints.

BY WILLIAM HOWARD COLE.

There are few improvements in the process of electric street railway construction that have attracted more attention in the past year, and that have been more thoroughly and carefully investigated by the railway men themselves, than that of the "Thermit" welding of rail joints.

It was rather a startling announcement made by Dr. Hans Goldschmidt when he informed the world that he was able to weld and virtually melt the ends of two large pieces of iron or steel together by means of a powder placed in a small crucible and lighted with a match, and that the whole process only required a few seconds, during which time any quantity of steel, of any degree of hardness, might be produced, and more startling than all that this steel was at the command of the user, heated to the temperature of 5,400° F., more than double the temperature necessary to melt steel.

It required much demonstration and explanation to convince the average person that there was not anything in the character of "fake" in the announcement, and that the application of thermit steel to the welding of rails was not a process, so complicated and uncertain as to make it practically of no use.

After this period of explanation was over, and the system was demonstrated to be entirely applicable in the hands of the everyday track man, and that the joint ceased to be a joint, and that the process made an actual continuous rail, with electrical and mechanical strength equal to a like section of rail itself, there came a period of technical discussion amongst those who had had experience with cast-welding and other methods of rail joining, and many statements were made as to the theory of a molecular change in the component parts of the steel in the rail.

Some said the steel was decarbonized by the application of the great heat. Some advanced the theory that the heat must anneal the head of the rail, and others remarked that the steel would be tempered.

It took a long time to demonstrate that none of these theories was correct, and that practically the steel remained the same where the joint had been welded by the thermit process, after, as before.

To the practical metallurgist this was quickly understood, for he saw the reason as soon as it was explained, but the average track superintendent was convinced of this only by a practical and personal demonstration. He thought much more of a micrometer measurement of the relative depths of two holes made on the top of the rail, by the same tool and by the exactly similar blows, one hole on the rail away from the joint, and the other at the joint at a point where it had the maximum of heat during the weld. The track men were very much more interested in the result of what occurred when the ram of a hydraulic press forced the rail at the joint down to a point of fracture, and to see if the two ends of the rails were actually and permanently alloyed and melted together, and they thought a great deal more of the comparative readings of a millivoltmeter over the joint in a test for the electrical conductivity than the theoretical explanation that the steel could not decarbonize without the presence of oxygen, and that this was virtually what occurred when the rail joint was welded with thermit under normal conditions.

After the demonstrations such as described many of the large companies permitted small sections of track to be welded up by the new process, in locations where they had heavy traffic conditions, and where the sections of lines might be under observation during the changes of temperature in the winter.

Now it appears that those interested are satisfied that the system is all right, and that it gives the results announced by Dr. Goldschmidt from the beginning.

As a matter of fact, the system and its application has been so simplified that it would seem to be "fool proof." One rarely hears of trouble of any kind from the many railway companies who are using thermit to not only join the new lines, but to repair and make good old and worn out joints, where it has been made possible to prolong the life of the old rails very much and to improve materially the running of cars.

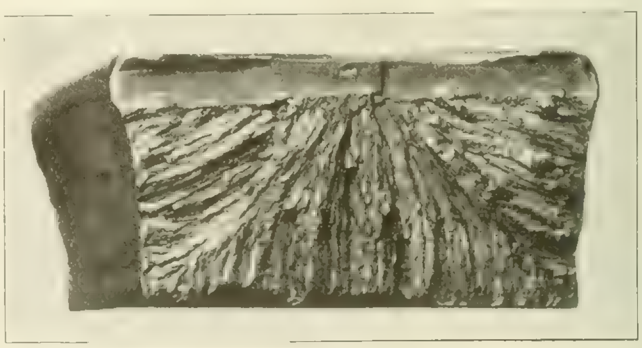
The method of application is as follows: The rail is lined and surfaced at the joint, to the position required. The ends are brused with a hand steel wire brush, to remove any dirt. The heat of a hand gasoline torch is applied to the ends of the rails enough to drive away any moisture. Sand clay molds are clamped on around the rail ends, and their joints luted with clay. The crucible is placed, with its supporting tripod over the molds in the proper position, and the bottom plugged up. The thermit welding portion is poured in the crucible. A pinch of ignition powder is placed on top of the thermit and ignited with a match. In eight or ten seconds the crucible is tapped by pushing a pin at the bottom of the crucible, and the highly heated molten steel flows down into the mold, and up around the rail ends.

This is the operation in detail, and if properly done the rail ends are melted together, so that if the joint is cut, the thermit steel cannot be distinguished from the steel of the rail, and the joint may be handled with a jim crow with the same facility as any other part of the line.

The use of thermit is not confined to the welding of rail ends, but it has entered everywhere, in shops and places where steel or iron is to be joined, or repaired, and every well equipped shop now carries a supply of thermit for emergency use where the parting of a shaft or axle might mean the loss of a lot of money in the shutting down of a plant, and which by means of thermit might be repaired in a few minutes.

A New Anti-Friction Metal.

The fact that a metal will stand the greatest compressive stress when its fibers present their ends toward the point of application of the stress is considered to be important in determining what is best in the composition and arrangement of the crystals in any piece of anti-friction metal which must carry a load. Experiments with a view to securing these characteristics in a bearing metal have been made during a period of 20 years and the Buda Foundry & Manufacturing Co. announces that these efforts have been rewarded by the satisfactory anti-friction metal which is illustrated herewith. The distinguishing characteristics of this material are clearly shown by the broken section; the crystals, it will be noted, extend perpendicular to the chilling surfaces. The alloy is of tin and aluminum base and its crystals always radiate from the chilling surfaces regardless of the number of times reheated, thereby presenting the ends and not the sides of its elements to the sliding friction surface. A close examination of the fractured metal shows it to be of so fine and smooth a texture with no granular matter interfering that it may be said to be a truly chemical compound.



FRACTURE OF BAR SHOWING CRYSTALLIZATION

The fact that the components in anti-friction metals do not fuse at the same temperature has been a source of much loss and trouble to the users because on remelting the metal with the lowest fusing point often volatilizes before the fusing temperature of the other components is reached. This causes the composition to become harder and less useful with each remelting. The maker of the metal which is illustrated herewith says that this defect has been remedied and that the combination of the components of this new anti-friction metal is such that it behaves as a new metal and will admit of remelting an indefinite number of times without becoming hard or losing its original properties.

The characteristics of this metal are considered to make it particularly desirable for use in the journals of all kinds of high speed machinery. The Buda Foundry & Manufacturing Co., Chicago, will

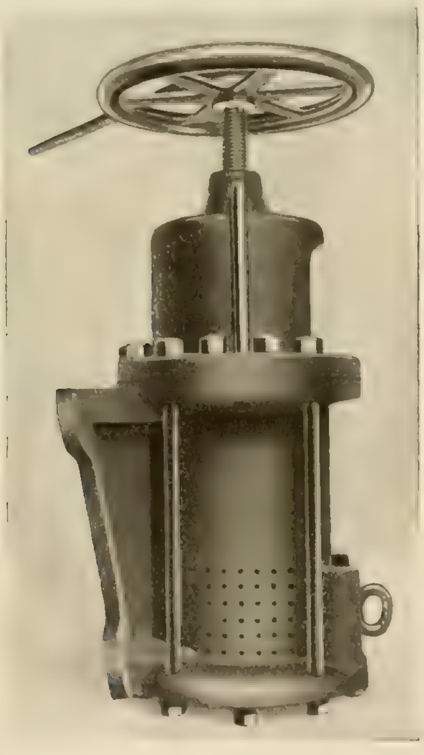
place this metal on the market together with some new bronze and a copper steel composition which it states is a rediscovery of the art of copper hardening.

The anti-friction metal department of the company will in the future be made an important branch of its increasing business, though it will in no way interfere with the railroad specialty department. The company has on hand samples of the new metal for distribution among interested persons, and will gladly send them, if application is made to the company's secretary, Mr. H. E. Gilbert.

A New Waste Press.

The accompanying illustration shows a new form of waste press designed for reclaiming used waste and the oil with which it is soaked. This new press is heavily built so that it will stand the most severe usage. Its essential parts are a heavy cylinder perforated at its lower part, and a plunger which is forced up and down within the cylinder by a screw. The framework and the cylinder consist of two castings flanged and bolted together. The lower casting is provided with suitable lugs for attaching the press to the power house wall by means of expansion bolts. A door for inserting and removing the waste is fitted in the front lower part of the cylinder.

When a quantity of oily waste has been inserted in the cylinder and the door replaced, the plunger is moved downward in its stroke by means of the screw wheel until the greater part of the oil has been squeezed through the holes in the lower part of the cylinder.



NEW BEDFORD WASTE PRESS.

A few final turns of the long lever arm attached to the screw wheel completely remove the oil from the waste and force this dirty oil through the openings at the bottom of the cylinder, where it is caught in a pan and later filtered. The waste when removed from the press can be re-used and the process continued.

This waste press is a product of the New Bedford Boiler & Machine Co., New Bedford, Mass. The simplicity and strength of its design make the press an efficient agent for reclaiming oil from dirty waste and rendering both these materials fit for renewed use. The fitness of the machine for economically doing this work is so pronounced that the manufacturer guarantees it to save 75 per cent of the oil and waste that may now be used in a power plant where such a class of device is not installed.

Cyclopedia of Applied Electricity.

The correspondence methods of instruction are too well known to require describing in detail. The advantages offered by these schools have been appreciated by many thousands of persons who in their earlier life had not the privilege of receiving an advanced education in their accepted fields. The entire world is the field covered by the correspondence schools, which now have some thousand students pursuing their courses. Of these students a large number are engaged in trades and professions which require both a practical and technical knowledge of applied electricity.

With a view to furnishing an up-to-date ready reference work on electricity, the American School of Correspondence at the Armour Institute of Technology, Chicago, has recently published a practical reference work on this subject which will be found a vast source of knowledge to all who are in any way allied with the promoting of electricity in the service of man. The "Cyclopedia of Applied Electricity" is published in five volumes, comprising about 2,500 pages, size 8 x 10 in., printed on high grade paper. The individual books are bound in three-fourths morocco leather, and supplied with a well chosen subject index, other than the usual form of chapter index. There are incorporated in the descriptions and explanations 2,000 illustrations, consisting of specially prepared diagrams, sections, full page plates, tables, formulae, etc. The list price of this work is $30.00, but a special introductory price of $18.00 is now offered, subject to increase.

This work is the most comprehensive treatment of its subject that has yet been published, and in its volumes the reader will find a treatment of the latest developments of electricity written by acknowledged authorities, fully indexed and explanations given in a simple, direct way, free from difficult mathematics and therefore especially adapted to the needs of a busy man. All the descriptions and explanations have been simplified and condensed to the utmost degree consistent with a thorough presentation of the subjects treated. Simple language has been used throughout in the explanations, and a knowledge of higher mathematics is not required in connection with the calculations given. A large percentage of the illustrations are half-tones which show the latest types of electric machines and apparatus made by the more prominent manufacturers in the United States. The closely related subjects are assembled under general headings, and the subject matter divided into chapters or sections, so that the work may be used as a text book.

The assistance of many eminent specialists has been obtained in the preparing of the work for presentation, among whom may be mentioned Prof. F. B. Crocker, of Columbia University; Prof. William Esty, of Lehigh University; Prof. D. C. Jackson and Prof. George C. Shaad, of the University of Wisconsin; Prof. Louis Derr, of the Massachusetts Institute of Technology, and many others, all of whom have prepared special articles and aided in the collaboration of this work. Standard reference books have also been used as a source of information in preparing these volumes.

The usefulness of this cyclopedia as a reference book is increased by the addition of the subject index contained in the fifth volume.

The value of this cyclopedia as a practical reference work can hardly be questioned, as it embodies the various subjects which have been so successfully used by the American School of Correspondence in its instruction courses.

As stated, the work is divided into five separately bound books. The first of these, called Part I, treats of the fundamental laws of electricity and the controlling factors of simple electric circuits. Examples and illustrations are given defining, first, the elementary units as determined by Ohm's law, later the centimeter-gram-second and other practical units, along with descriptions of the necessary commercial types of instruments for measuring electric power. A section of this book is devoted to the installation of electric machinery, with rules for wiring and directions for the proper location of the different pieces of apparatus. The first volume concludes with an elaborate treatment of the subject of telegraphy.

The second volume of the series includes the subjects of dynamo electric machinery and storage batteries, beginning with the fundamental principles and gradually leading up, by means of careful descriptions and explanations, to the more intricate problems and formulae used in determining the characteristics of such machines. In this section a concrete example of each general type of generator is taken and each step in the calculation and design of the machine worked out. All the latest commercial types of apparatus are care-

fully described, and electric motors being almost identical with generators, are included in these descriptions, as are the subjects of motors, generators and the use of boosters.

The use of electric motors for driving shop tools is treated. The volume concludes with a section on storage batteries, giving the reader a good idea of the entire subject by means of a large number of well chosen illustrations and instructions regarding their general use.

The early part of the third volume is devoted to a comprehensive treatment of electric lighting and the apparatus used in this field. This is followed with a section devoted to electric railways, which is profusely illustrated and which very carefully describes several types of car equipment and numerous styles of car motors. Under this subject is a description of the different methods of current control and a general treatment of the designs of track and overhead materials, supplies for conduit lines, rails and rail joints, including cast, electrically and thermit-welded joints. The next division of this volume is given over to the description of the power supply and distribution circuits, and is brought down to date by the inclusion of alternating current railway systems. In this chapter are instructions for the operation of cars and methods of testing faulty equipment. The following section is of special value to the station operator because of its thorough treatment of the building to the operation period. This volume concludes with a number of valuable suggestions in regard to the placing of electrical machinery for general central station work.

The fourth volume of the Cyclopedia of Applied Electricity is devoted entirely to alternating current and automatic machinery. The volume begins with descriptions of the simplest types of alternating current machinery, treating the advantages and disadavantages of the use of alternating current for the transmission of power, and after a description of the instruments and auxiliary apparatus used in its handling, concludes with a treatise on rotary converters and an explanation of the general calculations needed for designing alternating current machinery and power transmission systems.

The fifth volume was written by William C. Boyrer, a telephone engineer of wide experience, who in this treatment of telephone engineering has carried out the idea of making this a first class text book for the student as well as a reference book for practical telephone exchange men. The entire subject of telephony is treated in a very thorough manner, describing telephone work in all its details

This series of books, which is intended to serve the double purpose of text book and reference library, contains a great deal of material which has never been published in book form, and while the work in primarily intended for those who have little electric foundation, nevertheless there is present much valuable information which will quickly win for the series its merited high place as a reference source for electrical engineers.

New York Central Lines to Enter Canada.

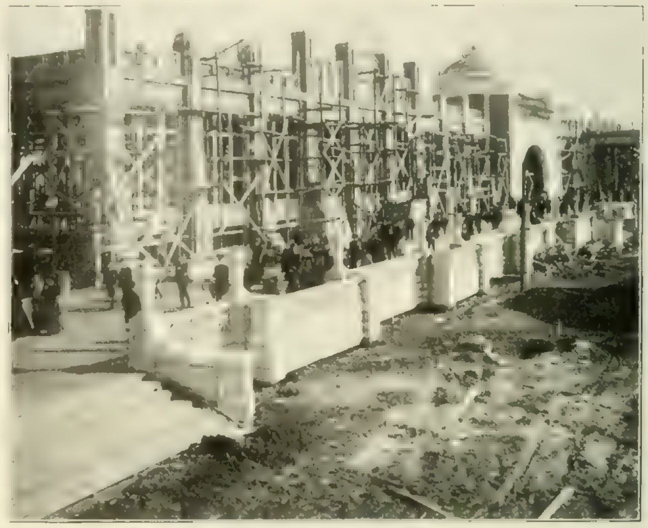
It is rumored in Montreal that the New York Central & Hudson River Railroad Co. is making an attempt to gain control of the Canadian companies which are supplied with power from the Niagara Falls generating stations. It is stated that the general plan comprises the building of a network of electric railways throughout the province of Ontario, and that these lines will be feeders for a four-track road which will be built on the roadbed of the Toronto & Hamilton Ry.

Apparently reliable information states that the syndicate headed by Frederick Nicholls, which controls the Electrical Development Co., of Ontario, the Toronto & Niagara Power Co. and the electric railway systems in Niagara, St. Catharines and Toronto is acting for the New York Central in combining the Canadian interests for an international merger.

Such a merger, it is stated, would include not only the electric lines about Toronto and Hamilton and the numerous properties in the International Railway system, but it would also include the upper steel arch bridge at Niagara Falls and the suspension bridge at Queenstown Heights. It is also believed that the Niagara Frontier Bridge Co., which has been incorporated at Albany, is a part of the same scheme, and that its bridge will be used to carry the New York Central's four-track route to Toronto across the Niagara gorge.

The White City, Chicago, Nearing Completion.

Typical of the promotion and organization of the White City Construction Co. is the rapid progress of its construction and with the pleasant weather which has prevailed during the past few weeks work at the White City has advanced until now over 75 per cent of the construction work has been done. The principal buildings have been completed with the exception of the finishing work and the smaller buildings are well under way. A noticeable feature in connection with the building of this summer resort is the quality of the material and the number of brick fire walls, which insure the safety and permanence of the structures. At the present time over



COLLEGE INN RESTAURANT

1,000 men are employed at the grounds and it is stated that everything will be in readiness for the opening, May 27th.

Three features of especial interest in connection with this large pleasure park are the sanitary arrangements, the fire department and the transportation facilities, all of which will no doubt be appreciated by its patrons. On either side of the park, connected with the colonade which acts as the base for the electric tower, will be located commodious and perfectly appointed toilet rooms.

The fire fighting equipment comprises two complete fire companies with 35 well drilled firemen, carefully selected for their experience and skill, and who will be on duty day and night. There are two fire engines, one hook-and-ladder with a 60-ft. extension ladder, two chemical engines and a coal wagon. In front of the buildings is a 40-ft. board walk, raised 4 ft. from the ground and under this are placed two 6-in. water mains. From these mains run adequate connections to the various buildings and in each of the main structures is a standpipe with hose attached all ready for any emergency. Connected with these mains outside of the board walk are fire plugs with double hydrants, ten in all. The reservoir, which forms the lake at the base of the Shoot-the-Chutes, holds 1,365,000 gallons of water and two electrically operated pumps will be working at all times to keep the water at a high pressure in the mains and standpipes. In the various buildings will be placed some 50 Babcock fire extinguishers, 200 dry powder extinguishers, buckets, etc., and the employes are subject to a regular fire drill. No fires of any kind will be permitted in the buildings with the exception of the fireproof College Inn restaurant, and during construction smoking has been prohibited in all parts of the grounds.

Besides the attractions mentioned in the "Review" for December in connection with the article regarding this new resort, the landscape gardening, the Banda Rosa and the College Inn are of considerable note. In addition to the many large flower beds the White City will have 150 large urns filled with plants, which will be placed on every alternate pedestal about the board walk. The urns were designed especially by the Decorator's Supply Co. Mr John Bergstrom, a well-known Chicago gardener and formerly royal gardener of Sweden, has charge of the gardening, and half an acre of ground and a large hot house will be used in propagating the flowers and plants.

The White City College Inn restaurant, one of the largest and most imposing structures on the grounds, will be operated by the proprietors of the Sherman House Hotel Co., Chicago. It will have accommodations for 2,500 people, the entire upper portion of the structure shown in the accompanying illustration being occupied by the College Inn, elevated above the board walk to permit of sufficient accommodation below for a dairy lunch room and a German Rathskeller. The management is making special arrangements for the accommodation of 800 automobiles in the garage to be located on South Park Ave. between 62nd and 63rd Sts. The Inn was designed especially for the White City and when completed will be one of the best appointed places of its kind.

GENERAL VIEW OF WHITE CITY.

A transforming station will be erected by the Chicago Edison Co. for the White City company at 64th St. and South Park Ave., which will supply the current for both lighting purposes and operating the many motors needed for various mechanisms about the grounds. The feed wires will run direct to the various buildings from the station, each building being on a separate cable.

Mr. Paul D. Howse, general manager of the White City Construction Co., has been in direct charge of the construction work. Mr. Franc R. E. Woodward has been appointed advertising manager and in addition to his many duties, is publishing a very attractive magazine called the "White City Magazine," the demand for which is increasing rapidly. Besides the interesting information it contains regarding the White City and its attractions, are short stories.

March Meeting of Ohio Interurban Railway Association.

The March meeting of the Ohio Interurban Railway Association was held at the Gibson House, Cincinnati, March 23rd, the meeting being called to order at 10:30 by President Spring.

At the morning session the principal subject of discussion was the "Transportation of United States Mails by Electric Railways," this matter having been brought up by Mr. F. J. Green, who urged that the Ohio association join in an effort to have the postoffice department increase the pouch rate which is now 3 cents per mile to at least 5 cents per mile, and increase the mileage allowance on compartment cars from the present rate of ¾ cent per ft. to at least 1 cent.

Mr. F. W. Coen stated that the principal difficulty in securing such action lies in the fact that Congress has not made a sufficient appropriation for the electrical mail service. In 1903 $500,000 was appropriated for trolley mail service, and in 1904 $530,000. The officials of the department in charge of this work could spend this appropriation to advantage [illegible] over the entire year to the great [illegible].

Discussion developed [illegible] Companies are required to [illegible] or connecting transportation companies, provided the point of delivery is not over 80 rods from the railway. The distance over which the mail has to be carried outside of the car is [illegible] the mileage for which the company is paid [illegible] quate to pay for the delivery service. In one case cited the contract is for $675 per year, and the cost of delivering is $48 per year.

In many instances where work is done [illegible] proper relation between the work done and the compensation. For instance, one company has pouch service [illegible] haul mail 15 miles for $47[illegible] per year and in the other receives $250 per year for a 5-mile haul.

The postal regulations provide for fines to be imposed upon the transportation company in case the mails are delayed. In practice some companies pay fines and some do not. In the case of those who have paid fines it appears that the reason is more negligence in making explanations to the postal department than negligence in transporting the mail.

Postoffice inspectors are provided with passes good on all trains over roads with which the government has contract for carrying mails. Several companies reported a tendency on the part of local inspectors to refuse to comply with the companies' rules requiring that a slip be filled out for the conductor for all persons using passes. Some companies obviate this difficulty by refusing to honor the government passes, but furnishing in lieu thereof the company's ordinary card passes for the use of inspectors.

On motion of Mr. Bicknell, the legislative committee was directed to confer with the committee of the American Street Railway Association having this subject under consideration.

At the afternoon session the subject of discussion was track work. Replying to a question as to use of cinders for ballast, Mr. Sloat deprecated their use because cinder ballast hastens the decay of the ties, but added that in one or two places on his road cinders had been the most satisfactory ballast, and by their use the sloughing of clay fills had been stopped.

Mr. B. K. Alderman expressed the opinion that to properly maintain interurban electric railway track would cost about $350 per mile per year, including tie renewals, and that of this 60 per cent would be represented by the cost of labor.

Mr. A. S. Richey, Indiana Union Traction Co., stated that on that system the cost of track maintenance was $250 to $300 per mile per year. The sections are 7 to 8 miles in length with one or two men and a foreman to each section during the winter and four to five men and a foreman on each section in summer.

Mr. Sloat stated that on the Cincinnati, Dayton & Toledo they had three sections of 18, 22 and 24 miles respectively. In summer there are seven men and a foreman on the shortest section and 10 men and a foreman on each of the others. In winter the track force is correspondingly reduced.

Mr. J. H. Merril stated that on the Western Ohio the rock ballasted portion of the road was divided into five sections of from 10 to 16 miles in length. On each section there was a foreman at $45 per month and from two to four men at 15 cents per hour. On other portions of the road with gravel ballast there were on a 12-mile section a foreman and six men.

The meeting adjourned at [illegible] o'clock and a great many of those present took advantage of an invitation of the Bullock Electric Manufacturing Co. to inspect its new plant. The trip to the Bullock works was a most enjoyable one and interesting as well.

As an experiment, the government is fitting up a new type of letter box for use on the street cars of Des Moines, [illegible]

Personal.

MR. HENRY W. PHIPPS of Pittsburg has [illegible] director of the Philadelphia Rapid Transit Co.

MR. GEORGE A. MURCH has been appointed general manager of the Atlantic Shore Line Railway Co., succeeding Mr. I. L. Meloon.

MR. W. F. BIEN, for 10 years cashier of the receiving department of the Detroit United Ry., has resigned and will return to Cleveland, O., his home.

MR. FREDERICK SARGENT, who has been in London testifying before the Parliamentary Commission on London rapid transit, sailed for America April 1st.

MR. H. M. MONTGOMERY has been appointed Chicago sales manager for the Alberger Condenser Co., and will have his headquarters at 316 Home Insurance Bldg., 205 LaSalle St.

MR. H. A. NICHOLL, general manager of the Cleveland & Southwestern Traction Co., has resigned to become general manager of the Indiana Union Traction Co., succeeding Mr. A. L. Drum. Mr. Nicholl is a man of extensive experience in both steam and electric railway management and operation and is admirably fitted to take charge of lines of the Indiana Union Traction Co., the largest interurban system in the country. Mr. Nicholl has been general manager of the Ithaca Street Railway Co. and the Brush-Shaw Electric Light Co., of Ithaca, N. Y.; general manager of the Taunton (Mass.) Street Railway Co.; superintendent of power and purchasing agent of the Rochester Railway Co., Rochester, N. Y.; superintendent of construction, Rochester & Sodus Bay Railway Co., superintendent and afterwards general manager of the North Chattanooga Street Car Co. and the Chattanooga & North Side Street Railway Co., of Chattanooga, Tenn. The steam railroad experience of Mr. Nicholl extended over a period of years, during which he was connected with the Illinois Central, the Chicago & Northwestern, the Yazoo & Mississippi Valley and the Natchez, Jackson & Columbus railroads.

H. A. NICHOLL.

MR. W. H. SMITH, of Pasadena, Cal., has been appointed general manager of the Vallejo & Napa Valley Electric Railway Co., which is nearing completion and is expected to soon be in operation.

MR. H. E. DALTON, who for the past 14 years has been superintendent of the Louisville & Southern Indiana Traction Co., New Albany, Ind., has resigned and will be succeeded by Mr. F. E. Cole, of Chicago.

MR. I. L. MELOON, general manager of the Atlantic Shore Line Railway Co., of Kennebunkport, Me., has resigned to accept a position with the National Light, Heat & Power Co., 30 Pine St., New York City.

MR. FREDERICK A. HUNTRESS, general manager of the Worcester (Mass.) Consolidated Street Railway Co., has resigned to become general manager of the Rio de Janeiro Light & Power Co., Rio de Janeiro, Brazil.

MR. A. C. RALPH, formerly with the Boston & Worcester Street Railway Co., has been appointed general manager of the Taunton & Buzzards Bay Street Ry. and the Taunton & Pawtucket Street Ry., with offices at Taunton, Mass.

MR. T. C. LINDSEY has been elected president of the Dayton, Germantown & Middletown Traction Co., Dayton, O., to succeed Mr. J. O. Arnold, deceased. Other officers elected are: F. M. Arnold, vice-president and treasurer, and T. C. Lindsey, jr., secretary.

MR. WILLIS W. STREET, superintendent of the Tri-City Railway Co., Davenport, Ia., has resigned to become superintendent of the Lansing & Suburban Traction Co., Lansing, Mich. He has been succeeded at Davenport by Mr. W. E. Smith, assistant superintendent, and Mr. Lee Hammond has been appointed assistant superintendent.

MR. E. C. HAWKINS, who was chief engineer in the construction of the White Pass & Yukon Ry., has been appointed chief engineer of the Pacific Traction Co., Tacoma, Wash., the company promoting the interurban electric railway between Tacoma and Olympia, Wash.

MR. WILLIAM B. McKINLEY, president of the various properties controlled by the McKinley Syndicate, is to accompany Secretary Taft and his party to the Philippines. The party will take passage on the Pacific mail steamship Manchuria, July 1st, touching at Honolulu, Yokohama, Kobe and Nagasaki, thence to Manila.

MR. FREDERICK A. C. PERRINE, consulting engineer, late professor of electrical engineering, Leland Stanford Junior University, and past president of the Stanley Manufacturing Co., delivered an address before the faculty and students of Purdue University, March 29th, the subject of which was "Long Distance Transmission of Power."

LORD KELVIN has been awarded the first John Fritz Medal which was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on Aug. 21, 1902, his 80th birthday, to perpetuate the memory of his achievements in industrial progress. The award was made to Lord Kelvin for "cable telegraphy and other general scientific attainments."

MR. EDWARD P. BURCH, consulting engineer, Minneapolis, will deliver a lecture before the electrical engineering department of the University of Minnesota, on "Speed-torque Characteristics of Steam and Electric Locomotives." Mr. Lee M. Coleman, electrical contractor, Minneapolis, will also deliver an address, entitled "Experiences of An Installing Engineer."

MR. E. E. WINTERS, general manager and receiver for the Montgomery Traction Co., has resigned, the receivership of the company having been discharged by the United States Court. He is succeeded as general manager by Mr. W. H. Ragland. Mr. C. C. Hogshead, formerly superintendent of the gas division of the Lynchburg (Va.) Traction & Light Co., has been appointed superintendent of the Montgomery Traction Co.

THE CROCKER-WHEELER CO. announces that Mr. A. C. Bunker and Mr. W. C. Appleton, who have made a specialty of alternating current electrical engineering, have become associated with the company in the engineering and contract departments, respectively. Mr. Bunker was formerly on the Pacific Coast for the Stanley Electric Manufacturing Co. and Mr. Appleton has been engineering salesman for the General Electric Co. in the Atlanta territory.

MR. J. F. SLOCUM, recently elected secretary and treasurer of the International Traction Co., of Jersey City, N. J., and the International Railway Co., of Buffalo, N. Y., was born at Geneva, N. Y., Mar. 25, 1876. About nine years ago he began his business career with the Power City Bank at Niagara Falls, N. Y. Four years later he was appointed to a position with the International system as cashier, and a short time later was elected assistant secretary and treasurer under the former secretary and treasurer, Mr. R. F. Rankine, who resigned Mar. 2, 1905, to engage in other business. The appointment of Mr. A. C. Emerick as auditor of the International Traction Co., to succeed Mr. H. M. Pease, has been announced, as has also that of Mr. C. J. Shave, as chief clerk in the auditor's department. Mr. Emerick was auditor of the Buffalo Traction Co. before it was absorbed by the International Traction Co. and since that time has been assistant auditor.

J. F. SLOCUM.

Mayor-elect Dunne of Chicago has arranged for the manager of the Glasgow Tramways to advise on the Chicago situation.

Recent insulation tests on 5½ miles of snow-covered, double-catenary, iron pole, single trolley construction showed a leakage of but one ampere at 6,000 volts.

Obituary.

MR. WILLIAM OFFUTT MUNDY, of the commercial engineering staff of the Westinghouse company, died at the East End Hospital, Pittsburg, Pa., on Wednesday, March 29th. Death was due to blood poisoning, developed from an affliction of the ear which first caused him annoyance about two months ago. Mr. Mundy was a graduate of the Rose Polytechnic Institute at Terre Haute, Ind., and was still a young man not yet having reached thirty. Mr. Mundy was a native of Louisville, Ky., and first entered street railway work there, afterwards going to St. Louis to become master mechanic of the St. Louis Transit Co., which position he resigned in April, 1904, to join the Westinghouse staff as commercial engineer. The new shops of the St. Louis Transit Co., embodying many of the best labor-saving devices, were built under his direction. Mr. Mundy was marked for his keen observation, especially in the lines of his profession which, coupled with his inventive genius, enabled him to improve shop conditions by the substitution of many labor-saving appliances. The inventions of Mr. Mundy were not confined, however, to the equipment of railway shops, for he did much toward the improvement of systems of electric train control. He was also the inventor of an air brake appliance of much merit. Quite recently he patented a street car window which was a marked improvement in construction. He was a leader in his profession, and his ideas have contributed much of value to electric railway practice, and particularly to the equipment of shops and to the construction of railway motors and controllers. Mr. Mundy was keenly alive to all that promised improvement in electric railway operation and was prominent in the organization of the American Railway Mechanical and Electrical Association, and was a member of its executive committee until October, 1904. Mr. Mundy was married to Miss Kathleen Eddy, of Detroit, Mich., Jan. 4, 1905.

W. O. MUNDY.

Parcel Carrying on Street Railways.

(From United States Consul Hamm, Hull, England.)

The Manchester tramways committee has for some time had under consideration the details of a scheme for carrying parcels on the street cars in that city, and has adopted a scale of charges for parcels, inclusive of the charge for delivery, for two areas, the "inside" and the "outside." The "inside" area will include the whole of the city of Manchester, the borough of Salford, and the township of Stretford as far as Warwick road. The "outside" area will include the suburbs which are around the district thus outlined and within the tramway's circuit. Parcels will be delivered to all parts covered by the scheme at intervals of not more than a quarter of an hour. The following are the charges for the two areas:

Weight. Not exceeding	Inside. service. Cents	Outside. service. Cents
14 lb.	4	6
28 lb.	6	8
56 lb.	8	12
112 lb.	12	16

Manchester, with Salford and Stretford, all included in the "inside" area, has a population of about 800,000 people. The "outside" area includes a number of suburban towns and villages. Persons who have been discussing parcel-carrying schemes by trolley cars in American cities will watch this experiment with considerable interest.

A through express and freight schedule, with two trips each way a day, is now being run between Kalamazoo and Detroit. About 4½ hrs. are required for the run.

Electric and Cable Car Mail Service.

The report of the [illegible] for the fiscal year ending June [illegible] electric and cable car [illegible]

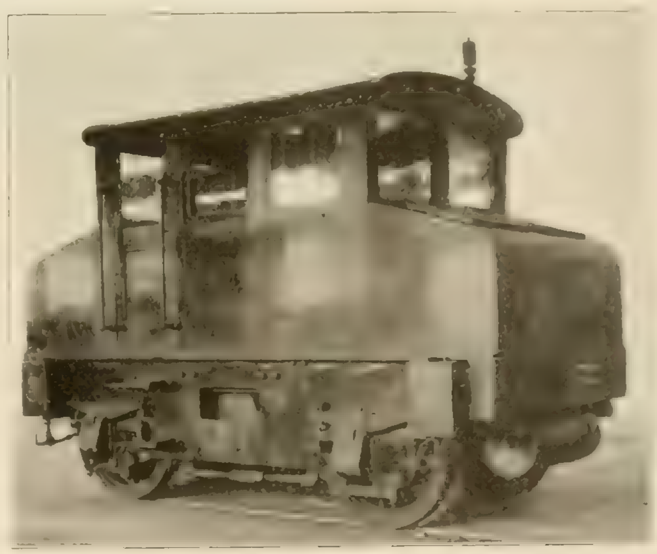
	Electric cars.	Cable cars.
Number of routes	[illegible]	[illegible]
Length of routes [illegible]	[illegible]	[illegible]
Miles traveled per [illegible]	[illegible]	[illegible]
Expenditure, rate per annum	[illegible]	[illegible]
Rate of cost per [illegible]	[illegible]	[illegible]
Rate of cost per [illegible]	[illegible]	[illegible]
Average trips per week	[illegible]	[illegible]

Deductions from [illegible] the year ending June [illegible] deductions were [illegible] $2.83.

The rates for the [illegible] and ¾ cent per foot per mile for compartment cars.

Single-Phase Locomotive for Sweden.

The locomotive [illegible] Swedish government by the Westinghouse Electric & Manufacturing Co. It is designed for using a trolley pressure of 18,000 volts in the open country and other pressures ranging as low as 3,000 volts in more thickly populated districts. Such high pressures necessitate the use of an oil cooled main auto-transformer and an oil-break circuit breaker. The control system is electro-pneumatic and consists of an air compressor [illegible] alternating current motor, an air motor on the induction regulator, air cylinders on the circuit breaker and reverser, and the necessary magnet valves. The same compressor will also furnish air for the brakes and sanders. Arrangements for multiple unit operation are provided and the master switch is so located that its operator has an unobstructed view.



SINGLE-PHASE LOCOMOTIVE [illegible]

The complete locomotive weighs 25 tons, all of which weight is carried by four 41-in. drive wheels. A single-phase 150-h. p. 3,000-alternation motor is geared to each of the two axles through gears having a reduction ratio of 18 to 70. These motors have shown their ability to handle a 70-ton train at 40 miles per hour without exceeding the rise of temperature for which they were designed.

Subject to the approval of the Massachusetts Railroad Commissioners, the Western Massachusetts Street Railway Co. has been granted authority to carry small parcels, baggage and freight in the towns of Westfield, Russell and Huntington, Mass., by the selectmen of those towns.

Steel Boat for Street Railway Parks.

[illegible] sports, boating is one of the most enjoyable and beneficial. An athletic instructor will advise that there is perhaps no better exercise than rowing, an athlete will tell you that there is perhaps no exercise more pleasant, while the pleasure-seeker will agree there is nothing more refreshing than a cool ride on the lake on a warm summer day. The wooden warship of a hundred years ago is obsolete today, and likewise the birch bark canoe has given way to the age of steel. Among those manufacturers who have kept abreast with the times is the W. H. Mullins Co., of Salem, O., whose stamped steel boats are shown in the accompanying engraving.

MULLINS STEEL BOATS IN SERVICE

In the stamped steel boats manufactured by this company the construction is of plates of steel covering an interior frame of wood which, although not bulky, is extensive and rigid. The frame consists primarily of bent wooden ribs which pass through the keel, the keel itself not being fastened to the outside of the metal covering, but is inside the boat. The top rail and seat-rests of the boat are also of wood, and the covering of the boat is of double-coated galvanized steel, made by a new process which prevents the scaling or cracking of the galvanized surface. The covering consists of a few large plates of this metal which fit snugly over the wooden frame, there being six plates in the smaller boats and eight plates in the 16-ft. model. In the construction of these boats it has been the purpose to reduce the number of joints, and these are tightened and tested until, it is claimed by the manufacturer, a leak at the joints is rendered an impossibility. An important feature of this boat is the air chambers, which render it absolutely safe in case of accident. Each boat is given a double coat of aluminum paint which adds to the finish of the craft and protects the galvanized surface.

The Mullins steel motor boat is constructed along the same lines as the row boat, the ribs and entire frame work being of selected oak, steam-bent to exactly fit the metal shell or hull. This frame work is made entirely independent of the shell, the shell being fastened only along the gunwales, keel, stem post and stern post. The advantage of this construction is that the vibration of the engine is absorbed by the frame work, and is not communicated to the hull of the boat, thereby eliminating the chances of opening seams. The joints between the plates are countersunk riveted and soldered, which makes a strong and secure construction. These boats are also fitted with large air-tight compartments in each end of sufficient capacity to safely float the boat, together with its occupans, in case of accident. The motors used in these boats are of the two-cycle type, simple in construction and of light weight, the 3 h. p. motors weighing 95 lb. and the 5 h. p. motors weighing 130 lb. each.

Besides the two types of boats described, the W. H. Mullins Co manufactures auto-speed boats, hunting and fishing boats and canoes, as well as a handy cart for the transportation of boats. Among the street railway companies which are using Mullins steel boats are the Omaha & Council Bluffs Street Railway Co.; Joliet, Plainfield & Aurora R. R.; Ottawa Electric Railway Co.; Meadville Traction Co.; Hartford, Manchester & Rockville Tramway Co.; Butler Passenger Railway Co. and the Pennsylvania & Mahoning Valley Ry.

New Interurban Lines Between Boston, Mass. and Manchester, N. H.

Charters have been granted for the Boston & Haverhill and the Manchester & Haverhill street railways. The distance between Boston and Haverhill is 32.5 miles; the track for 30 miles of this distance will be built on a private right of way. It is proposed that a maximum speed of 60 miles an hour will be maintained, and if terminal facilities can be arranged with the Boston Elevated Railway Co., the 55-ft. cars of the proposed line will use the Sullivan Sq. terminal.

Mr. Wallace D. Lovell, of Boston, to whom the charters for these lines were granted, is planning to build the Boston and Haverhill section first, and has retained Mr. G. M. Thompson as construction engineer. The new road will enter parts of Massachusetts and New Hampshire which at the present time are not occupied by electric lines. The construction of the roadbed will require the erection of a large bridge over the Merrimac River between Bradford and Haverhill.

Mr. A. E. McReel, formerly superintendent of the Exeter, Hampton & Amesbury Street Railway Co., has been retained as manager of the proposed properties.

The Detroit, Monroe & Toledo Short Line Ry. interests have obtained control of Monroe Piers and the Hotel Lotus, which are located adjacent to their line and will erect the necessary buildings for an up-to-date pleasure resort.

During the year 1904 the electric roads of Michigan carried 151,011,029 passengers at an average fare of 4¾ cents each.

Plans of Electric Railways for 1905.

Authentic Reports of New Construction and Track Rebuilding, Proposed Additions to Power Plant, Shop and Car House Buildings, and New Machinery and Rolling Stock for Street and Interurban Railway Companies as Reported by Railway Officials, April, 1905—Reports of Manufacturers Concerning Orders and Contracts Recently Placed for Electric Railway Work—Summary of the Principal Urban and Interurban Electric Railway Companies Incorporated Within the Last Six Months.

Reports From Railway Officials

ALABAMA.

The Sheffield Co., Sheffield, Ala., has purchased the material for the construction of one mile of track, also one 500-kw. rotary. J. B. McClary, general manager.

The Birmingham Railway, Light & Power Co., Birmingham, Ala., is planning a large amount of rebuilding and new work for the coming season. The improvements will include coal handling apparatus, coal storage bins and mechanical stokers at the power house; extension of gas mains in all directions, a viaduct over the railroad tracks in Bessemer, a terminal in Bessemer with a freight house, waiting station and electric light offices; the relaying of the South Bessemer line between Powderly and Bessemer with 70-lb. rails, and the addition of 10 new motor cars, several new trail cars, a new freight motor car, new freight box cars and a general overhauling of the electric light distribution circuits and the replacing of many of them with heavier copper. J. A. Emery, of Birmingham, general manager, and Ford, Bacon & Davis, engineers.

Selma Street & Suburban Railway Co., Selma, Ala., will build three miles of new track. Col. F. M. Abbott, president, treasurer and purchasing agent.

Montgomery Traction Co., Montgomery, Ala. Will build five miles of new double track and a new car barn, and has recently placed orders for four new cars and 16 new motor equipments. E. D. Apperson, president.

ARKANSAS.

Ft. Smith Light & Traction Co., Ft. Smith, Ark., will build three miles of new track and reconstruct one-half mile old track; is now building a car barn and has bought 15 cars, 3 new engines and 3 generators. R. G. Hunt, treasurer and purchasing agent.

ARIZONA.

Tucson Street Railway Co., Tucson, Ariz. Will build 2½ miles of new track and reconstruct 4½ miles of old track, will remodel its old car barn, purchase three new cars and one generator. Charles F. Hoff, general manager and purchasing agent.

CALIFORNIA.

San Diego Electric Railway Co., San Diego, Cal. Will build 7 miles of new track and reconstruct 3 miles of old track, and will purchase 6 new cars and 6 sets of new motor equipments and new generator of 750-kw. capacity. B. M. Warner, general superintendent.

Union Traction Co., Santa Cruz, Cal. Will build about two miles of new track and reconstruct about four miles of old track; will build a new sub-station and a carn barn for 30 cars, and will purchase some new cars and motor equipments. John M. Gardiner, general manager.

San Jose & Santa Clara Railway Co., San Jose, Cal. There is an option on the road at present and new owners have not as yet taken control. They expect to make extensive improvements and extend the road 40 miles. H. P. B. O'Dogherty, superintendent.

The United Railroads of San Francisco, San Francisco, Cal. The company will build new general repair shops covering an area of ten acres and will purchase new machinery for equipping it. George F. Chapman, general manager; C. D. Baldwin, purchasing agent.

Bakersfield & Ventura Railroad Co., Los Angeles, Cal. The company has under construction 125 miles of railway and will build all of the new track it can during the year. The company will also build a new power station and purchase the necessary equipment for it, as well as 75 new cars and the necessary motor equipment [illegible]

CONNECTICUT.

[illegible] mile of old track. L. S. Risley, superintendent.

COLORADO.

The Denver City Tramway Co., Denver, Colo. [illegible] having extended several of its car barns, also having purchased a large number of new cars and motors, the company does not contemplate [illegible] during the present year. John A. Beeler, vice-president and general manager.

DISTRICT OF COLUMBIA.

The Capital Traction Co., Washington, D. C. Will purchase seven new car bodies during the coming season. D. S. Carll, electrical engineer and superintendent.

Washington, Arlington & Falls Church Railway Co., Washington, D. C. This company has recntly purchased material for the reconstruction of about one mile of old track and the construction of one-half mile of new track; also five miles of telephone lines. It will purchase from 2 to 4 new cars and the necessary motor equipments, 4 to 8. The company has also purchased a new booster. F. B. Hubbell, vice-president and general manager.

Baltimore & Washington Transit Co., Washington, D. C. Will rebuild two miles of old track and the entire line will be changed from trolley to American monorail system, work now being under way. William A. Mellen, president.

FLORIDA.

North Jacksonville Street Railway, Town & Improvement Co., Jacksonville, Fla. Will build 2.2 miles of new track and will purchase two new cars and two new double motor equipments of 40 h. p. each. Frank C. Elwes, general manager.

GEORGIA.

Augusta-Aiken Railway & Electric Co., Augusta, Ga. Improvements on this line recommended by its president include the purchase of a new express car and building an express station for the storage of such express matter as is offered the company and building a station and office building; and the purchase of an entire new car equipment for the Aiken line, which plan also includes the building of a power house in the city of Augusta of sufficient power to provide power for the full Aiken line. John Blair MacAfee, president, Philadelphia; R. E. Hunt, general manager, Augusta, Ga.

Atlanta & Carolina Railway Co., Atlanta, Ga. Will build 25 miles of new track, a new car barn and will purchase new cars. The company will buy current. M. T. Edgerton, secretary.

Macon Railway & Light Co., Macon, Ga. Will reconstruct two miles of track and build two miles of new track, and will purchase six new cars with the necessary new motor equipments. J. T. Nyhan, general manager.

Valdosta Street Railway Co., Valdosta, Ga. Will do very little building [illegible] W. J. Lane, general manager and treasurer.

IDAHO.

[illegible]

Will construct $2\frac{1}{2}$ miles of new track. R. F. Blackwell, vice-president and general manager.

ILLINOIS.

Springfield & Northeastern Railroad Co., Bloomington, Ill. Will [illegible] new [illegible] power [illegible] car barn, and will [illegible] 3,000 h. p. of new engine and 3,000 kw. new generators. The L. E. Meyers Construction Co., Monadnock Bldg., Chicago, manager.

Illinois Traction Co., Champaign, Ill. Will build 120 miles of new track and rebuild 2 miles of old track; will build a new car barn, purchase 17 new cars and will increase the capacity of its old power station, having purchased 2,000-kw. turbine and 800-d. c. generator. William B. McKinley, president.

Chicago & Southern Traction Co., 1213 Hartford Bldg., Chicago, Ill. Will build 56 miles of new track and will purchase 24 cars, 4,500 h. p. of engines and 3,000 kw. generators. J. B. Reed, secretary.

Alton, Granite City & St. Louis Traction Co., Alton, Ill. Will build six miles of new track between Granite City and East St Louis and a new car barn at Granite City, Ill. J. F. Porter, president.

East St. Louis & Suburban Railway Co., East St. Louis, Ill. Contemplates the reconstruction of six miles of track and the construction of four miles additional track. J. M. Bramlette, general superintendent.

Illinois Valley Railway Co., LaSalle, Ill. Will build five miles of new track between Marseilles and Seneca and possibly extend the present line from Ladd to Princeton, Ill. H. E. Chubbuck, general manager.

INDIANA.

Richmond Street & Interurban Railway Co., Richmond, Ind. Will reconstruct 6 miles of old track. Albert Gorden, superintendnt.

The Indianapolis & Ohio Valley Traction Co., Indianapolis, Ind. Will build 27 miles of new track between Rockport and Cannelton, a new power station and car barn at Newtonville or Troy, and will purchase cars and other necessary equipment, including an electric locomotive. J. H. Larimer, president.

The Ft. Wayne & Springfield Railway Co., Decatur, Ind. Will construct 20 miles of new track and has just completed power station and car barns at Decatur, Ind. W. H. Fledderjohann, president and general manager.

Columbus Street Railway & Light Co., Columbus, Ind. This company has secured control of the John S. Crump street railway and will build about three miles of new track, a new power station, and will purchase six new cars, 12 new motor equipments, two 300-h. p. engines and two 200-kw. generators. R. F. Gottschalk, president.

Indianapolis, Columbus & Southern Traction Co., Columbus, Ind. Will buy new sub-station equipment. William G. Irwin, general manager and purchasing agent.

Indianapolis & Cincinnati Traction Co., Rushville, Ind. This company expects to extend its line from the present terminus to Connersville, Ind., a distance of 17 miles. A. A. Anderson, general superintendent.

Indianapolis, Newcastle & Toledo Electric Railway Co., Indianapolis, Ind. Will build new track from Indianapolis to Newcastle, a new power station and car barn at Newcastle. Eli Marvin, treasurer.

Kokomo, Marion & Western Traction Co., Kokomo, Ind. Will build 15 miles of new track and a new car barn, and has just completed a new power station. T. C. McReynolds, general manager.

Indianapolis & Martinsville Rapid Transit Co., Indianapolis, Ind. Will build 25 miles of new track. Paul H. White, general manager.

IOWA.

Fort Dodge Light & Power Co., Fort Dodge, Ia. This company has just completed the construction of a new power plant. W. M. Healy, general manager.

Citizens Railway & Light Co., Muscatine, Ia. The material is on hand for one-half mile of new track to be built by this company. A. L. Lindner, manager.

The State Electric Co., Clinton, Ia. Has recently purchased eight new cars and eight new motor equipments. C. C. Ewing, assistant general manager.

Iowa Valley Interurban Railway Co., Belle Plaine, Ia. Will construct about 30 miles of new track during the coming season. H. R. Mosnat, secretary and general manager.

Interurban Railway Co., Des Moines, Ia. Will build 40 miles of new track during 1905. H. H. Polk, president and general manager.

Burlington Railway & Light Co., Burlington, Ia. Will reconstruct five miles of old track during the summer of 1905. C. H. Walsh, manager.

KANSAS.

The Topeka Railway Co., Topeka, Kas. Will reconstruct about $2\frac{1}{2}$ miles of old track. A. M. Potter, general superintendent.

The Electric Railway, Light & Ice Co., Junction City, Kas. Has just finished new car barns and has purchased one 250-h. p. engine. F. G. Kennedy, secretary.

KENTUCKY.

The Henderson City Ry., Henderson, Ky. Will build 42 miles of new interurban track and extend the city lines 2 miles, also a new power station and car barns. The company will also purchase 14 new cars and their motor equipment and two new engines and generators for the power plant. K. R. Battin, superintendent.

Kentucky & Ohio River Interurban Railroad Co., Paducah, Ky. Will build new power station and car barns at Paducah; will buy six passenger and two express cars, eight new motor equipments, two cross-compound 800-h. p. engines and two 800-kw. generators. W. H. Paul, secretary and electrical engineer.

LOUISIANA.

Lake Charles Street Railway Co., Lake Charles, La. Now has under construction $7\frac{1}{2}$ miles of new track and a new car barn, and has purchased 6 new cars with motor equipments and the necessary equipment for its power station, the building for which is completed. J. A. Landry, treasurer and manager.

MAINE.

Rockland, South Thomaston & Owls Head Ry., Rockland, Me. Will build 4 miles of new track, a new car barn, and will purchase 3 new cars.

Atlantic Shore Line Railway Co., Kennebunkport, Me. Now has under consideration the extension of its line from Kennebunkport to Wells Beach, a distance of 18 miles, the reconstruction of several miles of old track and the building of an auxiliary steam plant. George A. Murch, superintendent.

Lewiston, Brunswick & Bath Street Railway Co., Lewiston, Me. Has just purchased new generators of 500 kw. capacity and contemplates no further improvements at present. F. C. Farr, general manager.

MARYLAND.

United Railways & Electric Co., Baltimore, Md. Will build a new power station at Pratt St. and O'Donnell's wharf to replace that destroyed by fire Feb. 7, 1904, and will purchase new engine of 7,280 h. p. capacity and new generators of 5,000 kw. capacity. William A. House, second vice-president and general manager.

The Baltimore & Bel Air Electric Railway Co., Bel Air, Md. Will construct 16 miles of new track during the year 1905. J. Alexis Shriver, general manager.

MASSACHUSETTS.

Holyoke Street Railway Co., Holyoke, Mass. Will reconstruct one or two miles of old track. William S. Loomis, general manager.

Cottage City & Edgartown Traction Co., Cottage City, Mass. Will reconstruct about two miles of old track. A. A. Highlands, president.

Worcester & Holden Street Railway Co., Holden, Mass. Will build 11 miles of new track, a new power house at Jefferson and a large addition to its car barns; and will purchase several new open and box cars and new engines and generators for the new power station. E. S. Douglass, treasurer.

Lowell, Alton & Maynard Street Railway Co., Maynard, Mass. Will build about 14 to 16 miles of new track during the coming season. John W. Ogden, treasurer, superintendent and purchasing agent.

Boston & Haverhill Street Railway Co., Boston, Mass. Will construct a double track electric railway between Boston and Haverhill, a distance of 30 miles, a new power station and car barns at Haverhill. The company will also purchase 16 new cars and 16 four-motor equipments, also new engine of 3,000 h. p. capacity and generators of 2,500 kw. capacity.

Templeton Street Railway Co., East Templeton, Mass. This com-

pany will purchase two second hand open cars. Dave S. Boyden, purchasing agent, 311 Washington St., Boston, Mass.

MICHIGAN.

The Houghton County Street Railway Co., Hancock, Mich. Will rebuild about ½ mile of track and that portion of the street to be paved in Red Jacket, Mich. Stone & Webster, Boston, managers; A. W. Leonard, local manager.

The Marquette County Gas, Light & Traction Co., Ishpeming, Mich. Will rebuild its old power station, having purchased the necessary additional equipment. H. T. Pearce, superintendent; George A. Rockwell, general manager and purchasing agent, Oshkosh, Wis.

Michigan Traction Co., Kalamazoo, Mich. Will build four miles of new track and purchase eight new cars and eight new motor equipments. D. A. Hegarty, general manager.

Lansing & Suburban Traction Co., Lansing, Mich. Will build 37 miles of new track between Lansing and Jackson, Mich. James R. Elliott, secretary.

Bay City Traction Co., Bay City, Mich. Will build one mile of new track and reconstruct one mile of old track. J. C. Young, general superintendent, Saginaw, Mich.

MINNESOTA.

Duluth Street Railway Co., Duluth, Minn. This company contemplates building very little new track, but if the city decides to do much paving the company will reconstruct considerable old track. H. Warren, general manager.

Twin City Rapid Transit Co., Minneapolis, Minn. This company expects to build approximately 50 miles of new lines, besides a considerable amount of construction work and paving. It also has in contemplation the construction of new shops midway between the two cities, and will add approximately 100 cars to its equipment during the year. The company builds its own cars. These improvements will necessitate some additional power and sub-station apparatus, which will be installed as required. Willard J. Hield, general manager.

MISSISSIPPI.

Gulfport & Mississippi Coast Traction Co., Gulfport, Miss. Will construct about 25 miles of new track, a new power house and car barn, and will purchase eight cars and their necessary motor equipment and the necessary engines and generators to equip the power house.

MISSOURI.

Hannibal Railway & Electric Co., Hannibal, Mo. Will reconstruct one mile of old track and will purchase one new motor generator set of 200-kw. capacity. J. S. Mainland, general manager and purchasing agent.

Kansas City Railway & Light Co., Kansas City, Mo. Will construct 2½ miles of new single track and reconstruct from 3½ to 7 miles of old single track. The company will also build a new car barn and will install 5,000-kw. turbine. Charles N. Black, general manager.

MONTANA.

Helena Light & Traction Co., Helena, Mont. Will build one mile new track, 6-in. T rails, renew special work and pavement and will purchase 2 new cars and 18 new motor equipments. R. A. Wilson, superintendent.

NEBRASKA.

Citizens Railway Co., Lincoln, Neb. Will build 7 miles of new track and reconstruct 2½ miles of old track, and will also purchase three new cars. Alex. Berger, president.

NEW HAMPSHIRE.

Manchester Street Railway Co., Manchester, N. H. On account of recent losses by fire this company will build a new car barn and will buy 23 new cars and the necessary equipment for them. P. L. Saltonstall, treasurer.

NEW YORK.

Ithaca Street Railway Co., Ithaca, N. Y. Will lease 2½ miles of new track which is to be built by the Ithaca & Cayuga Heights Railway Co. This company will also purchase six new cars and 5 new motor equipments. R. L. Post, general manager.

Ithaca & Cayuga Heights Railway Co., Ithaca, N. Y. Will build about 2½ miles of new track and has recently purchased five new cars and the necessary motor equipment for them. J. T. Newman, president.

Chemung Valley Traction Co., Elmira, N. Y. Will build 18½ miles of new track. This is a new line and its president reports that construction work will begin as soon as the necessary consents are obtained. E. E. Buchanan, president.

Jamestown Street Railway Co., Jamestown, N. Y. Will make considerable improvements in its Washington St. car barns during the coming season. George E. Maltby, general manager and purchasing agent.

Buffalo & Rochester Railway Co., Depew, N. Y. Will build 61 miles of new track, one new power station and three sub-stations and their necessary equipment, two new car barns, and will purchase 25 cars and their equipment. John T. Mooney, general manager.

Bennington & Hoosick Valley Railway Co., Hoosick Falls, N. Y. Will make such improvements about its power plant as will put it in first class shape and will build a pavilion at its Battlefield Park. George E. Greene, president.

Syracuse, Skaneateles & Moravia Railway Co., Moravia, N. Y. Will build 43 miles of new track, a power station at Moravia, and will purchase eight new cars, six new motor equipments, 3,000 h. p. of engines and 2,000 kw. of generators. W. T. Parker, president.

Elmira Water, Light & Railroad Co., Elmira, N. Y. Will reconstruct two miles of old track. H. M. Beardsley, treasurer.

Binghamton Railway Co., Binghamton, N. Y. Contemplates the erection of three new power stations, has recently built a new car barn and purchased four new cars and their necessary motor equipment. Also has under consideration the extension of its line but no definite action has been taken as yet. J. P. E. Clark, general manager.

Ogdensburg Street Railway Co., Ogdensburg, N. Y. Will build 1 mile of new track and reconstruct 6 miles of old track, and will either rebuild its old power station or build a new one. The company will purchase one 300-kw. generator. E. E. Hawkins, president.

Catskill Electric Railway Co., Catskill, N. Y. Will build 6½ miles of new track and a new car barn of 20 cars capacity, and will also purchase 4 new cars and 4 sets of new motor equipments. William E. Stewart, president.

NORTH CAROLINA.

Consolidated Railways, Light & Power Co., Wilmington, N. C. Will build 2½ miles of new track and reconstruct 6 miles of track. The company has recently purchased 3 new cars, one 400-kw. generator and one 25-kw. exciter set. A. B. Skelding, general manager and purchasing agent.

NORTH DAKOTA.

Fargo & Moorhead Street Ry., Fargo, N. D. Will build three miles of new track and new car barn, and buy four motor cars and four trailers. R. E. Heath, general manager.

OHIO.

The Marion-Bucyrus Railway & Light Co., Toledo, O. Will build 20 miles of new track, a new power house and car barn and will purchase 4 new cars, two 350-h. p. engines and two 300-kw. generators. Ellis Bartholomew, president.

The Toledo & Indiana Railway Co., Delta, O. Has just completed its new power house, car barns and shops at Stryker, O., and has purchased two new engines of 1,000-h. p. capacity each. The company will purchase three new passenger coaches and one new express and baggage car. D. H. Lavenberg, general manager.

Lima, Findlay & Toledo Railway Co., Lima, O. Will construct 32 miles of new track. F. D. Carpenter, general manager.

Ft. Wayne, Van Wert & Lima Traction Co., Lima, O. Will build 34 miles of new track and will purchase seven new cars and seven quadruple motor equipments. H. F. Dicke, superintendent.

The Newell Street Railway Co., East Liverpool, O. Will build 2½ miles of new track and a new car barn. F. B. Lawrence, general manager.

Columbus, New Albany & Johnstown Traction Co., Columbus, O. Will build 17½ miles of new track and will purchase four new cars and motor equipments for them. L. P. Stephens, general manager.

Springfield, Troy & Piqua Railway Co., Springfield, O. This company has just placed orders for two new closed and two new open cars and the necessary motor equipment for them. F. J. Green, general manager; H. C. Dimond, secretary and purchasing agent.

The Lake Erie, Bowling Green & Napoleon Railway Co., Bowling Green, O. Will extend its lines west of Bowling Green and east of Woodville, and will purchase one new car. J. R. McKnight, superintendent.

The Ashtabula Rapid Transit Co., Ashtabula, O. This company will purchase one new car and its necessary motor equipment. E. R. McDowell, manager.

The Toledo, Fostoria & Findlay Railway Co., Fostoria, O. Will build 18 miles of new track. F. W. Adams, general manager.

Toledo, Bowling Green & Southern Traction Co., Findlay, O. This company will reconstruct 25 miles of old track during 1905, now has under construction a new power house, the equipment for which is contracted for, and will purchase five new cars with the necessary motor equipment. C. F. Smith, general manager.

Southeastern Ohio Railway, Light & Power Co., Zanesville, O. Will build 15 miles of new track during 1905 and will purchase eight new cars and new generators of 800 kw. capacity. Edward R. Meyer, secretary.

Columbus, Delaware & Marion Railway Co., Delaware, O. Will build six miles of new track, is now rebuilding its power station, will purchase four new cars and motor equipments and has recently purchased 3,000 h. p. new engines and 2,000 kw. new generators. George Whysall, general manager.

The Cincinnati, Millford & Loveland Traction Co., Cincinnati, O. Will build 30 miles of new track and a new power station, and will puchase five new cars and their necessary motor sets, two 750-h. p. engines and two 500-kw. generators. J. P. Penning, general manager.

Cleveland, Painsville & Ashtabula Railroad Co., Geneva, O. Will construct six miles of new track and will purchase 24 new motor equipments, 2,400 h. p. boilers and 1,000 h. p. turbine, and new generators of the 3-phase, 25-cycle, 13,000-volt type. J. R. Curtis, general superintendent.

Cleveland, Painesville & Eastern Railroad Co., Willoughby, O. Will construct one mile of new track and rebuild one mile of old track. J. Jordan, superintendent.

The Scioto Valley Traction Co., Columbus, O. Will build 21 miles of new track and will purchase six new cars and their necessary motor equipments. L. C. Bradley, general superintendent.

United Electric Co., Dennison, O. Will reconstruct about one mile of old track. O. B. Welch, general manager.

Eastern Construction Co., Cleveland, O. Will build 42 miles of new track, a new power station at Kinsman, O., and a new car barn at Mesopotamia, O., and will purchase four new cars. Francis B. Morgan, president.

Zanesville Railway, Light & Power Co., Zanesville, O. Will build two miles of new track during 1905. W. A. Gibbs, general manager and purchasing agent.

Lake Shore Electric Railway Co., Cleveland, O. Will build six miles of new track during 1905. F. W. Coen, purchasing agent.

Marion-Bucyrus Railway & Light Co., Bucyrus, O. Will build 20 miles of new track, a new power station and a new car barn, and will purchase four new cars and their motor equipments, two 350-h. p. engines and two new generators. Ellis Bartholomew, president.

OKLAHOMA.

Guthrie Railway Co., Guthrie, Okla. This company is now building six miles of new track and will soon begin the construction of a new car barn. John W. Shartel, manager.

OREGON.

Albany Street Car Co., Albany, Ore. This is at present a horse car road, but expects to change its line for electrical operation, which will include the reconstruction of its track, improvements in its power house, and the purchase of new cars and their equipment and one new generator. C. Sullivan, general manager, purchasing agent and chief engineer.

The Oregon Water Power & Railway Co., Portland, Ore. Will build 4½ miles of new track and a new power station during the coming season. It has not been decided as to the units to be installed. W. H. Hurlburt, president.

PENNSYLVANIA.

The York Street Railway Co., York, Pa. Will build ¼ mile of new track and will purchase two new motor equipments. A. H. Hayward, general manager.

Central Pennsylvania Traction Co., Harrisburg, Pa. Has purchased new material for the construction of 5½ miles of new track and the reconstruction of two miles of old track. This company is now building its car barn, which is nearing completion. Frank B. Musser, president.

York County Traction Co., York Pa. Surveys have been completed and the necessary franchises assured for the extension of this company's lines to Littlestown, touching Pennsburg and Mt. Pleasant, a distance of 7 miles, and the improvements will be pushed rapidly. The company also contemplates several improvements and extensions to its lines at Hanover.

Shenango Street Railway Co., Greenville, Pa. Will build 65 miles of new track, a new power station, a new car barn of 36 cars capacity, and will buy 30 new cars, 20 new motor equipments, new engines of 2,500 h. p. capacity and new generators of 2,000-kw. capacity. W. H. Waugh, chief engineer.

Ringing Rocks Electric Railway Co., Pottstown, Pa. Will build 2½ miles of new track and reconstruct 1 mile of track, and will purchase 4 new cars and 4 new sets of motor equipments. Ralph E. Shaner, superintendent and purchasing agent.

Pittsburg, McKeesport & Greensburg Railway Co., Greensburg, Pa. Will build 5 miles of new track and will purchase 10 new cars and 10 sets of new motor equipments. M. A. Coffey, superintendent.

New Holland, Blue Ball & Terre Hill Street Railway Co., New Holland, Pa. Will build 3½ miles of new track and will purchase 2 new cars. J. F. Seldomridge, secretary.

Conneaut & Erie Traction Co., Girard, Pa. Will purchase four new 50-ft. cars and four new quadruple motor equipments. C. E. Flynn, vice-president and general manager.

Pottstown & West Chester Electric Railway Co., Philadelphia, Pa. General offices 1001 Chestnut St. Will build 22 miles of new track, a new power station and a new car barn, 40 x 100 ft., at Byers, Chester Co., Pa., and will purchase 15 new cars, 10 motor equipments and new engines of 800-h. p. capacity. W. T. Forsythe, chief engineer.

Shamokin & Edgewood Electric Railway Co., Shamokin, Pa. Will build a new car barn during the summer of 1905 and will purchase two new cars and their necessary motor equipments. M. H. Barr, secretary.

Northumberland County Traction Co., Northumberland, Pa. Will construct ten miles of new track and reconstruct five miles of old track, an addition to its present car barn and an addition to its present power station, including one 500-h. p. engine and one 400-kw. generator. The company will also purchase eight new cars and their necessary motor equipments. D. A. Hegarty, general superintendent.

Warren & Jamestown Street Railway Co., Warren, Pa. Will build 22 miles of new track between Warren, Pa., and Jamestown, N. Y., a new power station at Stoneham, Pa., and additions to its car barns at Warren. The company will purchase seven new cars and their motor equipments, two new gas engines of 500 h. p. each and two new generators of 260 kw. each. D. H. Siggins, president.

York & Susquehanna Street Railway Co., York, Pa.; capital, $84,000, has been granted a charter by the state department for the building of a suburban railway from York to Long Level, on the Susquehanna River, a distance of 14 miles, passing through Green Hill, Longstown, Yorkana and East Prospect. William Hall has been elected president, and the directors are Joseph T. Walmsley, John F. B. Attson, William L. Gleason and Joseph B. Lanning, of Philadelphia.

West Chester Street Railway Co., West Chester, Pa. Will construct 3½ miles of new track and reconstruct 4½ miles of old track, and build a new car barn with capacity for 25 cars. The company will also purchase four new cars and their motor equipments. Henry H. Archer, general manager.

Washington & Canonsburg Ry., Washington, Pa. Will build one mile of new track. R. R. Reed, general manager.

Philadelphia, Lancaster & Harrisburg Passenger Railway Co., Parkersburg, Pa. Will build 16 miles of new track. E. M. Raymond, general manager.

The Nashville Railway & Light Co., Nashville, Tenn. Contemplates the expenditure during 1905 of about $600,000, in addition to $150,000 already expended this year. Of this amount something like $200,000 will be for enlarging the power plant by the addition of a 3,000-kw. turbo-generator, boilers, rotary converters, etc. Another $200,000 will be required for the site (already purchased) and

a new car barn, plans for which are now under consideration. The barn will be almost in the center of the city, near the company's transfer station. The Nolensville Pike extension of the Cherry and College St. line will require $75,000, the remainder being expended in the reconstruction of its various lines, among which are the Belmont and the Jefferson St. lines and extensions now nearing completion, and for new car equipment. Orders have been given J. G. Brill Co. for 10 single truck cars, 5 double truck motor cars and 8 double truck trail cars. Work is being pushed on the extension out Nolensville Pike to the village of Flat Rock, a distance of nearly two miles; the fences along the entire distance have been set back from the pike to make room for the roadbed, and grading has been completed a considerable part of the way. Track laying has been delayed on account of difficulty in getting rails, but the 700 tons ordered some time since have been received and are now being rapidly put down. It is expected to have the line completed and in operation by June 15th. The county and city have recently granted franchises for the extension of the Broad St. line out the Richaland or Harding turnpike for a distance of 1½ miles.

Memphis Street Railway Co., Memphis, Tenn. Plans are already under way for the reconstruction and rebuilding of the company's entire system to bring it up to the standard of the lines already owned by the Newman interests, Nashville and Knoxville, Tenn., and Birmingham, Ala., and Little Rock, Ark.

TEXAS.

Bonham Electric Light & Power Co., Bonham, Texas. This company will purchase two second-hand motor cars. Charles Halsell, manager and purchasing agent.

Galveston City Railway Co., Galveston, Tex. Will build two miles of new track and reconstruct six miles of old track during the coming summer. H. S. Cooper, general manager.

Austin Electric Railway Co., Austin, Tex. Will reconstruct about two miles of new track and has under consideration the purchase of new cars and additional equipment for its present power station. W. H. Young, president.

VERMONT.

Brattleboro Street Railway Co., Brattleboro, Vt. Will purchase one new boiler of 150-h. p. capacity. C. K. Jones, superintendent.

Burlington & Southeastern Railway Co., Burlington, Vt. Will build ten miles of new track and reconstruct five miles of old track, and will purchase six new cars and their necessary motor equipments. F. O. Sinclair, general manager and purchasing agent.

VIRGINIA.

Newport News & Old Point Railway & Electric Co., Hampton, Va. Will purchase [illegible] new cars and their necessary motor equipment. H. H. Carr, general manager.

WEST VIRGINIA.

Steubenville & Wheeling Traction Co., Wheeling, W. Va. Will build eight miles of new track and will purchase seven new cars and the necessary motor equipments for same. G. O. Nagle, general manager.

Wheeling Traction Co., Wheeling, W. Va. Will build two miles of new track and will purchase ten new cars and their necessary motor equipments. G. O. Nagle, manager.

Fairmont & Clarksburg Traction Co., Fairmont, W. Va. Will build and equip 20 miles of track between Fairmont and Clarksburg, a new central power station and two sub-stations and a new car barn and shops, and will purchase 12 new cars and 14 new motor equipments and new generators of 1,500-kw. capacity. A. L. Linn, jr., general manager.

WISCONSIN.

Sheboygan-Elkhart Lake Railway & Electric Co., Sheboygan Falls, Wis. Will build 25 miles of new interurban track and a new power station at Sheboygan. Charles H. Thomas, secretary.

Fox River Electric Railway & Power Co., Green Bay, Wis. Will build two miles of new track and reconstruct two miles of old track, and will purchase seven new cars and their necessary motor equipments and a 200-kw. generator. George W. Knox, general manager.

CANADA.

Sarnia Street Railway Co., Ltd., Sarnia, Ont. This company will build a loop and several new sidings and a new car barn during the coming season and will purchase two new cars and motor equipments. H. W. Wills, general manager.

Sandwich, Windsor & Amherstburg Ry., Windsor, Ont. Will build ¼ mile of new track and purchase three sets of new motor equipments. James Anderson, manager and purchasing agent.

The Windsor & Tecumseh Electric Railway Co., Walkerville, Ont. Will build 18 miles of new track, a new power station and a new car barn, and will purchase six new cars and their motor equipments, two 400-h. p. engines and two 300-kw. generators. Willis F. Brown, general manager.

London Street Railway Co., London, Ont. Will build one mile of new track during this spring. C. E. A. Carr, general manager.

Orders and Contracts Recently Placed.

The John Davis Co., manufacturer of power plant materials, Chicago, Ill., reports that orders on hand and those recently completed include material for the power plants of the Galesburg Electric Motor & Power Co., Galesburg, Ill.; Springfield Consolidated Railway Co., Springfield, Ill.; Lincoln Traction Co., Lincoln, Neb.; Madison Traction Co., Madison, Wis.; Metropolitan Street Railway Co., Kansas City, Mo.; Danville Street Railway & Light Co., Danville, Ill.; Decatur Railway & Light Co., Decatur, Ill.

The Sterling-Meaker Co., Newark, N. J., has recently closed a contract with the Brooklyn Heights Railroad Co. for 300 of its latest type No. 5 Sterling-Meaker round fare registers with combination backs (to be used with either rod or cord ringing device) and locks complete.

The United States Electric Signal Co., of West Newton, Mass., is about completing its contract with the Boston Elevated Railway Co. for the equipment of the Boston surface lines with automatic block signals. The company has recently completed a contract with the Birmingham Railway, Light & Power Co. and is also supplying the roads at Knoxville and Nashville, Tenn. During the coming spring and summer the company will supply crossing signals to a large number of railroads in Vermont, it being required by a rule of the Railroad Commissioners. The United States signal box embodies some recent changes which make it more convenient.

The Green Engineering Co., Western Union Bldg., Chicago, during the past nine months has received orders for traveling link grates for the boiler equipment of the power plants of the following companies: Birmingham (Ala.) Railway, Light & Power Co., 12,000 h. p.; City of Chicago, 1,500 h. p.; Urbana & Champaign (Ill.) Railway, Gas & Electric Co., 800 h. p.; Merchants Heat & Light Co., Indianapolis, Ind., 2,600 h. p.; Galesburg (Ill.) Gas & Electric Co., 800 h. p.; Quincy (Ill.) Gas & Electric Co., 500 h. p.; Ottumwa (Ia.) Traction & Light Co., 1,800 h. p.; Springfield (Ill.) Electric Light, Heat & Power Co., three orders, 1,000 h. p.; St. Joseph (Mo.) Railway, Light, Heat & Power Co., 2,000 h. p.; Toledo Railways & Light Co., 2,600 h. p.; Stark Electric Railroad Co., Alliance, O., two orders, 400 h. p.; Metropolitan Street Railway Co., Kansas City, Mo., seven orders, 1,000 h. p.; Omaha & Council Bluffs Street Railway Co., Omaha, Neb., 3,000 h. p. The company now has a total of very close to 200,000 h. p. in street railway plants.

The New Bedford Boiler & Machine Co., New Bedford, Mass., reports that it has equipped and is now furnishing valves for the power plants of the Manila Electric Railroad & Light Co., Manila, P. I.; the Pennsylvania R. R. at Long Island City; the Massachusetts Electric Co., Boston; and the New York, New Haven & Hartford R. R., at Warren, R. I. The company has also furnished during the past few months 80 throttle valves for steam turbines that are using superheated steam.

The Power Specialty Co., 126 Liberty St., New York, reports a large number of traction and lighting plants equipped with its superheaters and among the contracts which it now has on hand are: Milwaukee Electric Railway & Light Co., 2,500 h. p.; Laclede Power Co., St. Louis, Mo., 1,000 h. p.; Terre Haute Traction & Light Co., 2,000 h. p.; Hartford (Conn.) Electric Light Co., 3,700 h. p.; Omaha Electric Light & Power Co., 1,760 h. p.; Interborough Rapid Transit Co., New York City, 3,000 h. p.; Nassau Light & Power Co., Glen Head, L. I., 1,000 h. p.; Philadelphia, Coatesville & Lancaster Railway Co., 750 h. p.; Cortland County Traction Co., 528 h. p.; Utica Gas & Electric Co., 1,300 h. p.; International Light

& Power Co., El Paso, Tex, 350 h. p.; Portland (Ore.) General Electric Co., 3,120 h. p.; Union Electric Light & Power Co., St. Louis, 20,000 h. p.; Chicago & Western Indiana Railway Co., 1,800 h. p.; Fullerton Ave. Electric Light Station, Chicago, 2,000 h. p.; Little Rock Electric & Railway Co., 1,730 h. p.; Philadelphia Electric Co., 2,140 h. p.

The General Electric Co. reports sales since Jan. 1, 1905, as follows: Albany & Hudson Railroad Co., one 300-kw., 500-r. p. m., 25-cycle, 600-volt rotary converter with transformers, switchboards, etc.; Scioto Valley Traction Co., three sub-station equipments, each consisting of one 400-kw., 25-cycle, 500-r. p. m. rotary converter; Metropolitan Street Railway Co., of Kansas City, Mo., one 1,000-kw., 250-r. p. m., 25-cycle rotary converter; Washington, Alexandria & Mt. Vernon Railway Co., four 4-motor equipments with controllers; Cincinnati & Columbus Traction Co., eight 4-motor equipments with type M control, two 800-kw. generators and five 400-kw. converters; Chicago & Milwaukee Electric Railway Co., one 300-kw. rotary converter with transformers; Zanesville Railway, Light & Power Co., one 300-kw. rotary converter with transformers and switchboard; California Gas & Electric Corporation, five 1,000-kw. rotary converters; United Gas & Electric Co., motor generator set consisting of a 250-kw. generator direct connected to a 300-h. p. induction motor; New York Central & Hudson River Railroad Co., the complete switchboard equipment for two main power stations which supply power for the electric service between New York and Croton and White Plains; Toledo & Chicago Interurban Railway Co., the complete electrical equipment for 50 miles of road, now building, comprising apparatus for the operation of the road on the General Electric single-phase alternating current system, consisting of two 800-kw., 3,300-volt, 25-cycle three-phase Curtis turbine generators, two 25-kw. exciters, three 270-kw. air blast transformers, and four sub-station equipments.

The Climax Stock Guard Co., Chicago, reports the sale of 25 carloads of "Climax" stock guards to the Long Island Railroad Co.; one carload to the Wisconsin & Michigan Railroad Co.; one-half carload to the Washington & Canonsburg Railway Co.; one-half carload to the New York Central & Hudson River Railroad Co., and small orders for the Portsmouth, Dover & York Street Railway Co., and the Waterloo, Cedar Falls & Northern Railway Co., Waterloo, Ia.

The Westinghouse Electric & Manufacturing Co. reports the recent sale of three steam turbine and generator outfits to the Public Service Corporation of New Jersey, one having an output of 500 kw. and two with ratings of 1,000 kw. each; 1,000-kw. turbo-generator set for the Indian Orchard Co., and a 400-h. p. induction motor with starting device and two 300-kw. transformers; 2,000-kw. alternating curren generator, four 750-kw. and four 625-kw. transformers for the Truckee River General Electric Co., of California. The South Side Elevated Railway Co., Chicago, has contracted for complete equipment for 70 cars; the Philadelphia Rapid Transit Co. and the United Electric Light Co., Springfield, Mass., turbine-driven generators, and the Phillipsburg Gas, Light, Heat & Power Co. new generator sets.

The Miller Anchor Co., Norwalk, O., reports through its agent, Porter & Berg, Inc., Chicago, orders for Miller anchors from the following electric railways and construction companies: Columbia Construction Co., Milwaukee; Knox Construction Co., Chicago; Rockford Construction Co., Rockford, Ill.; Electrical Installation Co., Chicago; Springfield Construction Co., Springfield, Ill.; Cedar Rapids & Iowa City Construction Co., Cedar Rapids, Ia.; North Shore Electric Co., Evanston, Ill.; Iowa City Electric Light Co., Iowa City, Ia.; McKinley Syndicate Properties, Champaign, Ill.; Elgin, Aurora & Southern Traction Co., Aurora, Ill.; Galesburg & Kewanee Electric Railway Co., Kewanee, Ill.; Chicago & Milwaukee Electric Railroad Co., Chicago; Joliet, Plainfield & Aurora Railroad Co., Joliet, Ill.; Muskegon Traction & Lighting Co., Muskegon Mich.; Chicago, Harvard & Geneva Lake Railway Co., Walworth, Wis.; Louisville Traction Co., Louisville, Ky.; Trinidad Electric Railway Co.; Trinidad, Col.; Nashville Railway & Light Co., Nashville, Tenn.

Companies Organized Within the Last Six Months.

ARKANSAS.

Van Buren Electric Railway & Bridge Co., Van Buren, Ark. Capital, $500,000. To build a railroad, electric railway, highway and toll bridge over the Arkansas River and to operate an interurban electric railway between the towns of Van Buren, Alma, Dyer and Mulberry in Crawford Co. The officers of the company are: President, Phil D. Scott; vice-president, L. H. Southmayd; secretary, Charles H. Dreanan; treasurer, J. S. Lunham.

Mount Mena Traction Co., Fort Smith, Ark. Capital, $50,000. To build an electric line from Mount Mena to Rich Hill. The officers of the company are: President, Alfred Bissell; vice-president, E. J. Mills; secretary and treasurer, James L. Hale. The officers, together with G. H. Little, G. B. Noble and W. W. Lowrey, are the incorporators.

Siloam Springs Electric Railroad, Power & Improvement Co., Siloam Springs, Ark. Capital, $500,000. To construct, equip and operate an electric railroad and to furnish power for commercial purposes. The officers are: President, D. Zimmerman; 1st vice-president, C. Harrington; 2nd vice-president, J. A. Riggen; secretary, R. J. Alfrey; treasurer, E. C. McCulloch.

The Northwest Arkansas Electric Railway Co., Siloam Springs, Ark. To construct and operate an electric railway in Siloam Springs and an interurban railway from Siloam Springs to several towns in Benton Co. President, L. D. Moore, of St. Louis, Mo.; vice-president, A. W. Perrine, of Siloam Springs; secretary and treasurer, John P. Logan, of Siloam Springs.

Little Rock (Ark.) & Hot Springs Electric Railway Co., connecting the cities named, and to be 57 miles in length. The capital is $2,000,000, and it is proposed to build the line from stock subscriptions and have no bond issue. The promoters are largely officials of the Frisco System. Chas. J. Kramer, president; L. Garrett, vice-president and general manager; Geo. W. Rogers, treasurer, and J. C. Marshall, secretary, Little Rock.

CALIFORNIA.

Oakland & Marysville Railway Co., Oakland, Cal. Capital, $4,000,000, of which $140,000 is subscribed. To project an electric line parallel to the Southern Pacific Co. between the cities named. Directors, Frederick W. Zeile, John D. McKee, John Zeile, W. B. Cope and R. T. Hooper.

GEORGIA.

The Atlanta & Carolina Railway Co., Atlanta, Ga. Capital, $2,000,000. To build and operate an electric line from Atlanta, Ga., to Greenville, S. C. The right of way of the proposed line passes through Lithonia, Lawrenceville, Hoschton, Jefferson, Commerce, Carnesville and Anderson, S. C. President, John R. Hosch, Hoschton; first vice-president, J. B. Thompson, Gainesville; second vice-president, W. P. Delapierre, Hoschton; secretary, M. T. Edgerton, Hoschton; treasurer, Joseph A. McCord, Atlanta; chief counsel, C. J. Haden, Atlanta.

INDIANA.

Indianapolis & Chicago Air Line Traction Co., Indianapolis, Ind. Capital, $100,000. To construct an electric line between Indianapolis and Chicago, passing through Jolietville, Kirklin, Michigantown, Flora, Rockfield, Francesville, Crown Point and Indiana Harbor. The incorporators of the company are G. B. King, W. S. Taylor, H. S. Leonard, J. A. Shaffer and John Feiger, of Indianapolis; Charles J. Raub, Chalmers, Ind.; C. F. Knowlton, Pennville, Ind.; J. J. Gibson, W. H. Thornburg and George F. Rauft, Alexandria; A. J. Behmer and H. E. Harvey, Tipton; J. W. Alderman, Chicago.

Marion & Eastern Traction Co., Marion, Ind. Capital, $30,000. Incorporators, Richard E. Breed and Wm. B. Dodds.

The Pocket Interurban Railroad Co., Princeton, Ind. To build electric suburban lines throughout this part of the state known as "the pocket." Jasper N. Davidson is at the head of the company.

The Kensington & Eastern Railway Co., Hammond, Ind. Capital, $50,000. To construct an electric line seven miles long from a point on the boundary line between Cook County, Illinois, and Lake County, Indiana, which will connect with the Chicago, Lake Shore and South Bend electric line. The directors are J. C. Welling, S. F. Andrews, Bluett Lee, A. P. Humberg and W. G. Bruen, all of Chicago. All of these gentlemen are connected with the Illinois Central R. R.

The Indianapolis, Logansport & South Bend Traction Co., South Bend, Ind. Capital, $10,000. To construct a line between Logansport and South Bend and to give direct connection between Indianapolis and South Bend. The directors are John M. Caulfield, George H. Leslie, S. S. Perley, Edmund Taylor and Virginius Nicar, of South Bend; J. J. Green, of Notre Dame, and F. Swigart, H. J. Crimond and J. G. Powell, of Logansport.

The Interstate Traction Co., Indianapolis, Ind. Capital, $160,000. To construct an electric line from Marion, Grant County, in a direct line to Lima, O., a distance of about 90 miles. The directors of the company are John C. Curtis, of Portland; John H. Painter, E. L. Murray, Fred M. Caldwell, Frank M. Caldwell, John S. Postal, A. C. King, A. L. Sharpe and Cuno Kibele, all of Buffton, Ind.

The Central Electric Traction Railway Co., of Indiana. Capital, $25,000. To construct an electric line from Peru north through Rochester, Argo and Plymouth to South Bend. The board of directors is composed of the following: Jerome Herff, Ben E. Wallace, James O. Cole, Abner C. Bearss, Harry Masters and William H. Zimmerman, all of Peru, Ind. Work on the line is expected to be commenced early in spring. The line will parallel the Lake Erie railroad from Peru to Plymouth and the Vandalia from Plymouth to South Bend, connecting at Peru with the Indiana Union Traction lines for Indianapolis.

The Ft. Wayne & Northern Traction Co., Ft. Wayne, Ind. Capital, $100,000. Incorporators, Frank H. Gutshall, Harry E. Vordermark and John W. Wessel, jr.

The Indianapolis & Ohio Valley Traction Co., Indianapolis, Ind. Capital, $50,000. Directors: A. E. Fauve, M. E. Julliard Fauve, Butler Smith and Joseph H. Larimer, of Indianapolis, and Peter Backer, of Troy. The line is to be constructed from Indianapolis to Rockport, Spencer Co., and will connect Troy, Tell City, Cannelton, St. Meinrods, Ferdinand, French Lick, West Baden, Bedford, Bloomington and Nashville. Butler Smith is chief engineer of the company.

The Huntington, Columbia City & Northwestern Railway Co., Columbia City, Ind. Capital, $25,000. To construct an electric railway between the above-mentioned points. The directors are: Benjamin Raupfer, W. H. Magley, W. F. McLallen, Willis O. Jones, J. P. Dolan, A. E. Wiest, Jr., and Melvin Blain.

The Lebanon-Thorntown Traction Co., Lebanon, Ind. Capital, $150,000. To construct an electric line between the above-mentioned points in Boone County. The directors are: Howard M. Atkinson, Americus C. Daily, Ruhard E. Moren, Robert P. Wood and Frank M. Reed.

ILLINOIS.

Kankakee & Western Electric Railway Co., Kankakee, Ill. Capital, $15,000. To construct an electric railway between the Foley-Williams

sewing machine factory in West Kankakee, and the city of Kankakee, as well as an interurban line connecting Kankakee and Chebanse, and running west from Chebanse into the rich and fertile Milk Grove country, which at present is without adequate transportation facilities. The incorporators are C. L. Robertson of Chebanse, and Judge John Small, C. L. Fox, George B. Compton and William Frazer, of Kankakee.

Elgin & Belvidere Electric Railway Co. Capital, $[illegible]. To construct an electric railway from Elgin to Belvidere. The incorporators are Hamilton Brown, of Geneva, [illegible] Cafford, of Elgin, J. Joseph Wright, Jacob H. Hopkins and Edward J. Queeny, of Chicago. The offices of the company are at Chicago, Suite [illegible], 79 Dearborn St.

Litchfield Traction Co., Litchfield, Ill. Capital, $[illegible]. Incorporators, C. B. Munday, Jr., M. J. Brennet, and G. L. Settemire.

The Lincoln & Mt. Pulaski Interurban Railway Co., Lincoln, Ill. Capital, $25,000. To build an electric railway between Lincoln and Mt. Pulaski. The incorporators are H. S. Behoneon and John C. England, of Mt. Pulaski, and N. F. Beidler, of Lincoln.

The Ozark Mountain Electric Railway Co., East St. Louis, Ill. Capital, $5,000. The incorporators are John Nirmes, F. W. Hackman, Jr., and E. W. Hartman.

The Paris Traction Co., Paris, Ill. Capital, $[illegible]. To construct an electric line from Paris, Edgar Co., in a westerly direction to Charlestown, Coles Co., from Paris in a northwesterly direction to Champaign, Champaign Co.; from Paris to Ridge Farm, Vermillion Co., and from Paris in a southerly direction to the Indiana state line at or near Sanford. The incorporators and first board of directors are: Andrew J. Hunter and F. L. Kidder, of Paris; John J. Cummings, of Chicago; Charles P. Hitch and Hugar L. Hodge, of Paris.

The Rock Island, Moline & Davenport Suburban Railway Co., Rock Island, Ill. Capital, $5,000. To construct a railway between Rock Island and Moline. The incorporators are August E. Steffen and C. G. Hipwell, of Davenport, Ia.; John W. Green, Stewart Spaulding and William A. Rawson, of Chicago, Ill.

The Springfield, Sweetwater & Peoria Electric Railway Co., Sweetwater, Ill. Capital, $2,500. To construct an electric railway from Springfield to Peoria. The incorporators are George W. Hatch, Greenview, and Thomas L. Alkire, John W. Terhune, James E. Culver and Augustus K. Jones, of Sweetwater.

The Central Illinois Interurban Railway Co., Mason City, Ill. Capital, $5,000. To construct an electric railway from Peoria to Pekin, Mason City, Springfield, Havana and Lincoln. The incorporators and first board of directors are John B. Abbott, Paul A. Enlows, Fritz Hindahl, Claude L. Stone and Otto S. King, all of Mason City, Ill.

The Watseka & Kankakee Traction Co., Watseka, Ill. Capital, $25,000. To construct an electric line from Watseka to Kankakee. The incorporators are David McGill, George W. Hoyt, Walter H. Hogle, O. F. Morgan and Robert L. Harrell, all of Watseka, Ill.

The Chicago & Southwestern Traction Co., Chicago, Ill. Capital, $400,000. To construct an electric line from Morris to Yorkville. The directors are W. P. Kopf, C. A. Newton, A. J. Claussen, F. W. Hill, H. W. Nichols, Jr., of Chicago.

Springfield, Beardstown & Quincy Interurban Railway Co., Springfield, Ill. To construct an electric railway from Springfield to Beardstown via Petersburg. H. H. Colby, president; C. W. Houghton, vice-president; R. E. Bone, secretary and treasurer, all of Petersburg.

Alton, Jacksonville & Peoria Railway Co., Jerseyville, Ill. Capital, $10,000. To construct an electric interurban line from Alton to Jacksonville and Peoria, passing through Jerseyville, Carrollton, White Hall and Roodhouse. President, Aaron O. Auten; first vice-president, Robert Curdis; second vice-president, Joseph M. Page; secretary, June M. Rhoads; treasurer, Andrew W. Cross. The board of directors consists of Robert Curdis, June M. Rhoads of Alton, Aaron O. Auten, Joseph M. Page, Joseph W. Becker, John C. McGrath and Andrew W. Cross, of Jerseyville.

Evanston Interurban Railway Co., Evanston, Ill. To construct a double-track electric line between Evanston and Glen View, single-track loop in Evanston, and possible extension to Niles Center. The incorporators are E. P. Clapp, J. W. Work, Andrew Simpson, C. H. Poppenheusen and J. F. Kennie.

Chicago & Central Illinois Railway Co., Kankakee, Ill. Caiptal, $100,000. To build an interurban line between Chicago and Kankakee. The incorporators are Wm. S. Reed, John B. Reed, Charles F. Davies, Wm. H. Voris and Horton W. Hanford, all of Chicago. The route for this line will strike Harvey, Homewood, Peotone and Manteno, running nearly parallel with the Illinois Central. Wm. S. Reed is a director of the Indianapolis & Northwestern Traction Co.

Bloomington, Clinton & Decatur Electric Railway Co., Decatur, Ill. Capital, $50,000. Incorporators, Harry Wapella; Edwin Weld, Clinton; L. M. Murphy, Clinton; T. N. Leavitt, Maroa; H. W. Knight, Kansas City.

Illinois & Wisconsin Railroad Co., Chicago, Ill. Capital, $25,000. To construct an electric line from Chicago to Barrington. Incorporators: R. E. Burke, C. E. Crafts, Henry Lutzenkirchen, Harry K. Crafts and A. L. Schiffman.

St. Louis, Freeburg & Fayette Railroad Co., Belleville, Ill. Capital, $10,000. To construct a railroad running from Freeburg, where it will connect with the Illinois Central, to the mines of the St. Louis Fuel Co. Incorporators: E. Ambs, of O'Fallon; George Geissler and A. Vogel, of St. Louis; Adolph Wolf and Peter Yeager, of Freeburg.

Troy & Suburban Railway Co. Capital, $50,000. To construct an electric line from Troy to Marysville, both in Madison Co., Ill. The directors are L. C. Haynes, J. M. Bramlette and T. W. Gregory, of East St. Louis; M. W. Schiefer and James A. Farmer, of Belleville, Ill.

The Springfield & Chester Suburban Railroad Co., Belleville, Ill. To construct an electric railroad from East St. Louis to Waterloo and Chester, through St. Clair, Monroe and Randolph counties. The directors are Thomas M. Chase and Tyron J. Woodward, of St. Louis; J. P. Slade and A. P. Garrett, of East St. Louis. Edward F. Schoening, of Columbia, Ill.

Springfield & Western Railway Co., Springfield, Ill. Capital, $100,000. To construct an electric line from Springfield to Quincy, touching Camp Point, Mt. Sterling, Rushville and Beardstown and passing through the counties of Sangamon, Schuyler, Morgan, Cass, Brown, Pike and Adams. The incorporators are F. M. Mills, D. A. Watson, George A. Wood and R. H. McAnulty, of Springfield, and H. K. Seibel, of Chicago.

St. Louis & Northwestern Railway Co., Edwardsville, Ill. Capital, $400,000. To construct an electric railroad from Edwardsville, Madison Co., to East St. Louis, St. Clair Co. The directors are William B. McKinley, B. R. Stephens, Charles Zilly, H. J. Pepper and S. A. Power, all of Champaign. This corporation is composed of the directors of the Illinois Traction System, and is for the purpose of building the connection between Edwardsville and East St. Louis for the interurban line now in operation between Decatur and Carlinville, and which is now building an extension to Edwardsville from Carlinville.

IOWA.

The Cedar Rapids [illegible]

Iowa & [illegible], Ia. To effect the rapid handling of passenger and freight business between Rockport [illegible]. The line will touch Sidney, Hamburg, Tabor, Glenwood and Malvern, Ia., crossing the Missouri River [illegible]. The directors of the company are James A. Swope, L. B. Hanson and A. J. Howe.

Iowa City & [illegible], Ia. Capital, [illegible]. The incorporators are Milton Remley, C. S. Ranck, Stephen Bradley, George W. [illegible].

St. Joseph, Albany & Des Moines Railway Co., Des Moines, Ia. Capital, $25,000. To construct a line from Des Moines to St. Joseph by way of Albany, and to also undertake the control of other interurban lines. President, F. S. Mordaunt; vice-president, Wallace Hubbard, [illegible].

Grinnel Interurban Co., Grinnell, Ia. Capital, $10,000. To construct an electric line from Grinnell to Tama and possibly to Belle Plaine, the ultimate scheme being to build a line from Independence to Grinnell, passing through Vinton. The incorporators are O. K. Cole, J. P. Lyman, E. P. Brande, R. M. Haines, B. J. Carney, C. W. H. Beyer, G. H. Hamlin and F. W. Spaulding. The proposed line is being promoted by O. K. Cole, who is the principal owner of the Grinnell Electric Light & Heating Co.

INDIAN TERRITORY.

The Choctaw Electric Co., South McAlester, I. T. Capital, $150,000. A. T. [illegible], president; [illegible], vice-president; M. M. Lindley, secretary; A. W. Thomas, treasurer.

KANSAS.

The Wellington & Cowley County Traction Co., Wellington, Kan. Capital, $500,000. To build an electric road in Wellington and to other towns in Sumner County and to maintain telephone and telegraph lines throughout the county. The directors are George H. Hunter and C. A. Gambrill, of Wellington; H. F. Haraugh and John Blattner, of Rome, and L. H. P. Northrup, C. A. Scruton and S. P. Gould, of Arkansas City, Ark.

The Bonner Springs & Kansas City Electric Railway Co., Bonner Springs, Kan. To build an electric line from Bonner Springs to Kansas City, a distance of 18 miles. President, John McDaniels, of Bonner Springs; vice-president, H. S. Burgin, Kansas City; secretary, W. H. Smith, Kansas City.

KENTUCKY.

Kentucky Midland Railroad Co., Frankfort, Ky. Capital, $1,000,000. To construct a line from Madisonville to Central City, a distance of 26 miles.

Paducah & Cairo Electric Railway Co., Paducah, Ky. Capital, $250,000. To construct an electric line between Paducah, Ky., and Cairo, Ill. L. B. Whitesides, president; J. J. Freundlich, vice-president and general manager; W. H. Taul, secretary; C. E. Whitesides, treasurer.

The Central Kentucky Traction Co., Lexington, Ky. Capital, $200,000. D. F. Frazee, president; John McClintock, vice-president; Waller Rhodes, treasure; E. G. Powell, secretary, and H. T. Brown, engineer. It is the purpose of the company to begin work on the erection of a line between Lexington and Versailles immediately. The Central Kentucky Traction Co. now holds the franchises and properties of all the other companies that had been incorporated for the purpose of building interurban electric lines connecting Lexington with surrounding towns.

LOUISIANA.

The Lake Providence & Gouldsboro Railroad Co., Ltd., Lake Providence, La. To construct two miles of electric railway through the town of Lake Providence, thence through Gouldsboro, a new addition to the town of Lake Providence, with terminus at the depot of the M. H. & W. Ry. A contract has been let to A. B. Sanders, of Shreveport, La., for the construction of this line, and he has placed orders for the material.

MASSACHUSETTS.

Boston & Providence Street Railway Co., Boston, Mass. Capital, $1,000,000. To construct an electric line 35 miles long, starting in Newton, Mass., and to extend through Needham, Dover, Westwood, Walpole, Norfolk and Wrentham, with Attleboro as its terminus. The incorporators are George K. Webster and Charles Mason, of Providence; F. Orr, James Orr, William Coupe and Thomas G. Sadler, of South Attleboro; Charles L. Barnes, Peter Nerney, E. S. Horton and D. H. Smith of Attleboro, and Thomas Dwyer and William L. Engreen, of Wrentham.

Charters have been granted Wallace D. Lovell, of Boston, Mass., for the construction of electric railways between Boston and Haverhill and Manchester and Haverhill. It is proposed to build the section, 32.5 miles long, between Boston and Haverhill first. This construction will require the erection of a large bridge over the Merrimac River. G. M. Thompson is construction engineer and A. E. McReel, formerly superintendent of the Exeter, Hampton & Amesbury Street Railway Co., is manager.

MICHIGAN.

The Michigan Interurban Railway Co., Kalamazoo, Mich. To construct an electric line from Kalamazoo to South Haven, Allegan and Grand Rapids. President, M. Meek; secretary, W. L. Barnum; treasurer, Luke Coney, Jr., all of Chicago.

The Lansing & Battle Creek Traction Co., Battle Creek, Mich. Capital, $50,000. To construct and operate an interurban railway between the points named. The incorporators are Charles J. Austin, William N. Dibble, George A. Hoeltzel, William M. Hoffmaster and Earl C. Corey of Battle Creek and Earl B. Hughes of Marshall. Messrs. Austin and Dibble are also officers of the Michigan & Indiana Traction Co.

The Ontonagon & Southwestern Railway Co., Ontonagon, Mich. Capital, $200,000. To build an electric road southwest from Ontonagon for 25 miles [illegible]. [illegible] Nester, Saginaw, vice-president and manager, John Hawley, Ontonagon; secretary and treasurer, D. J. Norton, Ontonagon.

MINNESOTA.

Mills Lacs & Minneapolis Electric Co., Minneapolis, Minn. Capital, $[illegible]. To [illegible]. The incorporators are C. S. [illegible] Falls; F. P. Quillen, of Aitkin, and C. H. Warner, of St. Paul.

MISSISSIPPI.

[illegible]

Woodville-Ft. Adams Electric Railway Co., Woodville, Miss. To [illegible] are: L. T. Ventres, president; Charles Cohen, vice-president; W. H. Woods, secretary; James M. [illegible], treasurer.

MISSOURI.

Sedalia & Warrensburg Interurban Electric Railway Co., Sedalia, Mo. Franchise has been granted through Sedalia. The road will [illegible] between Sedalia and Warrensburgh. W. E. Winner, of Kansas City, is among the incorporators.

The Sedalia Transit Co., Sedalia, Mo. To construct and operate an electric railway in Sedalia. H. S. Rumsey, St. Louis, president; Joseph Clarke, St. Louis, vice-president; W. H. Powell, Sedalia, secretary and treasurer.

The Missouri & Illinois Electric Co., Hannibal, Mo. Capital, $20,000. To build an electric line between Hannibal and Quincy, Ill. The incorporators are J. Edward Carter, Chicago; W. Osgood Orton, South Bend, [illegible] and W. A. Munger, of Hannibal.

MONTANA.

Whitman Electric & Power Co., Butte, Mont. Organized to construct an electric railway from Colfax to Palouse, in the state of Washington. I. B. Harris, president; Charles F. Stewart, secretary; W. W. Tracy, of Butte, general manager.

Amador Railway Co., Missoula, Mont. Capital, $1,000,000. To build and operate by steam, electricity or other motive power, a railway in Montana on Cedar Creek, running to the Amador mines. The road is to be built for the purpose of hauling ore, material and workingmen between the town of Amador, on the Northern Pacific and the mine of the Amador Co. Robert M. Maher, Chicago; Joseph Sherlaw, Chicago; William Surman, Carlinville, Ill.; M. A. Burns, Chicago; Erasmus B. Waples, Wilmington, Del., are interested. W. A. Peek has been appointed to act as agent for the company in Montana.

The county commissioners of Dawson Co., Montana, have granted a franchise to H. J. Haskell, E. S. Bach, B. S. Adams, J. J. O'Brien and J. R. Widmyer, petitioners for the Glendive & Yellowstone Valley Rapid Transit Co., Glendive, Mont. To build an electric railway and telephone line from Glendive to a point on the Missouri River opposite Budford, N. D., a distance of 80 miles. The road will traverse the entire length of the Yellowstone valley, in which the government will begin the construction of irrigation ditches in the spring, which will cost approximately $2,000,000 and reclaim 60,000 acres of land.

NEBRASKA.

Citizens Railway Co., Lincoln, Neb. Capital stock, $1,000,000. F. W. Levering, L. E. Weetling, J. E. Miller, W. E. Sharpe, J. H. Smith, F. W. Brown and W. T. Fitzgerald are interested.

NEW YORK.

Buffalo, Batavia & Rochester Electric Railway Co., Buffalo, N. Y. Capital, $3,500,000. To construct and operate an electric line 65 miles long from Williamsville, Erie County, to Rochester, with a branch to Akron. The directors are Loran L. Lewis, Stuart R. Mann, Spencer Kellogg, George L. Lewis, George E. Pierce, William N. Evarts, Charles N. Almy, Robert Leslie, Loran L. Lewis, Jr., and William C. Carroll, of Buffalo, and Lafayette L. Grove of Williamsville.

Auburn & Northern Electric Railroad Co., Auburn, N. Y. Capital, $250,000. To operate an electric line from Auburn to Port Byron, a distance of 8 miles. The directors include Edwin D. Metcalf, Charles H. Mosher, Orlando Lewis, Charles A. McCarthy, of Auburn, and Clifford D. Beebe, of Syracuse.

The Buffalo & Rochester Railway Co., Depew, N. Y. Capital, $3,000,000. To build and operate an electric railroad from Depew, Erie Co., to Rochester, through Erie, Genesee, Livingston and Monroe counties, a distance of about 60 miles. The directors are. H. H. Kingston, J. A. Hardis, Jr., John J. Collins, H. A. Foster, P. Henry Dixon and Samuel Welch of Philadelphia, William B. Cutler, George A. Ricker and Herbert P. Bissell of Buffalo.

The Chemung Valley Traction Co., Elmira, N. Y. Capital, $700,000. Incorporated to build a street surface railroad between Waverly and Elmira, over a route which will be 18½ mlies in length. The directors are E. E. Buchanan, Boyd McDowell, Judge George McCann, George H. Davidson, J. E. Rawlins, J. Henry Clark and Fred D. Herrick of Elmira, and J. E. Lyford and P. L. Lang of Waverly.

The Hornellsville, Bath & Lake Keuka R. R., Kanona, N. Y. Capital, $50,000. Incorporated to operate a street railway from Kanona to Bath. The directors include L. D. Masson and J. S. Hubbs of Hammondsport, and Thomas Shannon of Bath.

Eastern New York Railroad Co., Ballston Spa, N. Y. Capital, $100,000. To construct an electric railway 10 miles long between Ballston Spa and Middle Grove, Saratoga Co. Thomas F. Barrett, Saratoga Springs; Fred A. Beach and B. S. Cole, Ballston Spa; T. R. Heller, Somerton, are directors.

The Bronx, Yonkers & White Plains Railway Co., White Plains, N. Y. Capital, $110,000. To operate an electric railway 11 miles long from Yonkers to White Plains, there to connect with the Harlem division of the New York Central & Hudson River R. R. The directors are W. H. Whittaker, J. H. Matthews, G. A. Matthews and W. C. Shires, of New York City; F. S. Fisher, E. M. Booth, Patrick McCann, Nathan Fernbacker and I. M. Hunt, of White Plains.

NORTH CAROLINA.

The Raleigh-Durham Passenger & Power Co., Raleigh, N. C. To construct an electric line between Raleigh and Durham, two belt lines in Raleigh, a pleasure park and possibly a resort hotel; also a car line through Durham and light and ice plants in that city. President, B. S. Jerman; vice-president, W. J. Nelms; secretary and treasurer, Thomas S. Fuller.

OHIO.

Muskingum, Coshocton & Tuscarawas Electric Railway Co., Zanesville, O. Capital, $10,000. To construct an electric railway extending from Zanesville to New Philadelphia and passing through Muskingum, Coshocton and Tuscarawas counties. President, John J. Adams; secretary and treasurer, J. R. Alexander; chief engineer, Henry S. Buell.

Bucyrus, Sulphur Springs & New Washington Traction Co., Toledo, O. Capital, $10,000. To build an electric line from Bucyrus to Sulphur Springs, New Washington and Plymouth, where connection will be made with the Sandusky, Norwalk & Mansfield. The incorporators are Ellis Bartholomew, president of the Toledo, Columbus, Springfield & Cincinnati Railway Co., and W. E. Mosier and S. S. Chorn of Toledo, and F. W. Armbruster and Elmer Luke.

The Barberton, Wadsworth & Western Traction Co., Barberton, O. Capital, $10,000. Incorporators, Byron M. Clendening, Charles S. Johnson, Samuel [illegible] and H. S. Davidson.

The Miami Transit, Light & Power Co., Lebanon, O. Capital, [illegible]. To build an electric railway from Lebanon to Xenia. The incorporators are: F. C. Richards, M. D. Burke, J. S. Storrs, C. A. Hough and C. A. Culbertson.

The Zanesville, Cambridge & Northern Traction Co., Coshocton, O. Capital, $10,000. S. A. Weller, E. C. Rinner, F. McCormick, and S. H. Nichols are among the incorporators.

The Ottawa Park Street Railway Co., Washington township, Lucas Co., O. Capital, $10,000. The incorporators are J. F. Kumler, L. W. Kumler, J. F. Kumler, Jr., B. F. Brough and F. A. Kumler.

The Stillwater & Wheeling Valley Traction Co., Flushing, O. Capital, $5,000. J. A. Hobson, V. N. Marsh, B. D. Judkins, Ed. L. Hobson and A. B. Hobson are the incorporators.

The Lima, Findlay & Toledo Railway Co., Lima, O. Capital, $700,000. To construct and operate an electric line from Lima to Findlay. The incorporators are Frank Butler, E. Sanborn, J. H. Griswold, C. L. Stocker and N. S. Harris. The incorporation of this company is the first definite step in the direction of the building of the new Western Ohio line that will complete the Western Ohio system as originally projected. The distance from Lima to Findlay is 30 miles and the territory much more populous than that served by the Western Ohio. It has two large terminals and many feeders, so that its success seems assured.

The Toledo, Ann Arbor & Detroit Railroad Co., Toledo, O. Capital, $1,500,000. A consolidation of the Toledo & Northwestern Railroad Co. and the Ohio & Michigan Traction Co. President, J. H. Clauss; vice-president, M. C. Briggs, Fostoria; secretary, C. H. Masters, Toledo; treasurer, J. W. Pero, Fremont.

Buckeye Street Railway Co., Cleveland, O. Capital, $50,000. To construct an electric railway connecting Canton and Akron. The incorporators are J. H. Vandeweer, E. H. Tracy, Davis Howley, Jr., J. E. Chadwick and G. D. Reed.

West Side Street Railway Co., Lorain, O. Capital, $10,000. To construct and operate an electric railway into the steel-mills district. The incorporators are W. B. Thompson, Orville Root, F. W. Pierce, R. Thew, B. G. Nichols, W. N. Little and William Sehrs.

The Cleveland, Wooster, Mt. Vernon & Columbus Railway Co., Columbus, O. To construct an electric railway connecting Cleveland and Columbus through Cuyahoga, Medina, Summitt, Wayne, Stark, Holmes, Ashland, Crawford, Highland, Knox, Licking and Franklin Counties. John J. Vail, James B. Graham, James A. Tilton, Fred W. Jones and E. F. Shelley are the incorporators.

Toledo Interurban Railway Co., Toledo, O. Capital, $100,000. Clem V. Wagner, Edgar Daykin, W. M. Long, George W. Acker and P. S. Willis are the incorporators.

Wilmington-Hillsboro Co., Dayton, O. Capital, $10,000. To build an electric line between the two towns named. The incorporators are E. G. Orr, E. A. Fay, W. D. Biddle, F. E. James, A. J. Miller. The company's offices will be established at New Vienna.

The Marion-Bucyrus Railway & Light Co., Marion, O. Capital, $250,000. Ellis Bartholomew, G. K. Canfield, Charles B. Selby, G. A. Bartholomew and P. M. Ditto are the incorporators.

Springfield, Washington Court House & Chillicothe Traction Co., Springfield, O. President, H. L. Rockfield; vice-president, Frank Patterson, New York; second vice-president, Lee M. Good; treasurer, A. M. Winger.

Galion Southern Railway Co., Galion, O. Capital, $10,000. To construct an electric line from Galion to Fredericktown, through Morrow, Richland, Crawford and Knox counties. The incorporators are W. L. Ball, O. Wise, M. H. Arnold, J. C. Brown and A. A. Crawford.

The Zanesville, Coshocton & New Philadelphia Traction Co., Zanesville, O. Capital, $10,000. To build an electric railway from Zanesville through New Concord, Otsego and Coshocton to New Philadelphia, where it will connect with the line to Cleveland. President, Frank McCormick; secretary, Samuel Nicholson; cashier, H. A. Sharpe.

PENNSYLVANIA.

Corry, Findley Lake & Northeast Railway Co., Corry, Pa. Capital, $130,000. To operate an electric line 13 miles long in Chautauqua Co., on the border line between New York and Pennsylvania. The directors are Charles P. Northrup, of Warren, Pa.; H. M. Raymond and A. L. Bush, of Corry; Ross Knight, of Westfield, N. Y.

Monongahela, Ellsworth & Washington Electric Railway Co., Washington, Pa. Capital, $150,000. Directors: James P. Mulvihill, C. A. Bentley, G. H. Murphy, Gerald O'Leary and George H. Stephens. James P. Mulvihill, president.

The Mahanoy City & Tamauqua Street Railway Co., Tamauqua, Pa. Capital, $60,000. To build and operate ten miles of electric railway in a zigzag course from Mahanoy City to Tamauqua. E. M. B. Shepp, of Tamauqua, president.

The Rohrerstown, Landisville & Mt. Joy Street Railway Co. Capital, $60,000. Charles B. Keller, of Lancaster, Pa., president.

The Lancaster & Safe Harbor Electric Railway Co., Lancaster, Pa. Capital stock of $54,000. The line will be nine miles long, extending from South Queen St. to Safe Harbor, by way of Canastoga Center.

The Dravosburg & Jefferson Street Railway Co., Dravosburg, Pa. To construct an electric railway between Dravosburg and Clairton, where it will connect with the tracks of the Pittsburg Railways Co. President, J. E. White; secretary, W. C. Weimer.

Huntingdon Street Railway Co. Capital, $180,000. To construct 30 miles of electric railway, from Huntingdon to Smithfield, Petersburg, Alexandria, Alfarata and Mt. Union, Pa. Elmer E. Davis, Johnstown, Pa., president.

Marshall Avenue Street Railway Co., Allegheny, Pa. Capital, $36,000. To construct six miles of electric railway from Perryville and Marshall Ave., Allegheny, to Brighton Road and along Craig St. to a proposed bridge across the Allegheny River, to Pittsburg. William Kaufman, Allegheny, president.

The New York-Philadelphia Co. Capital, $4,000,000. To construct a shorter through trolley line between Camden, N. J., and New York City. The incorporators are A. N. Chandler, of A. N. Chandler & Co., bankers; H. D. Long, of Philadelphia, and Norman Grey, counsel for the Corporation Co. of Camden. It is stated the new company will start at once the construction of cut-offs to reduce the distance between the termini, and the running time from Camden to Jersey City will be lowered to three hours. The line will be double tracked and heavier cars will be ordered and placed in service as soon as delivery is made. It is also planned to construct several subsidiary lines, connecting a large number of smaller towns throughout central New Jersey. Right of way for these roads is now being obtained. The charter under which the company is formed is broad, permitting it to do a general real estate and banking business, own and operate railroads and trolley lines, electric and gas works, lend money and engage in manufacturing work.

Bridgeville Street Railway Co. Capital, $60,000. To construct ten miles of electric railway in Scott township, Allegheny county, Pa. President, A. J. Barron, Pittsburg.

Bradenville & Derry Street Railway Co. Capital, $36,000. To build a six-mile electric line from Latrobe to Bradenville, Snydertown and Derry.

Danville & Northumberland Street Railway Co., Danville, Pa. Capital, $60,000. President, Frank C. Angle, Danville.

Greenville Street Railway Co., Allegheny, Pa. Capital, $26,000. To construct 4½ mi. of street railway over streets of Greenville. Curtis G. Hussey, Allegheny, president.

Watson Street Railway Co., Allegheny, Pa. Capital, [illegible]. To construct [illegible] of electric railway from [illegible] St. to terminus of [illegible], Va. President, William [illegible], Allegheny.

The Shenango Traction Co., Shenango, Pa. To construct an electric line from Meadville to New Castle [illegible] and Greenville. Application has been made for franchises in Sharon, Pa., and Wheatland, Pa.

Lansdowne Central Street Railway Co., Lansdowne, Pa. Capital, $10,000. Walter L. Rogers, Sheldon, Mass., president.

George W. Drum, Guy Webster and I. G. Brown, of York, Pa.; W. H. Lyon, of Harrisburg, and G. K. [illegible], Pittsburg, [illegible] the Sunbury Bridge Co., secured a charter to construct a bridge over the Susquehanna River from a point near Sunbury to Selinsgrove Dam in Snyder county. The new bridge, which will cost about [illegible],000, is intended to be part of the Sunbury & Selinsgrove Electric Railway Co. line, for which a charter was granted to the incorporators of the Bridge company. I. G. Brown is president of both the railway and bridge company.

Bloomsburg & Millville Street Railway Co., Bloomsburg, Pa. Capital, $60,000. To construct an electric line between the above mentioned places. President, C. W. Miller.

Philadelphia, Lancaster & Harrisburg Street Railway Co., Philadelphia, Pa. Capital, [illegible]. To build an electric line between Mt. Joy and Middletown and between Strasburg and Centreville. The incorporators are Jacob L. Brock, Strasburg; William Trimble, Samuel L. Hibbard, Jr., Philadelphia; Joseph I. Raymond, A. L. Etter, Middletown, and Jacob G. Stauffer, Elizabethtown.

Latrobe, Mt. Pleasant Street Railway Co., Latrobe, Pa. To construct an electric railway between these points via Pleasant Unity, [illegible], Hostetter, Klondike and several other mining towns. Mt. Pleasant and Pittsburg promoters are the stockholders.

Tarentum & Breckenridge Street Railway Co., Tarentum, Pa. Capital, $5,000. To construct an electric line in Allegheny County. William White, Jr., of Pittsburg, president.

York & Maryland Line Street Railway Co., York, Pa. Capital, $21,000. To build a line in York County from [illegible] to Loganville and to be one of the many divisions of the York County Traction Co. William H. Lanius, of York, president.

RHODE ISLAND.

Massachusetts & Rhode Island Street Railway Co., Providence, R. I. Capital, $1,500,000. To build an electric railway, partly on private right of way, between Milton, Mass., and Providence, R. I., via Canton, Stoughton, Sharon, Foxboro, Mansfield, Attleboro and Seekonk, Mass. The incorporators are Albion B. Turner, William F. Gareelon, Herman Holt, Jr., Horace G. Pender, J. Harold Melledge, Oren C. Boothby and Richard B. Starley.

Boston & Rhode Island Electric Railway Co., Providence, R. I. Capital, $1,000,000. To build an electric railway between Boston and Providence, via Hyde Park, Milton, Canton, Sharon, Foxboro, Mansfield, North Attleboro and Seekonk. The incorporators are William O. Chapman, Freeland D. Leslie, Edwin F. Thayer, Frederick S. Lane, Edward J. Fuller, George F. Chapman and Charles H. Blood.

Boston, Pawtucket & Providence Street Railway Co., Providence, R. I. Capital, $2,000,000. To build an electric railway between Forest Hills, in Boston and Providence, R. I., via Attleboro. It also desires authority to build on private lands. The incorporators are Michael A. Cavanaugh, Thomas F. Cavanaugh and R. Elmer Townsend.

The Worcester & Providence Street Railway Co., Providence, R. I. Capital, $1,000,000. To construct and operate an electric railway between Newton, Mass., and Providence, R. I., via Dedham, Needham, Dover, Medfield, Walpole, Norfolk, Wrentham, North Attleboro, and Attleboro, Mass., and Pawtucket, R. I. The petition asks for authority to build on private land for the purpose of operating its cars at high speed. The incorporators are Horace A. Kimball, Fred L. Sayles, William H. Pendlergast, Fayette E. Bartlett, John McLaughlin, John P. Meade, Belmont Smith and James McLaughlin, mostly residents of Providence, North Providence, Smithfield and Burrillvill, through which towns it is proposed to build the road.

SOUTH CAROLINA.

The Charleston & Summerville Railway Co., Charleston, S. C. Capital, $100,000, with the privilege of increasing it to $1,000,000. President, Ogden Edwards, Troy, O.; vice-president and general manager, Robert J. Smith, Summerville, S. C.; secretary and treasurer, E. P. Guerard, Charleston, S. C.

Sumter Electric Light & Railway Co., Sumter, S. C. Capital, $200,000. To conduct a general light, power and street railway business. The incorporators are C. W. Brister and Albert DeHaven, of Philadelphia; E. M. Beale, of Lewisburg; J. L. Almett and H. F. Wilson, of Sumter.

TENNESSEE.

Nashville Interurban Co., Nashville, Tenn. Capital, $100,000. A consolidation of the Nashville & Columbia Electric Railway Co. and the Nashville & Gallatin Electric Railway Co. President, E. B. Stahlman; vice-president, Nat Baxter; secretary, Joseph Frank.

TEXAS.

The Rio Grande Valley Electric Railway Co. Capital, $1,000,000. Offices at Las Cruces, Tex. The intention of the company is to build an electric railway 65 miles long from El Paso, Tex., to the mining camp of Organ in Dona Ana Co., via Las Cruces, Dona Ana and Anthony.

The Houston-Galveston Electric Railway Co., Houston, Tex. Capital, $1,350,000. To build and operate an electric railway between Houston and Galveston, a distance of 54 miles. The principal office of the company is at Houston. The board of directors comprises Frank Pread, William Johnston, R. M. Johnston, George L. Horton and A. D. Trotter, all of Houston.

VERMONT.

The Bennington & North Adams Street Railway Co., Bennington, Vt. Capital, $150,000. To construct an electric railway between Bennington, Vt., and North Adams, Mass. A. H. Rice, of Pittsfield, Mass., who is a director of the Hoosac Valley Street Railway Co., is president, and O. M. Barber, of Bennington, is treasurer.

VIRGINIA.

The Pocahontas, Graham & Tazewell Electric Belt Line, Pocahontas, Tazewell Co., Va. Capital, $50,000. To construct an electric railway between these points. J. S. Browning, president; William Leckie, vice-president; V. L. Sexton, secretary. The general offices are at Pocahontas, Tazewell Co., Va.

The Alamance Street Railway Co., Graham, V[illegible]. To construct and operate electric lines in that section. J. L. Williamson is one of the principal incorporators.

WASHINGTON.

Walla Walla Railway Co., Walla Walla, Wash. Capital, $500,000. To build, equip and operate a street railway in Walla Walla and suburbs, and an interurban railway in Oregon and Washington, with the right to acquire lands and franchises, to build and maintain electric light and power plants, to acquire water rights and to [illegible]

[illegible] The incorporators are [illegible].

[illegible]

WEST VIRGINIA.

[illegible] Williams, Abraham P. Gross, T. R. Palmer, John S. Seibert, B. W. Wright, Urus G. Carl, Cumberland, Md.

[illegible]

WISCONSIN.

[illegible] Capital, $750,000. Incorporators, B. K. Miller, W. D. Hickman and J. A. McCormack. To construct and operate a street railway in the city and [illegible] where in the state, and to furnish and sell electricity, gas and water for heat, light and power purposes.

The Park City Electric Railway Co., Kenosha, Wis. Capital, $25,000. To construct an electric line from this city to Lake Geneva, [illegible]

Oshkosh & Western Electric Railway Co., [illegible] Capital, $10,000. To build an electric line from Omro to Berlin, a distance of 22 miles, and to operate cars from Oshkosh to Berlin. The incorporators are J. H. Porter, Oshkosh; Clement C. Smith, of the Columbian Construction Co., Milwaukee; George Hilton, Oshkosh, and C. S. Morris, Berlin.

The Kenosha & Lake Geneva Railway Co., Kenosha, Wis. Capital, $25,000. To build an electric railway from Kenosha to the lake regions. At the time of incorporation it was stated that the company is allied with the Park City Railway Co., of Kenosha.

CANADA.

Quebec & Saguenay Railway Co., Montreal, Quebec. To construct a railway to be operated by steam or electricity from the terminus of the Quebec Railway, Light & Power Co's. line at St. Joachim, following the shore of the St. Lawrence River to the mouth of the Saguenay River, with power to construct branch lines. R. Forget, W. McL. Walbank and W. G. Ross, [illegible] of the Montreal Street Railway Co., of Montreal; A. Girard, Marieville; James McCarthy, W. Price, P. A. Croquette, C. Langelier, E. B. Garneau, G. Tanquay, N. Rioux, J. Cameron and L. A. Taschereau, of Quebec, are interested.

Hamilton, Ancaster & Brantford Railway Co., Ancaster, Ont. To construct a line 23 miles long to connect the above cities. President, C. D. Haines, New York; vice-president, A. Kennedy, Pittsburg, Pa.; secretary, E. Kenrick, Ancaster, Ont.; treasurer, S. Strathy, Brantford, Ont. The board of directors consists of the officers of the company and L. Harris, of Brantford. The contract for the construction of the line has been let to E. T. Haines, of New York, and I. K. Pierson, of Cleveland, O., has been appointed chief engineer. A private right of way has been secured between Hamilton and Ancaster, and franchises have been secured for the right of way through the townships to Brantford.

CUBA.

The Cienfuegos, Palmira & Cruces Railway & Power Co., Cienfuegos, Cuba. To construct an electric line from Cienfuegos to Cruces, a distance of 23 miles. Bruno Diaz is president of the company and C. C. Vermeule, of 26 Broadway, New York, is the consulting engineer.

MEXICO.

The Ferrocarril Jalisco & Michoacan Co., Guadalajara, Mex. Capital, $1,500,000. To construct and operate an electric railway from the city of Guadalajara to the town of Patzcuaro, state of Michoacan. The proposed road will be 200 miles long and concessions for its constructions have been obtained from the Mexican Government. The line will run from Guadalajara to Lake Chapala, a great pleasure resort, along the shores of the lake, crossing to the important town of Zamora and then running to the city of Patzcuaro. The building of several branch lines is contemplated and the company will handle both freight and passenger traffic. President, Carlos Llagune del Hoyo, of Zamora; vice-president, William V. Backus, of the City of Mexico; treasurer, Jose R. Carral, of Guadalajara; secretary, Ignacio Carranza, of Guadalajara; auditor, Jose Lopez Portillo y Rojs, of Guadalajara.

BRAZIL.

The animal traction tramway system of Para, Brazil, has been sold to an English syndicate, which will install electric traction within a few months. Mr. Moller, of Moller & Co., bond brokers, New Broad Street House, London E. C., the agent of the syndicate, has the necessary documents perfecting the deal. Vice-Consul Tiedeman, Para, states he has every reason to believe that a great part of the materials will come from the United States.

A freight service has been established on the Detroit, Ypsilanti, Ann Arbor & Jackson. A freight car leaves Detroit every day at 6:30 p. m., arriving at Jackson [illegible] morning at [illegible].

It is [illegible] that a consolidation is about to take place of the Chattanooga Electric Co., the Chattanooga Electric Railway Co. and the Rapid Transit Co., including the Lookout Mountain Incline and the line to Chickamauga National Park. Several times heretofore the owners of the two street railway properties in Chattanooga have attempted a consolidation, but without success. Each of the street railway companies owns and operates about 35 miles of track.

The Amesbury Trolley Wheel.

The Amesbury trolley wheel is made of new copper, junk being never used, and by special alloy is rendered very hard and tough, not brittle, and has great durability. The wheel is hollow, and when assembled is filled with grease of a special composition, which melts slightly in the heat of operation and without refilling lubricates the bearing continuously. The bushing lasts as long as the material itself.

The manufacturer claims the unique achievement of constructing a trolley wheel in which the wheel itself, the bearing and the lubricant last equally long. In some cases a change of pin is required, but ordinarily the wheel needs no attention whatever from the day it is put on the car until it is worn out. Beyond these points the particular claims made for the wheel are the following:

The lubricant cannot work out, so that there is no dripping onto the pole and car roof, but the wheel remains always clean.

An ordinary bushing wears rapidly on the outer edges and quickly causes the wheel to wabble and leave the wire easily. The Amesbury bushing wears so little that it never wabbles and the wheel keeps the wire (according to the testimony of all motormen who have used it) very much better than any wheel they have ever seen.

Owing to the construction the current flows through the wheel freely and without the arcing which is so common, thus saving the trolley wire.

The Amesbury wheel is especially designed for extra hard service and while new to the market has been tested for months in severe service. The first road to complete tests, one of the most important and well equipped in New England, has adopted this wheel, as it saved this road one-third in cost, not reckoning the cost of oil and labor necessary in the use of ordinary wheels.

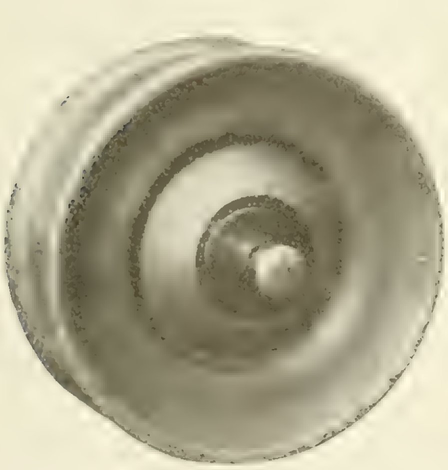


FIG. I.

FIG. 2.

The wheel is made to fit the ordinary harp and no change or special equipment of any kind is required in connection with its use. Three sizes are manufactured—the regular 4-in. size, a 5-in. wheel with either the standard ½-in. pin or a ⅝-in. pin and a 6-in. wheel with 3-in. bearing for either size pin. The 6-in. wheel is specially designed for extra high speed cars.

The Amesbury wheel is manufactured by the Climax Igniter Co., all parts being constructed by it in its factory at Amesbury, Mass.

Fig. 1 shows a wheel and pin after 33 days' service under conditions so severe that the wheels formerly used were changed every day, and during the 33 days the wheel illustrated was in use 32 of the other type were worn out in similar service. The wear of the bushing was .002 in. Fig. 2 is a section of the 4-in. wheel.

A New Electric Car Heater.

What is known to the trade as the "Radium Economic" car heater has been developed after extended experiments, and is now being placed on the market by Alfred K. Prince, 401 Security Bldg., St. Louis, who is sole selling agent. The energy consumption of these heaters is reported at 200 watts per hour for the minimum when current is on, and 550 watts per hour for the maximum degree of heat. The electric heater is the only electrical apparatus for which 100 per cent efficiency can be shown, and with the "Radium Economic" some improvements have been made in the arrangement of the heaters in the cars which are believed to be of substantial advantage.

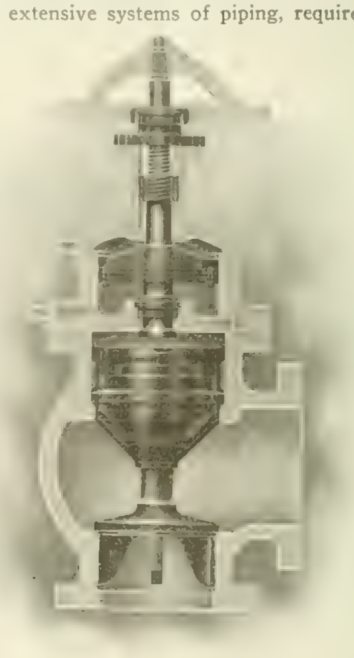
Industrial Beneficial Association.

An employes' beneficial association has lately been organized by the workmen in the shops of the Crocker-Wheeler Co., Ampere, N. J. Each member on payment of weekly dues of 10 cents is entitled to a benefit of $10 per week for 20 weeks if incapacitated for work through illness. In case of death the family of the insured employe will receive $100. The payment of 20, 30 or 40 cents a week increases the indemnity to $15, $20 or $25, respectively, with death benefits of $150, $200 or $250.

The Crocker-Wheeler Co. has offered to contribute an amount equal to the assessments collected by the association, thus doubling the income. This beneficial association will be managed entirely by the employes in the company's shops.

Combination Automatic Stop Valve.

Modern power stations and large manufacturing plants with their large boiler installations generating steam at high pressure, for distribution through extensive systems of piping, require the use of a



ANDERSON TRIPLE-ACTION VALVE.

type of valve that will act as a safeguard in emergencies such as the bursting of pipes or fittings that would fill the engine room with steam and prevent access to the valves. To meet these conditions the Best Manufacturing Co., of Pittsburg, has placed upon the market the Anderson cushioned triple-acting non-return valve shown in section herewith. The pilot valve can be located at any desirable place, thus permitting control from distant points. The valve illustrated is a non-return valve, an automatic emergency stop-valve and a hand stop-valve.

Syracuse Rapid Transit Co. Express Service.

Express service was begun on the lines of the Syracuse Rapid Transit Co., Syracuse, N. Y., April 1st, and will include four trips daily, covering practically all sections of the city. An express car is scheduled to leave the city at 8:25 a. m. for East Syracuse, at 11 a. m. for Onondaga Valley, at 1 p. m. for Liverpool, and at 4 p. m. for Solvay, serving all intermediate territory. A tariff of 20 cents and upward has been fixed on trunks and on packages and express matter the charges will be as follows:

Five pounds and under	15 cents
Over 5 and under 10 lb.	18 cents
Over 10 lb. and under 20 lb.	20 cents
Over 20 lb. and under 30 lb.	25 cents
Over 30 lb. and under 50 lb.	30 cents

Plans for Reorganizing the A. S. R. A.

[The following report was prepared by Prof. Henry H. Norris, of Cornell University, who has been retained by the Joint Committee appointed at the New York meeting of the A. S. R. A. Executive Committee in February last, to investigate similar organizations. The report as here printed is subject to revision, our date of publication not permitting us to wait for the amendment that may have been incorporated by the Joint Committee.—Ed.]

In analyzing the methods of working of various associations their work was divided into the following sections:

(a) Object.
(b) Means of attaining same.
(c) Members.
(d) Privileges of same.
(e) Officers.
(f) Meetings.
(g) Lines of work undertaken.
(h) Dues.

The study has resulted in the following suggestions as to important matters which should have consideration and these are incorporated in the proposed constitution.

GENERAL FEATURES

The Central Organization

The central body would be known as the American Electric Railway Association, which would concern itself with the general management of electric railway properties by:

a. Considering those general questions which are connected with the relation of electric railways to the public.

b. Receiving reports from the branch or affiliated organizations which would contain digests of progress made during each year in their particular fields and which would recommend for the consideration of the central organization those features in which each special department requires the co-operation of the others in order to more perfectly accomplish its work.

c. Exercising such control over the branch affiliated organizations as would produce most efficient and economical progress as a whole, while interfering to the minimum extent with the autonomous government of the separate associations.

In order to accomplish the desired compactness of the entire organization the following "binding" features are recommended:

1. A "blanket" fee from company members paid to the central organization, from the treasury of which annual grants would be made to the several affiliated organizations.

The fee would be graduated upon a gross income basis so that the large roads bear a proportionate share of the expense.

The grants would be made by the Executive Committee and so proportioned as to meet the specific needs of each branch or affiliated organization which would have the option of assessing its individual members in case its grants did not cover their needs for the year.

2. The printing and substantial binding of one or more volumes of proceedings including the work of all branch or affiliated associations, at the expense of the central organization. The proceedings would be edited by a committee representing all of the organizations.

3. The granting of charters to and the approval of the constitutions of all branch or affiliated associations, all of which would be in harmony with those of the group of organizations.

4. The recommendation to the branch or affiliated associations of such topics for investigation and report as are within their particular fields. The committee on subjects, which makes these recommendations, contains representatives from all of the associations.

The Executive Committee of the central organization would consist of:

1. The president of the American Electric Railway Association.

2. Three vice-presidents of the American Electric Railway Association.

3. A member, preferably the president, of each of the affiliated associations.

The Secretary of the American Electric Railway Association would devote his time to the work of the Association and would have duties and salary as arranged by the Executive Committee.

Membership in the American Electric Railway Association should comprise the following:

Active members [illegible] operating electric [illegible] be entitled to [illegible] encouraged to [illegible] able.

Associate members [illegible] identified with electric rai[illegible] nature as to make their connection with the association desirable. These members would [illegible] would have all the privileges [illegible] tion except those of voting and holding office. It is suggested that this class of membership be made attractive as it spreads interest in the work of the association [illegible] the central active membership. These members would receive copies of the proceedings, the cost of which would be more than covered by the fee mentioned.

GENERAL FEATURES

Branch or Affiliated Organizations

It is proposed that such branch or affiliated associations as are deemed necessary for the proper covering of the field of electric railway work, be encouraged to organize with the approval of the American Electric Railway Association.

These associations would prepare their own constitutions and would submit the same for the approval of the parent association. The field of activity of each would be designated by the Executive Committee of the parent association.

The names of the branch or affiliated associations would be selected in harmony with a general system for which the following are suggested:

American Electric Railway Association.
American Electric Railway Accountants' Association.
American Electric Railway Claim Agents' Association.
American Electric Railway Engineering and Maintenance of Way Association, etc., or
American Association of Electric Railway Accountants.
American Association of Electric Railway Engineers.
American Association of Electric Railway Claim Agents, etc.

The branch or affiliated organizations would be free to work out their own plans except for the limitations already prescribed.

It is suggested that there be no company members in the branch or affiliated associations and that the terms of individual membership be prescribed by each affiliated organization. They would make their rules as to the matter of dues if such are found necessary to supplement the grants made by the central organization.

In regard to the proceedings of the separate organizations, arrangement could easily be made by which these could be printed in separate pamphlets at a nominal price per copy, as it is evident that the technical features of each association's work would be most useful to its own members in this form. At the same time, the feature of a complete set of proceedings, edited and published through the general secretary's office and distributed to members to the parent association, is a most valuable one.

Conventions.

There are two possible plans for holding conventions both of which have many points in their favor. One of these as suggested by Mr. Richard McCulloch, consists in arranging all of the conventions at one time and place in such a way that one member can attend more than one convention. This plan gives concentration and efficiency of convention work although it does disturb to some extent the routine work of the member companies. It also restricts the time allotted to each association to a small number of hours unless the conventions be extended over a week or more. It would be possible also to hold these conventions in rapid succession, one following the other immediately or two or more at the same time where the lines of work were absolutely diverse.

The other general plan dictates a separate convention for each group of associations held at different times and places. These would result in the following advantages: minimum disturbance of routine work of the member companies; relief of congestion of convention work; efficiency of convention work through concentration upon particular topics and [illegible] continuity of work [illegible] within a few days at the general convention. The weakness of this plan consists in the lack of [illegible]

ment at previous conventions. However, it appears to be [illegible] conviction that these social features should now be [illegible] second place and that they should be turned over largely to the Manufacturers' Committee which appears desirous of assuming the responsibility.

In order that the Manufacturers' Committee [illegible] such an interest in the material welfare of the members of the association at the time of holding conventions shall have official recognition, it is suggested that a standing Committee on Conventions and Exhibits, containing a representative of the Manufacturers' Committee, should control the question of exhibits to be held in connection with conventions and to determine what should be the nature and extent of the entertainment features. The Manufacturers' Committee would be consulted as to these matters as at present, but in addition, the official representation on the standing committee would give the Manufacturers' Committee official recognition by the Association.

With the foregoing there was submitted a draft of constitution and by-laws for the American Electric Railway Association, designed to carry out the general features of the plan described.

The committee on reorganization is desirous that the plans proposed shall receive the fullest discussion and all interested parties are invited to submit criticisms, addressing communications to Prof. H. H. Norris, Cornell University, Ithaca, N. Y., by whom they will be laid before the full committee at a meeting to be held in Philadelphia some time in June, after the return of Mr. Ely, who is now in Europe.

The "Review" desires to congratulate Professor Norris upon his report, which is most admirable in being clear, comprehensive and concise. The general scheme is well-considered but we believe there are some respects in which the interests of the existing departmental associations should be further protected from what must be more or less of an experiment, because the conservation of the Accountants' and the Mechanical and Electrical associations is quite as important as the reform of the A. S. R. A.

Specifically we think the central association should stipulate not "minimum interference" but "no interference" with the autonomous government of existing departmental associations; at least for a time, say one, two or three years, after which period the success of the reorganization to accomplish its objects could be judged better than in advance.

Secondly, the existing departmental associations should in recognition of their past work be assured of an income at least equal to that now enjoyed, with perhaps the expense of publishing proceedings deducted, this work being for the future undertaken by the central association.

The recommendation to make the dues of active members (railway owners) proportional to the gross earnings of the respective railways is a most excellent one. On the contrary, the proposal that each member have but one vote regardless of the amount of dues paid by it is a violation of the principle of "no taxation without representation" which the American people is supposed to regard as fundamental. The impropriety of placing a 500-car road and a 5-car road on an equality when voting on a question of standards in car construction should be apparent; and the impropriety is perhaps greater when it comes to expending the $501, of which the larger road contributes $500.

In the proposed constitution and by-laws it is provided that the secretary shall maintain an office in New York City. This is a needless particularity and one that will not increase the popularity of the association with companies operating outside of the immediate sphere of influence of the metropolis. The older and more common provision that the "office of the association shall be where the secretary resides" would cover all the requirements, and not tie up the association so that an amendment to the by-laws is required to make a change.

The foregoing comments are based upon the preliminary report, which is subject to revision, and when revised it is possible that some of the features mentioned may be found to have been eliminated.

The large brick two-story car barn of the Public Service Corporation in Camden, N. J., was destroyed by fire March 22nd, together with six trolley cars and other material stored within the structure.

Engine Accidents and Their Preventions.

In spite of marked improvements in engine and power appliances generally, and apparently without regard to the usual safety stops applied to engines by their builders, serious fly-wheel accidents are of very common occurrence, and statistics show that such accidents are steadily increasing in number and seriousness. The further fact that they frequently occur in big well-regulated plants where thorough periodical inspections are made and every possible precaution is taken, seems to show very clearly the need of some mechanical device for closing the throttle automatically and positively in case of "racing," thus preventing the serious damage to property which almost inevitably follows the bursting of a flywheel and the not infrequent loss of life. No human prevision can anticipate and guard against all the emergencies by which an engine may be suddenly relieved of its load and allowed to race; and with the higher speeds of modern practice, such accidents are bound to become more and more common in the absence of some device which will act with equal certainty and promptness under all conditions.

According to a booklet recently issued by the Consolidated Engine Stop Co., New York, under the title "As Others See us," it appears that this need is fully met by the "Monarch" engine-stop and speed limit system, which not only closes the throttle automatically in case of over-speeding but also enables it to be closed with equal promptness from any part of the plant by means of push switches. The booklet referred to contains testimonials from more than 80 representative concerns in various lines of business, all of whom have had practical demonstrations of the "Monarch" system's preventive value in emergencies where no human agency could have averted disaster. The company states that this system has been in use for years and offers as evidence of its reliability the fact that it is widely used by engine builders, from whom many repeat orders are received.

Annual Report of Metropolitan Elevated.

The earnings of the Metropolitan West Side Elevated Railway Co., Chicago, for the year ended Feb. 28, 1905, were $2,160,941, of which $2,089,937 were passenger earnings. The operating expenses for the year were $1,064,660, leaving net earnings from operation $1,096,281, with which is added other income of $5,553, making the net income $1,101,834. Deducting from this the fixed charges of interest, rentals and taxes there is a surplus of $241,425, which added to the surplus from the previous year makes the total surplus $468,382.

In his annual report President McAllister stated that the demands on the service during the rush hours necessitated the purchase of 68 additional cars and it was also found necessary to change the method of operation from single motor cars hauling trains to the multiple unit system of control, the addition in equipment making a total of 157 motor cars and 262 coaches. The air brake system was also changed and storage batteries were provided at various stations. The terminal station at Fifth Ave. was also put in operation October 3rd. The old officers were re-elected with the exception of the president, who was succeeded by Mr. H. G. Hetzler, superintendent of terminals of the Chicago, Burlington & Quincy Ry., Chicago. Mr. McAllister, who announced his intended retirement some time ago, will take a vacation of several months.

Peacock Brakes for Chicago.

The National Brake Co., of Buffalo, N. Y., has received an order from the Chicago City Railway Co. for 400 of its "Peacock" brakes, which will be part of the equipment of the cars recently ordered by the Chicago City Ry. This order, coming so close upon that for brakes for the 250 cars building for the Brooklyn Rapid Transit Co., announced in our last issue, is striking testimony as to the merits of this brake. Among the roads that have adopted the "Peacock" are several of the largest city systems in the country, of which Brooklyn, Baltimore and Chicago are examples, and there are over 150 roads now having these brakes in service.

The especial feature of the Peacock brake is the eccentric spiral drum about which the brake chain is wound, by means of which the leverage is automatically multiplied as the stress upon the chain increases, reducing the time required for an application, and relieving the motorman of unnecessary effort.

New Gasoline-Electric Motor Car.

One of the latest developments in electric traction has recently been completed in the form of a gasoline electric motor car, at the locomotive and car shops of F. M. Hicks & Co., Chicago Heights, Ill. This car was designed and built for the St. Joseph Valley Traction Co. The framing of the car body was carefully designed to provide sufficient strength for the concentrated loads upon the floor, and at the same time to reduce the number of redundant members to a minimum. Two 6-in. [illegible]-lb. I-beams serve as the

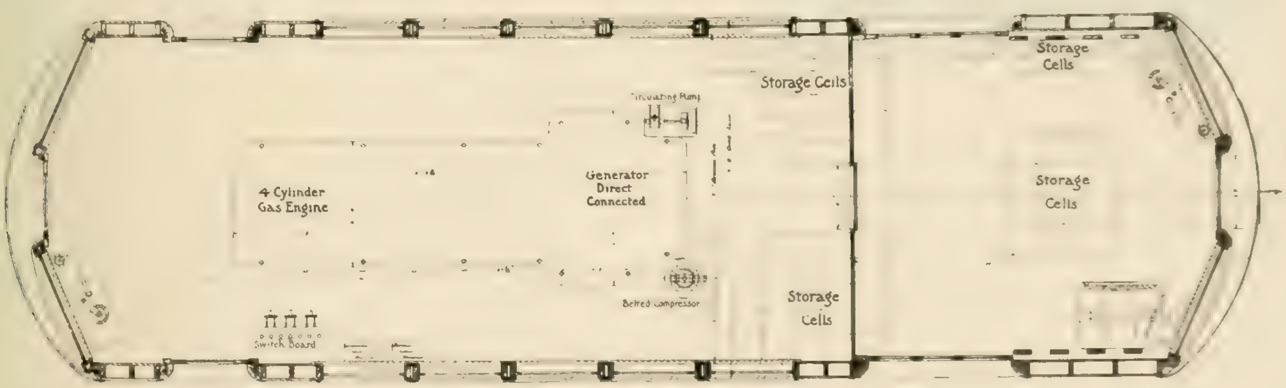
[illegible] are of heavy design [illegible]

The motive power is [illegible] marine type [illegible] the particular [illegible] consumption [illegible] cylinder jacket water is kept [illegible] a rotary pump [illegible] of the jacket water is effected by [illegible] ¾-in. automobile radiator pipe, and thence through a supply tank

GASOLINE-ELECTRIC CAR FOR ST. JOSEPH VALLEY.

center sills; the two side sills are 5 x 8-in. yellow pine; there are also four intermediate sills of 4 x 6½-in. yellow pine. The transverse under framing consists of two oak end sills, 8 x 12 in.; two transoms, each built up of two wrought iron plates, 1 [illegible] in. thick and 10 in. wide; and joists 2¾ x 6½ in. The under framing is

of 100 gallons capacity. The radiation of heat [illegible] coils is rendered more effective by a blast from two 42-in. fans revolving in a horizontal plane, at the rate of 300 r. p. m., directly under the radiator and exhausting the [illegible] the upper deck.



FLOOR PLAN OF CAR.

well tied with transverse, wrought iron tie rods ⅝ in. in diameter. The floor is of two thicknesses of ¾ in. pine separated by a layer of "Neponset" paper. The side framing is made extra heavy and reinforced by continuous blocking. Although the underframing is designed to carry its load with a large factor of safety, additional provisions have been made to transmit stresses, due to excessive bending moments upon the underframing, to heavy wrought iron carlines which serve as trusses across the deck of the car. The body is trussed by two 1½-in. rods with 1¾ in. ends.

The car is 34 ft. long over end sills and is divided into two compartments, an engine room and a baggage room. The width over side sills is 9 ft. 8 in. The exterior is painted Pullman standard color with gold striping and lettering.

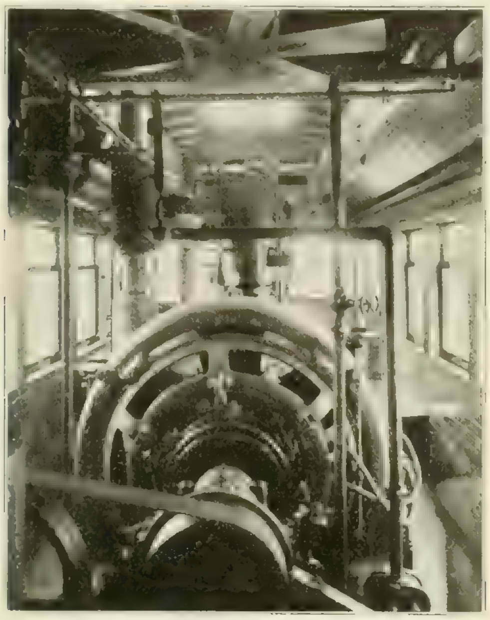
The engine is direct connected to a Sprague Electric Co. 50-kw. 250-volt direct current generator which supplies current to four 35-h. p. motors, mounted upon the trucks. To provide for the heavy load which is thrown upon the generator, for an instant, due to accelerating the car in starting, a battery of 120 "Chloride" accumulator cells is installed. The normal rating of each cell is 2.08 volts and the 120 cells [illegible] potential of 249.6 volts at the terminals of the battery. The cells are placed in well ventilated lockers painted internally with asphaltum paint. The gases arising from the battery are drawn from the lockers and exhausted through the ventilators by the fans.

The leads from the battery are carried to the switchboard, which is of special design, and there connected in multiple with the gen-

erator leads to the main controller leads. Current demands in excess of the generator capacity are met by the battery and when the output of the generator is in excess of the demand, the excess charges the battery. Circuit breakers are connected in the battery and generator leads to the switchboard, to obviate the necessity of replacing blown-out fuses.

In addition to the traction load, the generator supplies current for a 4-h. p. motor compressor connected with the air brake system, current for lighting purposes, and for a small storage battery used in the gas engine ignition. The car is equipped with the National Electric Co's. automatic air brake system, and also has hand brake rigging. In the upper deck, directly above the engine cylinders, are two heavy hinged trap doors through which the cylinder heads and pistons may be readily removed. The trap doors may also be used in fair weather as a means of ventilating the car. The gasoline supply is carried underneath the car in a heavy galvanized iron tank of 125 gallons capacity. The gasoline is fed to the engine by a small reciprocating pump; the supply is always greater than that required by the engine, and the excess flows back to the reservoir.

In this car, two methods for starting have been provided, either of which may be used independent of the other. The first method,



INTERIOR OF CAR.

and the one which will no doubt be more generally used, is that of driving the generator as a motor for the storage battery until the gasoline is working normally through the engine. The field leads from the generator, instead of being run directly to the field rheostat, are led through an intermediate switch upon the board, by throwing which the field of the generator may be connected with the storage battery and fully excited. Then by means of a single pole, four-point switch, connected with a series of resistances, current may be gradually introduced to the armature when the generator will start as a motor. As soon as the engine takes hold of the load, it is only necessary to throw the field current back under the control of the rheostat.

The second method is that of driving the engine by compressed air until gasoline works normally through the engine. An air compressor is belted to a pulley on the engine shaft. This compressor has a capacity of 5.9 cu. ft. of free air per minute, when running at 165 r. p. m., and maintains a pressure of 200 lb. per sq. in. in two cylindrical steel reservoirs. These reservoirs are also connected with the reservoirs of the air brake system (where a pressure of 90 lb. per sq. in. is maintained) through a reducing valve so that in case the motor compressor should become disabled the air brake system could be operated.

The mechanical and electrical equipment of this car, all of which is representative of the best and most modern design, occupies one third of the floor space of the car and in the aggregate weighs about 25 tons. The weights are: Gas engine, 18,000 lb.; generator, 3,000 lb.; storage batteries, 9,250 lb.; motors, 10,000 lb.; body and trucks 33,600 lb.; gasoline tank full, 2,000 lb.; jacket water and tank, 2,000 lb.; miscellaneous, 4,000 lb.; total, 86,850 lb.

Tramway Progress in the United Kingdom.

Glasgow.

Cars have now commenced running between Glasgow and Paisley. The service is arranged to suit the traffic, there being long intervals between cars up till 8:30 a. m., but from this time of the day there is a six-minutes' service, and on Saturday afternoons a four-minutes' service.

Dartford.

The Urban Council proposes to extend its electric tramways from Bexley Heath to Horn's Cross, about 8¼ miles of single track. J. G. White & Co. have the work in hand, and when constructed this firm is to work the new lines for five years, or at the council's option, for 15 years. The company would pay all capital and interest charges, and would recoup itself out of the profits made. Current for running the lines will be supplied from the Council's generating station.

Newcastle-on-Tyne.

In a case where a passenger sued the Newcastle Corporation for damages for injuries received by being jerked from a car, the judge found for the defendant corporation. The passenger at the time of the accident was standing on the footboard preparatory to alighting, and it was held that passengers had no right to ride on the footboard.

Falkirk.

A start has been made with the laying of tramways in the Falkirk district, and it is expected that the cars will be running within six months. The length of the route will be about seven miles, and two or three small bridges will require to be widened in connection with the scheme. Current is to be supplied by the Falkirk Corporation.

South Shields.

A special meeting of the Town Council has been held to discuss the respective merits of the electric tramway and the motor bus. A deputation sent to a number of the principal towns to see the motor bus in actual operation, came to the conclusion that it was quite unsuited to a place like South Shields, and was not to be compared with the electric tram for comfort and convenience. The Council adopted the committee's report, 24 voting in favor of it, and 6 against. Therefore, tenders are to be considered shortly for putting down electric tramways.

Scioto-Valley Traction Co.

At the recent meeting of the pool trustees of the Scioto Valley Traction Co. held at Columbus, O., the construction pool was formally dissolved, the road was turned over to the stockholders, the common and preferred stock distributed and arrangements for an issue of $2,000,000 in bonds made. At the meeting of the stockholders the following were elected as a board of directors: A. B. Voorheis, vice-president of the German National Bank of Cincinnati; J. C. Hooven, of Cincinnati; J. G. Schmidlapp, president of the Union Savings & Trust Co., of Cincinnati; W. S. Courtright, president of the Union National Bank of Columbus; E. R. Sharp, president of the State Savings Bank & Trust Co., of Columbus; E. K. Stewart, vice-president and general manager of the Columbus Railway & Light Co.; Frank A. Davis, Theodore Rhoads and Henry B. Peters, of Columbus.

The directors organized by electing Frank A. Davis, president; W. S. Courtright, vice-president, and E. R. Sharp, secretary and treasurer of the company.

The first connection between the system of subways under the streets of Chicago and a railway freight terminal will be made during the coming month, and connections with five other roads are to be completed in June.

Mutual Benefit Associations.*

BY W. G. ROSS, MANAGING DIRECTOR MONTREAL STREET RAILWAY.

The formation of mutual benefit associations among the employes of large railway and industrial companies, started within the last few years, has proved very successful from the point of view of the employes as well as the employer, for the reason that the object of such associations is to better the general condition of the employe and in so doing improve their standard and create a better feeling between them and the management. This, I consider, is essential to the proper management of a company, particularly street railways, which, being public service corporations, are continually in touch with the public; and when the public know that the management of a company is looking after the needs of its employes, their general attitude is materially different in times of trouble. You will agree that this in itself is worth attention, also that the success of a street railway depends to some extent upon its popularity with its employes and the general populace which it caters to.

The introduction of the employes' mutual benefit association in Canada was brought about in 1884, when the Grand Trunk Railway Co. established, under the provisions of several acts of Parliament, the Grand Trunk Railway Insurance and Provident Society. The objects of this society are to provide benefits or allowances to members unable, through sickness or bodily injury, to follow their usual occupation in the company's service; and to assist the legal representatives of deceased members. All except salaried employes, who contribute to a special superannuation fund of the company, are compelled to join, paying monthly contributions, the company paying an amount equal to 50 per cent of the amount paid in by the members. The management of the society is controlled by a board of directors, composed of an equal number of officials and employes, the latter of whom are elected by members of the society. The Grand Trunk Railway Co. experienced some trouble in the first few years of its organization in getting the employes to join, principally owing to the fact that they were not thoroughly conversant with the many advantages to be obtained, but now that they have familiarized themselves with the many benefits from membership in the society, it has turned out a complete success.

The Canadian Pacific Ry. organized within the last few years a pension fund for its employes. It has no society to provide allowances for its employes in case of disablement, either through sickness or bodily injury.

In the spring of 1903 the writer suggested the formation of a mutual benefit association among the employes of the Montreal Street Ry., and in August, 1903, the company requested the employes to elect two of their number from each of the various departments to meet the officials of the company, to discuss the advisability of forming such an association. This meeting took place at the head office of the company on August 17th. Rules and by-laws were drawn up and proofs distributed to the representatives of the men for careful consideration and discussion among their fellow-employes, the meeting then adjourning until August 20th, to give the men time to consider the matter. On the latter date all the representatives were present, as well as the officials of the company, and after reading the clauses, the rules and by-laws were passed, as amended, and a temporary board of directors was elected, composed of four members elected by the directors of the company, and four elected by the representatives present, with the general manager of the company as chairman. The newly-elected board then elected a secretary-treasurer and medical officer, and in order to expedite matters ten of the representatives were instructed to devote their whole time to explain to their fellow-employes the objects of the association and enroll applicants for membership. Forms of application, rules and by-laws, in the English and French languages, were at once printed, and in the short period of two months the membership of the association had reached 600. Since then the membership has increased, until today it has reached the 1,500 mark, or about 80 per cent of the total number of employes.

The objects of the Montreal Street Railway Mutual Benefit Association are to afford relief to such employes of the Montreal Street Ry. and the Montreal Park & Island Ry. as may become members of the said association, by providing [illegible] and medicine to members [illegible] vocation in the service of the company [illegible] bodily injury, by providing a pension [illegible] and by providing [illegible] of the deceased member. Members [illegible] tiation fee, and thereafter 50 cents a month, for which they receive, in case of disablement [illegible] day, including Sundays, [illegible] including Sundays, for the next 90 days, including medical attendance and medicine. In cases of sickness the payment starts from the seventh day of illness, no payment being allowed for the first six days, and monthly dues are not exacted during disablement. Members over 65 years of age, and having served in the company's employ for 25 years, are also entitled to a pension for life at the rate of 50 cents a day, or may commute the daily payment for an immediate payment of a total sum, provided that if the employe temporarily, at any time thereafter, shall return to work or engage in any other work, at a rate of daily wages exceeding 50 cents, the payment of the pension shall be suspended during the continuance of such re-employment or period of actual work. Upon the death of a member, from whatever cause, $500 is paid, providing the deceased member was under 40 years of age when admitted to membership; $333.33 when between the ages of 40 and 50, and $[illegible] when 50 years and over. In addition to the above sum $50 is allowed to cover funeral expenses. Leaving the service of the companies severs membership, and no member leaving during the first five years of his membership in the association has any claim to insurance benefits or refunds, or a refund of any fees paid during such membership. After five years and up to ten, members severing membership are allowed a refund of one-third of the fees paid during membership. After ten years members are allowed a refund of two-thirds, without interest in every case. Any amount paid to such members for benefits during membership is, however, deducted from the refunds. The Montreal Street Ry. and the Montreal Park & Island Ry. jointly contribute to the funds of the association a sum annually equal to 100 per cent of the annual amount collected from members as admission fee, and 50 per cent of the annual amount collected for monthly dues, and in addition furnish necessary office accommodation and defray all other expenses of management.

From the above you will admit that the benefits to be derived by being a member are numerous and inviting to the employes, yet when one considers that the association was formed immediately after a general strike and that the employes were more or less suspicious, one can realize to some extent the labor experienced in bringing the same to a successful issue. This, however, was accomplished by conscientious work on the part of the company and the men. Under the powers of incorporation, granted in May, 1904, the board of directors was increased from 9 members to 15, of which 8 are elected by the directors of the Montreal Street Ry. and 7 by the members. The increase in the directorate allows the various departments to have a representative upon the board, which prevents jealousy existing among the employes of the various departments. Meetings of the board are held monthly, at which a statement of the revenue and expenses for the previous month, the benefit claims and other bills paid, as well as all applications for admission are submitted for approval, and all other matters of interest to the association are taken up and discussed. The annual meeting is held in June in each year, and after the usual business is transacted, a smoking concert is held, the talent being selected from the members present. During the course of last year a picnic under the auspices of the association was held at one of our leading parks, lasting for four days, and netted a profit, in spite of the unsatisfactory weather conditions, of $1,361.88. During the month of January, through the courtesy of the Montreal Street Ry., the members and their families were given a theater day, each member receiving two tickets and the necessary transportation tickets, in order to attend the entertainment without expense. This proved a great success and was very much appreciated by the members. These acts of kindness and attention on the part of the company have greatly assisted in the good results obtained. The members who, as I said before, represent over 80 per cent of the total number of employes, feel that they are being considered, and are in consequence interested in the welfare of the association.

*Read before the Canadian Street Railway Association, March, 1905.

[illegible] 16 months the association has paid out the [illegible] amounts which go to show the great necessity for such [illegible]. Sickness and injury claims, $6,866.85; death and [illegible], $[illegible]; medicine, $384.78; medical examination, $671.50; medical attendance, $1,385.24; total, $13,116.04.

The income from all sources for the same period has been as follows:

From members—Fees	$1,657.00	
From members—Dues	8,749.00	
		$10,406.00
From Company—Fees	1,657.00	
From Company—Dues	4,374.50	
	6,031.50	
Special Donations	6,000.00	
		12,031.50
Picnic	1,361.88	
Interest	97.01	
		1,458.89
		$23,896.39

leaving a surplus for 16 months of operation of $11,780.35. In addition to the company's contribution of $12,031, the expenses of management and organization for the same period amounted to $10,292.79, making a total cost to the company of $22,232.79. During the last nine months of operation the following work has been done by the medical department: Number of consultations, 2,902; number of visits, 388; number of prescriptions, 1,147.

In view of the large increase in membership, arrangements were completed on February 1st last to open medical offices at the different depots of the company, where physicians would be in attendance daily, excepting Sundays and holidays, between 11 a. m. and 12 noon, this being in addition to the office of the chief medical officer and examiner, whose office is at the head offices of the association. This additional accommodation has been much appreciated by the members. Sick committees of four to visit the sick have been formed in the various depots and departments of the company, of which the director representing the depot or department acts as chairman, and the duties of such committee consist in visiting disabled members and reporting thereon.

Our requirements for the pension and death funds have been carefully passed on by a life insurance expert, and every precaution has been taken to secure the complete success of the association.

The Des Moines City Railway Co. is building an observation car in its shops.

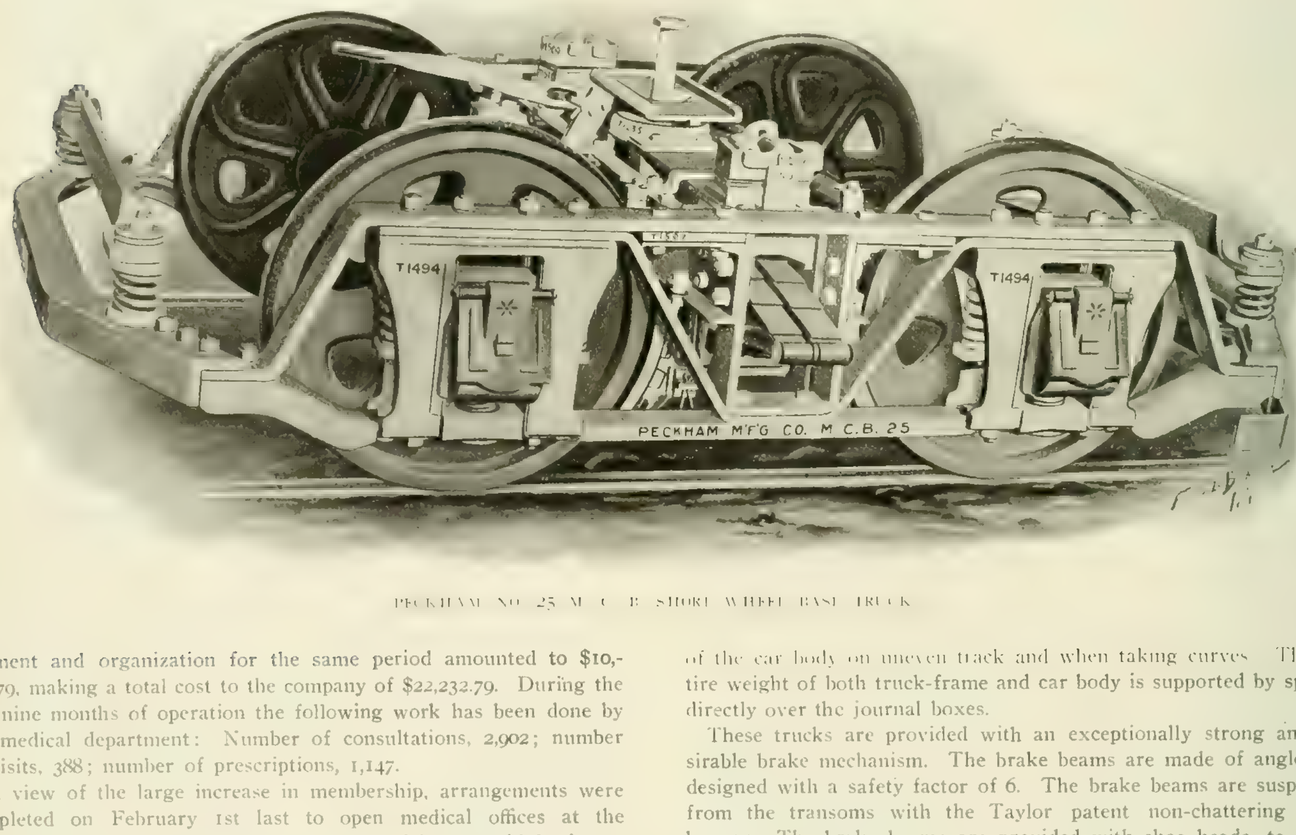
Peckham Short Wheel Base Truck.

The truck illustrated herewith is a new design of the Peckham Manufacturing Co., known as the short wheel base No. 25 M. C. B. truck. Four hundred of these are now under construction for the new surface cars being adopted by the Brooklyn Heights Railroad Co., in place of shorter cars mounted on maximum traction trucks. The Peckham company states that the No. 25 truck is meeting with general popular favor, and in addition to the order received from the Brooklyn Heights company there are several other large orders for this type entered in its books.

The construction of the No. 25 truck is practically an M. C. B. construction without equalizing bars, and is designed for cars requiring a short-wheel base truck with outside hung motors. Very few castings enter into the construction. The side frames are of patent combination, with a center truss rigidly secured to the pedestals and top frames. This combination is to give a double factor of safety, and as designed without equalizing bars to give the same spring base on the short-wheel base truck that can be obtained in a wheel base running from 6 ft. 6 in. to 7 ft., where the M. C. B. construction is used. The weight of the car body is carried directly on two double elliptic springs, which are seated in the spring plank, consisting of a channel iron and malleable iron seat suspended from swinging links, which are so designed as to provide against rocking of the car body on uneven track and when taking curves. The entire weight of both truck-frame and car body is supported by springs directly over the journal boxes.

These trucks are provided with an exceptionally strong and desirable brake mechanism. The brake beams are made of angle iron designed with a safety factor of 6. The brake beams are suspended from the transoms with the Taylor patent non-chattering brake hanger. The brake beams are provided with shoe heads, to which the brake beam is keyed, which facilitates the changing or renewing of shoes when they are worn out. The adjustment of brakes is made either with a turnbuckle or with pins, similar to steam railway practice. The bolsters are provided with wearing pieces which wear against similar pieces on the transom channel, and thus allows for adjustment and insures an even braking car at all times.

In designing this form of truck it has been the aim of the Peckham company to eliminate cast steel or forged side frames, and to provide a construction with hardly a part to break that cannot be repaired in any ordinary car shop.



PECKHAM NO. 25 M. C. B. SHORT WHEEL BASE TRUCK.

The Toledo, Fostoria & Findlay Electric Railway Co. has contracted with Creswell & Kleinman, of Findlay, O., for the grading of its extension to Pemberville, a distance of 17 miles.

United Railway Company of St. Louis.

The fifth annual report of the United Railways Co. of St. Louis, covering the year 1904, has been submitted to the stockholders by Mr. Murray Carleton, president. The report is of special interest because of the World's Fair traffic handled by the company during the past year.

Nov. 1, 1904, the company began the operation of its own property, the lease to the St. Louis Transit Co., which was the operating company operating since September, 1899, having been canceled. Additional track to the extent of 6.5 miles was constructed during 1904 and 5.65 miles no longer being used was taken up. At the close of the year reported the number of miles of track owned was 353.67; in operation, 344.44; leased, 2.54; not used, 6.69. The former equipment was made complete by the purchase of 450 new cars.

The report states that the company's power plants, of which there are eight, are in excellent condition, and are producing power with economy, sufficiency and certainty. The wood-working shop is not well located, being several miles removed from the machine and paint shops, and as the company now owns a piece of vacant ground near the machine shop it is recommended that a wood-working shop should be erected upon this land at a cost not exceeding $40,000. With a shop in this location the work can be done conveniently and more economically. The construction of a car house at Kossuth Ave., just west of Grand Ave., is recommended. The report states that the physical condition of the property is good, and it is the expectation of the management that its present condition and degree of efficiency can be maintained and improved out of the earnings. With this end in view it is proposed to renew some 10 miles of track this year, and it is expected that the cost of this renewal will be paid from the earnings.

The accompanying data cover the operation of the property for the year 1904; ten months by the St. Louis Transit Co. and two months by the United Railways Co.

The gross income for the period reported was $9,977,564.17; operating expenses and taxes, $5,751,066.65. After deducting $2,446,292.36 for interest on funded debt, miscellaneous, interest and organization expenses, the net income for the year is $1,780,205.16. From this net income dividends were declared to the amount of $598,022.50, leaving a surplus of $1,182,182.66. This surplus and considerable additional cash were required for the payment of certain debts of the St. Louis Transit Co. which were assumed by the United Railways Co. The surplus for the year 1904 is in contrast with the deficits of $62,780.66, $268,083.40, $525,030 for the years 1903, 1902 and 1901, respectively.

During the year reported the cars carried 201,316,532 revenue passengers and 83,974,502 passengers having transfers or passes thus making the total number of passengers carried throughout the year, 285,291,034. The car-mileage for the year was 37,910,484.

The report states that 39.64 per cent of the revenue passengers used transfers, and the average passenger earnings were 4.89 cents per revenue passenger and 3.46 cents per total passenger.

Removal Announcements.

The Elmer P. Morris Co., 15 Cortlandt St., New York, will remove to the ground floor at 51 Dey Street, May 1st.

E. J. Lawless, general sales agent for the John Stephenson Co., will remove his office to the Park Row Building, New York, May 1st.

W. S. Silver & Co., will remove to the Park Row Building, New York, May 1st.

The Vose Spring Co., Gus Suckow, general manager, will remove its office to the Park Row Building, New York, May 1st.

The National Electric Co., Milwaukee, will May 1st remove its New York offices to the new Trinity Building, No. 111 Broadway. The National company will have offices on the 12th floor.

The Muncie, Hartford & Ft. Wayne Railway Co. is fitting up a car for the handling of freight and it is expected to begin freight service on this line about April 15th.

Two Hundred Cars for Chicago City Ry.

The Chicago City Railway Co. last month placed orders for 200 new cars. The J. G. Brill Co. will build the bodies, which are to be 46 ft. long over bumpers and 9 ft. wide over water tables. The McGuire-Cummings Manufacturing Co. received the order for 424 of its standard M. C. B. trucks. Orders for Hale & Kilburn seats, International fare registers, "Consolidated" electric heaters and General Electric No. 80 motors (four per car) were also placed.

D. & W. Fuse Co. in New Quarters.

The D. & W. Fuse Co., Providence, R. I., has moved into its new factory, the great demand for the line manufactured by this company having forced it to seek larger quarters. The new building is three stories high, 285 x 50 ft., giving a floor capacity of about 53,000 sq. ft. The offices are in a separate building from the factory building. The "Deltabeston" magnet wire placed upon the market by this company is the cause of the trouble, if a need for large works is trouble. The sale of the wire has been exceedingly large, some of the largest manufacturers in the country making it their standard. The D. & W. Co. intends to protect its patents.

Lightning Protection.

The problem of protecting high tension lines from serious lightning trouble has been much studied, and experiments have been made with many types of protecting devices. The results have been varied. Some interesting methods and results with lightning protection devices are reported in the March number of the Sibley Journal of Engineering by Mr. Julian C. Smith, of the Shawinigan Water & Power Co. This company operates an 86-mile, 44,000-volt, transmission line between Shawinigan Falls and Montreal, Quebec. Some of the results of two seasons' experimenting may be outlined as follows:

Lightning disturbances do not confine themselves to single storms, but the electric disturbance lasts two or three days. The storms are much more severe in certain localities along the line.

The most severe storms may generally be expected between 2 p. m. and 5 p. m.

When a line pole is struck its neighbors usually have splinters knocked off.

Perhaps the most important fact noted was this: The reactance of the line is so great that 20 miles of line is protection from the most severe storm. In other words, a storm center 20 miles from the station may damage the line, but no very excessive potentials will be felt in the station.

In nearly every case when arcs were noted in the stations it was found by the line patrolmen that from 5 to 10 poles had had large splinters taken out.

In order to care for excessive discharges a set of horn arresters was after careful experiments installed in each station of this line. These horns were set to discharge at a voltage 25 per cent higher than the standard arresters, by which means the system was made selective; the ordinary storms are taken care of by the standard arresters, which cause practically no disturbance, while heavy discharges are taken care of by the horns, which provide a low resistance path to the ground.

A unique feature of these horn arresters is the insertion of a 6-ft. fuse between one horn and the ground as a protection from a short circuit in case the arc does not blow at the tips of the horns. During the last year this arrangement of arresters has worked in a very satisfactory manner, discharging many times, sometimes blowing the fuse, but without seriously disturbing the operation of the line.

The Memphis Street Railway Co. has appropriated $1,000 towards employing a Young Men's Christian Association secretary to take in charge the street railway department at Memphis. Rooms will be equipped in the central car barn by the management of the railway company. Educational, religious and social works will be undertaken under the direction of the committee of management, which consists of street railway employes. Save for the Y. M. C. A. street railway department at Richmond, Va., the one at Memphis will be the first of the kind in the South.

Open Cars for Ft. Smith, Ark.

Fifteen 10-bench open cars like the one illustrated have lately been delivered to the Fort Smith Light & Traction Co. by the American Car Co. The new cars are intended for use in and about the city of Fort Smith, and will reach McLoud Park, the company's popular amusement resort, and also Lemert Park. Fort Smith is the second city in importance in the state, and is rapidly growing. It is situated on the Arkansas River about 165 miles above Little Rock, and is contiguous to the rich coal fields of middle western Arkansas and the northwestern portion of Indian Territory; hence the city is a most important mining center, being the outlet for the extensive mines surrounding it. A fruit growing industry of large proportions in districts near Fort Smith also adds greatly to the commercial life of the city.

The new cars are 21 ft. over the end panels and 7 ft. ½ in. over the seat ends. Wide wire guards are placed on one side of the car fitted in sections of two to a side. The guards are detachable and may be used on either side of car and can be readily removed by one man. The seats are reversible with the exception of the two corner seats at one end of car. It will be noticed that the folding gates are set unusually high. The sashes in the bulkheads are arranged to drop into pockets between the seats. The interiors are finished in ash with ceilings of decorated birch, and the seats are also of ash. Among the patented specialties included in the furnishings are sand boxes, angle iron bumpers, and "Dedenda" gongs of Brill manufacture, and folding gates and signs made by the American Car Co.

AMERICAN CAR FOR FT. SMITH, ARK.

The general dimensions of the cars are as follows: Length over crown pieces, 28 ft. 8¾ in.; from panel over crown piece, 3 ft. 10 3-16 in.; width over sills, including plate, 6 ft. 3 in.; the sweep of posts is 5 in.; between centers of posts, 2 ft. 8 in.; side sills, 3¾ x 7 in.; sill plates, ⅝ x 8 in.; thickness of corner posts, 3⅝ in., and of side posts, 2¾ in.

Easter Outing in Nashville.

The Nashville Railway & Light Co. is making active preparations for its Third Annual Easter Egg Hunt at Glendale Park on Saturday, April 22nd. For the past two years this has been made a big feature and has proved very successful in bringing out large crowds, old as well as young. Several barrels of Easter eggs are hidden on the grounds during the forenoon, among which are prize eggs bearing numbers corresponding to numbered prizes for the finders of such eggs. Among the prize eggs will be one of a golden color, entitling the finder to five dollars in gold, and one of a silver color calling for a prize of a silver dollar. A great many merchants contribute to the prizes, making it, altogether, very popular in every way. The searchers for the eggs are not turned loose to hunt for them until about three o'clock in the afternoon. In their search for the eggs, the children startle and catch many rabbits, entirely surrounding them, so great is the crowd, giving the animals no chance to escape, which greatly adds to the fun.

Mr. George E. Pratt has been appointed special agent in charge of the power department of F. M. Hicks & Co., car and locomotive builders, Chicago.

STREET RAILWAY REVIEW

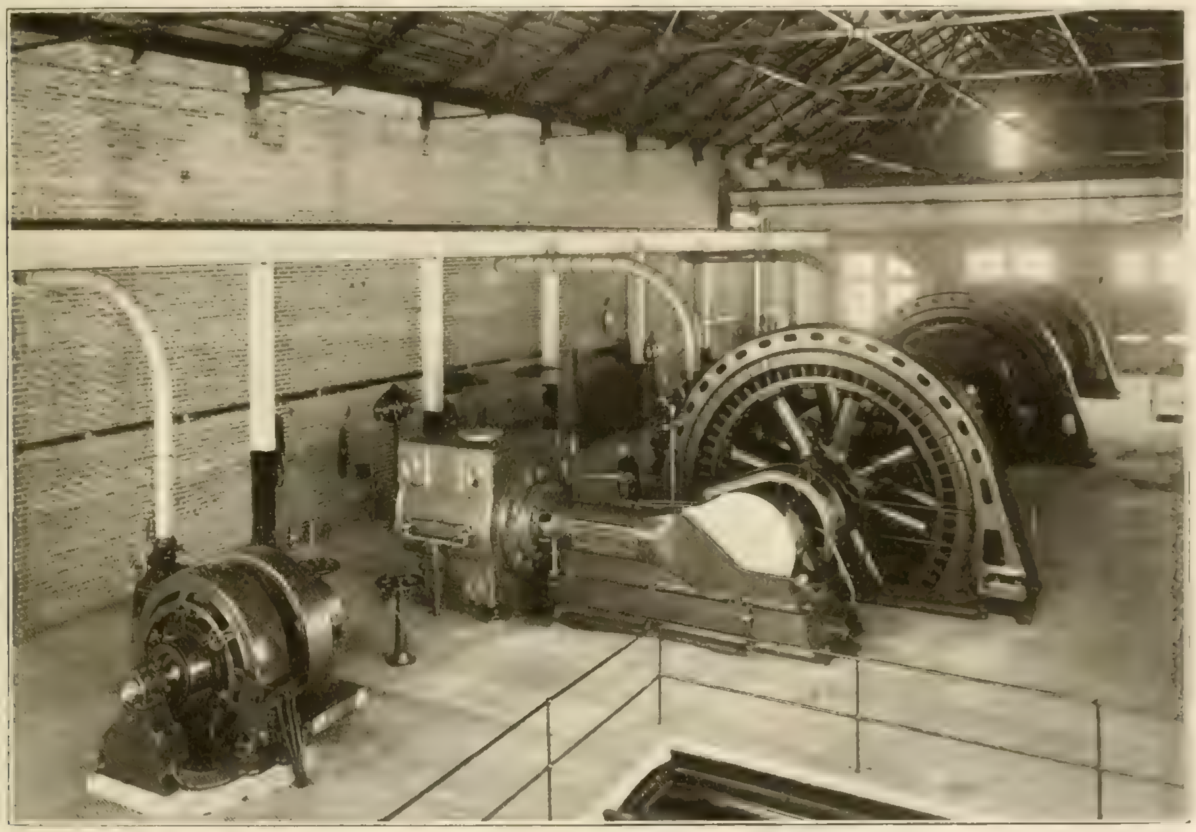
Vol. XV — MAY 15, 1905 — No. 5

New Power Plant of the Camden Interstate Railway Co.

BY G. [illegible]

The Camden Interstate Railway Co. has lately completed and put into operation a new power station at Kenova, W. Va. The construction of this station became necessary on account of the inability of the old plant at Ashland, Ky., to meet the demands of the increasing traffic. The new plant which has twice the capacity of the old one, requires but half the number of men to operate it, and burns an average of 35 tons of coal a day, which is but one half the consumption of the old plant at Ashland. This station first supplied power for the entire railway and lighting systems Nov. 9, 1904, after a construction period of 13 months.

This new power plant is situated near the center of the company's line of business along the Ohio River valley. On one side of the building is the Big Sandy River, on the other the Ohio River is close at hand. From the grounds of the power station can be seen three states, the name Kenova standing for the three—Ken, for Kentucky; O, for Ohio, and Va, for Virginia.



ENGINE ROOM, SHOWING LARGE UNITS AND EXCITER, CAMDEN INTERSTATE RAILWAY CO.

The building is constructed in a thoroughly fireproof manner. The materials used were dark red brick with gray sandstone foundation and trimmings. Its size is 150 x 120 ft., which allows ample room for the present equipment and added space for the accommodation of all the apparatus which will be needed for some time to come. This structure, which was built by Caldwell, Drake & Co., of Columbus, Ind., has a slate roof 45 ft. above the engine room floor, supported by steel trusses furnished by the Bracket Bridge Co., of Cincinnati, O. One of the illustrations is a view of the exterior of the building, showing the general design of the structure, and the barometric condenser at the rear.

The interior of the building is divided into two general divisions by a fire wall, one of these divisions is occupied by the present equipment of engines, generators and auxiliary apparatus, the other by the boilers, their auxiliary apparatus and the coal handling system.

The coal is brought to the building on a steam railroad track at the side nearest the boilers. It is unloaded into a hopper under the cars, then carried by means of an elevator, driven by a [illegible] engine, to an overhead bunker. This elevator has capacity of 30 tons per hour, and is also arranged to convey the ashes from the fire room to an overhead hopper from which they may be dropped through a chute into a car on the coal siding and thus carried away to be used for grading and other purposes.

From the four steel coal bunkers, each having a capacity of $37\frac{1}{2}$ tons, the coal is led through chutes controlled by levers to the chain-grate stokers of the four 400-h. p. horizontal, water-tube boilers comprising the boiler equipment.

An accompanying view of the boiler room shows the relative positions of the coal hoppers, boilers, feed water heater and connecting piping.

The chimney for the station is [illegible]

150 ft. high with an external diameter of 18 ft. at the base and a clear flue diameter of 8 ft. at the top. From the ground up for a distance of 30 ft. the shape is octagonal, above this point the section is circular. The boiler feed is taken through a feed-water heater and purifier.

At the rear of the building are two 8-in. air lift wells 180 ft. deep which supply a storage pond 200 x 100 ft. in size with an average depth of 4 ft. The compressed air for lifting the water from these wells is supplied by a 45-h. p. air compressor. This storage pond supplies all the condensing and boiler feed-water used in

BAGGAGE AND EXPRESS CAR

the station. The condenser equipment consists of a Worthington central condenser and two circulating pumps 12 x 18 x 18 in.

The accompanying illustration of the engine room shows the arrangement of the generator units and one exciter unit. There are three 4-valve horizontal cross-compound condensing engines, direct connected to three 600-kw. fly wheel type, General Electric, alternating current generators. The engines are rated at 900 h. p. each and have a speed of 120 r. p. m., with 140 lb. of steam. They are built with corliss valve gear controlled by an automatic shaft governor, and have their main journal crank-pin and cross-head bearing surfaces automatically oiled. A traveling crane of 25 tons capacity operates over the entire length of the engine room.

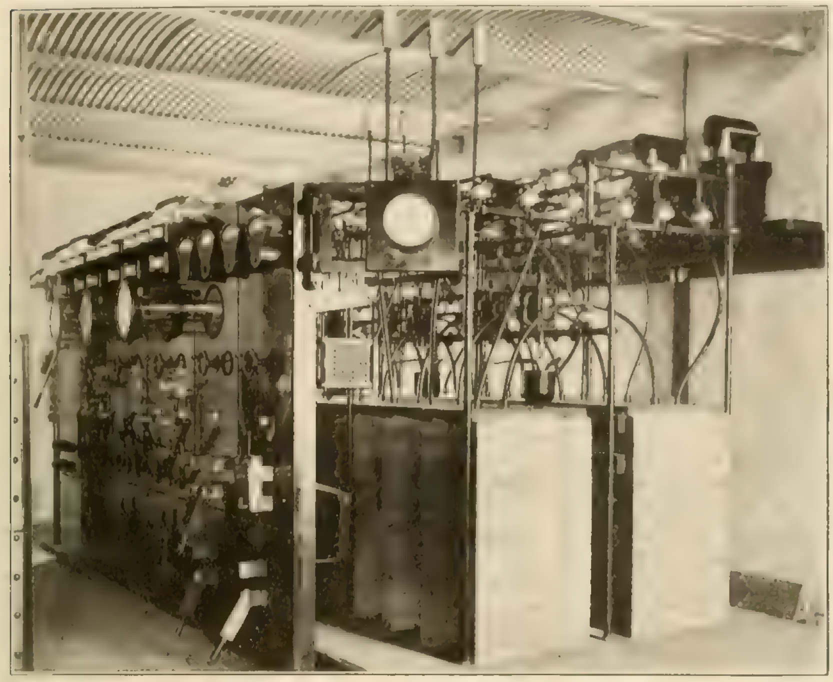
The three 3-phase alternating current machines generate cur-

POWER HOUSE, STORAGE POND IN FOREGROUND.

rent at 11,000 volts. Two of these machines have capacity for the entire load on the station, thus leaving the third unit for use in time of emergency. Exciting current for the fields of the generating units is furnished by two exciter units, each consisting of a 75-kw., 125-volt, G. E. direct current generator, direct connected to a 120-h. p. single-valve condensing engine running at 225 r. p. m. One of these exciter units has sufficient capacity to furnish exciting current for all three of the main units.

BIG SANDY BRIDGE, CAMDEN INTERSTATE RAILWAY CO.

The switchboard for handling the output of the main units and the auxiliary current is shown, together with part of its wiring, in one of the illustrations. This switchboard is made of black enameled slate, 2[illegible] in. in thickness, and has three generator and two exciter



GENERATOR AND EXCITER BOARD AND OIL SWITCHES WITH WIRING.

panels. Each generator panel is equipped with the necessary ammeter, voltmeter and a recording polyphase wattmeter, all of the Thompson type. The 11,000-volt oil switches are placed at the rear of the board in fireproof brick cells, and are operated by levers connected with the usual handles on the front of the board. The switchboard wiring is so arranged that the generators may be operated together or separately on either railway or lighting circuits. This switchboard and its auxiliary apparatus are of the General Electric Co's. make.

The feed wires for distributing the 11,000-volt current are led out of the power station through terra-cotta tubes. The outgoing wires are protected by fuse-breaks and Westinghouse lightning arresters.

This power station and its three dependent sub-stations with their storage batteries furnish current for the running of the interurban cars between Guyandotte, W. Va., and Hanging Rock, O., a distance of 30 miles, and also local cars in Huntington, W. Va., Ashland, Ky., and Ironton, O. The same station also generates arc and commercial lighting current for the following towns and cities along its line: Guyandotte, Huntington, Kenova and Ceredo, W. Va.; Ashland, Ky., and Ironton, O.

The rolling stock operated by the Camden Interstate Railway Co. consists of 43 motor cars operating over 30 miles of single track, standard gage road located along the south side of the Ohio River for the greater part of this distance. At Ashland, Ky., the line crosses the Ohio River and extends on to Hanging Rock, O. An accompanying illustration shows the company's bridge across the Big Sandy River, and also illustrates the standard type of trolley, high tension and direct current feeder construction.

The cars operated on the Ironton Division are of the semi-convertible type, built by the J. G. Brill Co. They have a seating capacity for 40 persons and are equipped with two Westinghouse No. 56, 50-h. p. motors, K-10 controllers and Westinghouse electro-magnetic brakes. The interurban cars used were built by the Brill company and are 47 ft. 6 in. long with a seating capacity [illegible] four Westinghouse [illegible] and the National Electric Co's. air [illegible] [illegible] American Car & Foundry Co., Huntington, W. Va., and is equipped with [illegible] Westinghouse motors, K-[illegible] controllers and the [illegible] Co's. air brakes.

There are three [illegible] owned by the [illegible] Beechwood Park, Ironton, O.; Clyffeside Park, Ky.; Camden Park, W. Va. A Chautauqua assembly is held at Clyffeside Park [illegible] miles east of Ashland, Ky., on the south side of the Ohio River. To the natural features of this park, the railway company has added many buildings and improvements such as pavilions, band stands, walks, drives and a great casino, which all add to its attractiveness.

At the completion of the power station which has been described, the employes of the Camden Interstate Railway Co., as a token of regard, presented to the company a 21 x 10-in. three-chime whistle to be used on the new station.

The erection of the generators and the wiring of the entire plant were done by the company's employes under the direction of Mr. James Fagan, the electrical and mechanical engineer of the company. The architectural plans of the power house were drawn by Mr. Fagan and all the construction work on the building was carried on under his personal direction. Great credit is due Mr. Fagan for his careful study of the needs of the company and the successful way in which the new plant has fulfilled the requirements.

The street railway companies of Tennessee are making preparations to observe the "Jim Crow" law passed at the recent session of the Legislature, effective July 3rd, and do not anticipate a great amount of trouble in complying with its provisions.

BOILERS AND AUXILIARY APPARA[illegible]

The contract for the power plant of the Toledo, Port Clinton & Lakeside Electric Railway Co., which will be erected at Port Clinton, O., has been awarded to local parties, and it is expected that the contractors will make rapid progress.

The Personal Element in the Adjustment of Damage Claims.

By Dr. H. B. Rockwell, Manager Railway Adjusting Bureau, Cleveland, O.

The vagaries of human nature assert themselves with more persistence and become more strongly conspicuous, when observed from the viewpoint of the claim adjuster than in almost any other relation of life, in which people come into close and intimate contact with each other upon matters of business or policy; and of all the idiosyncracies of the mind none is more common or difficult of explanation than the readiness and ease with which people lapse into lying when they have been injured through the instrumentality of a corporation or its servants, one is almost prone to believe that the accident itself results in a psychological condition wherein the moral sense becomes so warped and distorted that it seems almost impossible for the party so injured to be absolutely truthful regarding either the cause of the accident or the extent of the injuries.

While they may not in all instances be guilty of direct falsehood there is a tendency to juggle with the truth to such an extent that whether viewed as an ethical question or by practical results the consequences are the same. I have in mind a clergyman whom I knew personally for years, and in whom I had learned to have the greatest confidence; who bore a most excellent name in the community, not only for piety but for honesty; whose name was a synonym for probity and uprightness, and yet when this man was injured in an accident on the Pennsylvania railroad, he feigned a serious injury to the hip, purchased a cane, and affected an exaggerated limp for nearly a year. He succeeded in extorting $2,000 from the company, and having received the money, he immediately discarded the cane and walked as straight as any man. In talking of the matter afterwards he said in a somewhat apologetic manner that he was not hurt much but that the Pennsylvania railroad was rich and would not miss a little thing like $2,000. And this man is still preaching the gospel and apparently to the satisfaction of his hearers.

Another condition of the mind that is almost invariably present in cases such as we are describing, is an unwarranted and unreasonable prejudice against the corporation that has caused the injury, amounting in some cases to a violent antipathy that obtrudes itself to the great disadvantage and embarrassment of the adjuster. The injured party is unwilling or unable to view his injury in the light of an accident, which the company was even more anxious to avoid than himself. He loses sight of the fact, or else is ignorant of it, that the company employs every known method and device to avoid accident; that it expends large sums of money to that end, and that it employs the most efficient and careful men obtainable. The applicant for damages ignores all these facts, and assumes the attitude, that the company is his enemy, seeking to do him harm, and that the employes are a lot of fiends bent on his destruction. Of course this feeling if often feigned, perhaps always, and is assumed for ulterior purposes, but nevertheless it constitutes one of the potent factors that contributes to the adjuster's discomfort and embarrassment.

There is one other property of the mind toward which the attention of the adjuster is frequently called, the innate desire to obtain something for nothing. This comprises that large and growing class known as "fakes." If they could be brought into court as defendants instead of plaintiffs, they would figure as "crooks" and criminals and would receive the punishment usually meted out to such people. There is many a man languishing in jail today who is no more guilty than most of these schemers. Their immunity from arrest and imprisonment arises from the iniquitous application of the doctrine of master and servant applied with unsparing relentlessness by the judiciary. These laws, since their inception, have been tardily amended, but are still altogether inadequate to the demands of justice, and will remain so until questions of fact are not left wholly to a jury biased in the plaintiff's favor. Hundreds of cases illustrative of this phase of human nature will at once suggest themselves to the readers of this article, but one case comes to my mind that is such a glaring example of audacity that I cannot refrain from describing it. A man living in one of the most fashionable suburbs of Philadelphia was in a wreck caused by the collision of two cars, in which many were severely injured and several killed. He was taken to a hospital, with others, complaining of a pain in his eyes. The oculist examined the man but could discover nothing abnormal about his condition. The trouble with the eyes continued and increased until at the expiration of three weeks the man became totally blind. He was dismissed from the hospital, led to a carriage and taken to his home. For two years he was under the care of physicians, one of whom was an eye specialist of eminence, and at the same time he was kept under close surveilliance of the company's detective, but he played his part well; he walked about the streets feeling his way, running into people, and exciting the commiseration of his fellow townsmen. He brought a suit for $50,000 and actually succeeded in obtaining as a compromise settlement $10,000 from the company. To my personal knowledge the man was able to count the money and is today in perfect health and conducting a notorious gambling resort in Atlantic City; and the company has no redress, because the wonderful achievements of science were credited with a marvelous cure.

In marked contrast with this iniquitous swindle it is refreshing in this connection to recall the case of a man and his wife, who were injured in a head-on collision, which occurred about two years ago; and a recital of which may help to dispel the pessimism, that the last case may have engendered. The injuries sustained were of the most serious character; the man had a fracture at the anatomical neck of the humerus, and the woman a compound fracture of both legs above the knee. They were seen at the hospital the second day after the accident and the man offered, voluntarily, to settle his claim for $100 and the hospital expenses, and the woman accepted, with a little urging, $1,200 and expenses and these people were not hypnotized either. They were refined and intelligent; the man was in the auditing department of a large transportation company. They simply accepted what they considered to be compensatory damages, and were, and are today satisfied with the settlement.

To meet all these varying conditions and the demands that arise in consequence, it is necessary for the adjuster to employ the highest degree of skill. He should, moreover, be a man fitted for the work. He should have natural qualifications, chief of which is tact, and in addition, he should be trained and educated in this particular and peculiar line of business. The old adage "Poeta nascetur non fit" is particularly applicable to the adjuster of damage claims. His is a difficult role to play and few men attain eminence in it. The art of adjusting claims is fast becoming a profession and deservedly so, and requires a knowledge of law, of medicine and most valuable of all that learning which is acquired only in the school of human nature.

In order to successfully cope with the first difficulty mentioned in this article, the proneness to mendacity, the adjuster must exercise the highest degree of diplomacy. It will not do to call a man a liar unless the fact can be proved absolutely, a difficult thing to do under all circumstances, and even if it can be proved, it would be an impolitic statement to make. And yet it is absolutely necessary to convince the party that he is wrong in his premises. It is wiser and safer to create the impression that you believe his statements, and then present some hypothetical case that is similar to his own and by thus making the matter altogether an impersonal one, you can abuse this fictitious creature with propriety and impunity and the party will soon recognize that you are aiming at him, and yet he will hardly become offended, for his mind will be occupied and his admiration excited by the adroitness with which you have handled a delicate subject.

I am much impressed by the indirect method of dealing with

the case, and I find that flattery ... [illegible] Nearly everyone is susceptible to it ... [illegible] ... ously applied it is possible to divert the attention of the claimant from his or her real or fancied grievance ... [illegible] ... the attention upon some point not germane to the subject ... claim is settled as an incident and not as the principal subject of discussion.

In order to controvert the prejudice that exists in the minds of applicants for damages, and thus pave the way to an equitable adjustment of their claims, the adjuster should endeavor to ... [illegible] of the benefits street railways contribute to the common good, and allow them to weigh in the balance against the alleged evils and cruelties complained of.

If the injured party happens to be a farmer living along the route of the railway, contrast his former condition, when through mud and snow he hauled his goods to market, with the sure and comportable means of transit now at his disposal. Remind him that the value of his property has been materially enhanced by reason of the railroad bisecting his farm. It may be just as well to remain reticent regarding the price the company paid him for that privilege, for whether it was much or little, it is likely to prove a stumbling block; if much, he will naturally infer that this ratio is the basis upon which the company transacts all its business, and if little, he feels that he has been swindled and will improve this opportunity to get even.

Or if the damage hunter happens to be a traveling salesman, the excellent service that the traction company affords should forcibly appeal to him and counteract any prejudice he may harbor against it. Speaking of traveling men, I have usually found that they are a most reasonable body of men. In the first place, they are a happy-go-lucky lot of fellows; their nomadic existence makes them philosophers; they are used to taking the bitter with the sweet, and it is of no great importance to them which commodity predominates, provided there is a surfeit of neither. Moreover, their time is their most valuable asset, and rather than waste it in prolonged litigation or argument, they will usually accept a settlement which, as business men, they know is disproportionate, in order to save time.

By far the largest class in which this feeling of prejudice predominates is made up of women; and in speaking of women in general, I would like to utter a note of warning to the man who proposes to enter the business of adjusting claims, to hesitate before engaging in that sort of work unless he has acquired an intimate knowledge of woman's frailties and virtues, for he must take advantage of the one and cultivate the other. It would almost seem as though the faculty of reasoning had been omitted in the make-up of woman. It certainly is the height of folly to undertake to reason with a woman who has been injured in an accident, and try to convince her that the company is not at fault, or that she has been guilty of contributory negligence. If she says she knows that the company deliberately misplaced a switch for the express purpose of injuring her, do not contest the point, but agree with her contentions, and avoid in every possible way, any controversy or any allusion or suggestion that appeals to her combative nature, with which undesirable attribute she is most liberally endowed.

There is one inherent trait in woman (and it is what makes her a woman), to which a man, if he be a decent man, can always appeal with success, her affections. I do not mean that in order to settle a woman's claims, an adjuster should make love to her, for this is likely to be a dangerous procedure and is apt to involve him in no end of difficulties, especially if for any reason the release should be contested, for he runs the chance of being confronted on the witness stand with an apparition compared with which Banquo's ghost was a pleasing vision. Moreover, she is an expert in the art of love-making and poor, weak man would find himself outplayed in that game and would be checkmated in less than half a dozen moves. But there is nothing a womanly woman so highly appreciates or so eagerly seeks and demands, as sympathy, and if she is approached in a gentle, tender, sympathetic manner, and if an appeal is made to the true, the beautiful and the good, she becomes amenable to almost any influence that is brought to bear. There is no point in an adjuster's career at which he is apt to make more costly mistakes or, on the contrary, obtain more brilliant victories, than in dealing with women injured in accidents.

But what are we to do with that despicable class of vultures that is lying in wait to prey upon a corporation's misfortunes and [illegible] sum in settlement.

[illegible] usually prompts this interference is the desire to curry favor with the injured party. The intruder is usually a woman and is always exactly informed as to just how much Mrs. So-and-so received in payment for her injuries, which, of course, were slight as compared with the injuries in the case you are trying to settle. It is hard to advise just what course of action it is best to pursue under such circumstances. If one followed the bent of his inclinations he would advise the intruder that this matter was none of her affairs; but that would be both unwise and impolitic. There are just two lines of action open to him, either to conciliate the unwelcome intruder by reciting again the argument originally employed, or else to gracefully withdraw from the contest, returning at a more auspicious season. I have in mind a frail little woman with whom I had been laboring several hours to persuade her to accept an amount in settlement of her claim, that seemed to me proper and adequate, and I had just reached that most interesting climax, where she took her pen in hand to sign the release, when in walked one of those prim, precise, but thoroughly respectable females, with lips drawn tightly over a firmly closed mouth (if she had only kept it closed!) I shall never forget the feeling of desolation that came over me as I gazed into her hard, unsympathetic, belligerent countenance. Aggressiveness was written all over her, even in the swish of her well starched skirts, and her very first words proved a bombshell in my camp. "Sarah, are you going to settle with this man? You better not be in a hurry; you may never get better, and you may die from these injuries; and then what will your poor children do?" Well, what was I to do? What could any man do under the circumstances? I immediately changed the subject of conversation and gradually diverted it into the channel of woman's dress, a subject on which I was fairly well conversant, and the result was that I succeeded in transforming the woman from an enemy into an ally, and left with the release signed and the signature of the intruder as a witness to it.

The dominant and all-powerful weapons that the adjuster of damage claims should make a part of his panoply of warfare, if he would win in his fight against the vagaries of human nature, are patience, perseverance and tact.

By the exercise of patience he can always accomplish his purpose. If he is denied an interview, let him wait. If the party is not ready to settle, let him wait. The favorable opportunity is sure to come, sooner or later. It may not be for a day, or a month, or a year; but it will surely come if he will but patiently wait. When the opportunity does arrive, let him bring into action the other weapon, perseverance. Having once started to adjust a claim, he should never give up. I know of no calling, in which such brilliant results are achieved by persistence, as in the settlement of claims.

But tact is the weapon to be relied upon. It is the magazine gun, the repeating rifle with an endless number of charges. It will bring down the most wily foe and subjugate the most stubborn enemy.

A school of instruction for motormen has been opened in the Forty-eighth St. car barn of the Broklyn Rapid Transit Co., the Sylvester method of instruction being used.

A sink hole on the line of the Urbana, Bellefontaine & Northern electric railway, south of Bellefontaine, O., in which the company has placed hundreds of carloads of earth, threatens to again become [illegible] feet, and it has been found very difficult to find a firm foundation for the roadbed.

Wheel Grinding on The Boston Elevated Railway.

On June 10, 1905, the Elevated Division of the Boston Elevated Railway Co. will have been in operation four years, and it is probably safe to say that upon no other rapid transit line thus far placed in service have the physical conditions of operation been as severe or the problems of maintenance as full of interest. The principal physical features of the Elevated Division are familiar to every engineer who has kept in touch with the technical press during the past four years, and of late the company has permitted to be made public much interesting data upon maintenance, in addition to the exhaustive descriptions of its rapid transit system published during the early months of operation. Conspicuous among these later publications was the New England Street Railway Club paper of H. M. Steward, roadmaster, upon Track Maintenance, printed in the "Street Railway Review" Nov. 20, 1904.

Closely allied with the problems of track mantenance stands the question of wheel wear. As might be expected, the excessive burdens imposed by the traffic upon the rails react upon the car wheels also. The tortuous alignment and grade of the Subway are likewise effective in promoting wheel wear. In a round trip from Sullivan Sq. to Dudley St. via the Subway, slightly over 10 miles, a train describes 9.43 complete circles, or an average of one complete circumference every 5,600 ft. There are 18 curves of less than 100 ft. radius and 34 curves less than 150 ft. The shortest radius is 82 ft. Over this curve passes a daily traffic of 44,000 tons. The running rails and the third rail are each 85-lb. A. S. C. E. standard T sections. The steepest grade is 8 per cent, over which trains are run downward only, and there are two up and two down grades of 5 per cent at the entrances to the Subway.

The rolling stock at present in use upon the division covers 174 passenger cars, weighing about 29.5 tons each, light, and 36 tons loaded, 3 flat cars, 1 wrecking car, 1 wrecking tool car and 1 road department construction car, making a total of 1,440 wheels.

The passenger cars are mounted upon two trucks each, one truck carrying the motors and weighing about 5 tons, the other being a trailer truck, weighing about 3.5 tons. The essential measurements of the cars are as follows:

Length over drawbars	46 ft. 10¾ in.
Width over drip boards	8 " 9½ "
Width across platforms	8 " 7¾ "
Running rail to top of platform	3 " 8 "
Between truck centers	32 " 3½ "
Length inside car	37 " 6 "
Height of car above rail	12 " 5 "
Wheel base of trailer trucks	5 " and 6 ft.
Wheel base of motor trucks	6 ft.
Distance between platforms at center	3½ in.
Percentage of weight on drivers	63.45
Seating capacity	48
Motor truck axle	6½ in., 7½ in. wheel and gear fit.
Motor truck journal	4¼ in. by 8 in.
Trailer truck axle	5 in. M. C. B.
Trailer truck journal	3¾ in. by 7 in.
Wheel diameter when new	Motor 34 in., trailer 31 in.

One hundred and fifty cars are equipped with the Sprague multiple-unit automatic control, and 24 cars with the Sprague-General Electric multiple-unit automatic relay control. The approximate maximum speed is 40 m. p. h., the schedule speed being about 14 m. p. h. The average consumption of the cars is 4 kw. h. per car-mile, the current input per car averaging 160 amperes at 550 volts while in motion. The annual car-mileage is approximately 7,000,000. Fig. 1 shows the standard wheel section on the division.

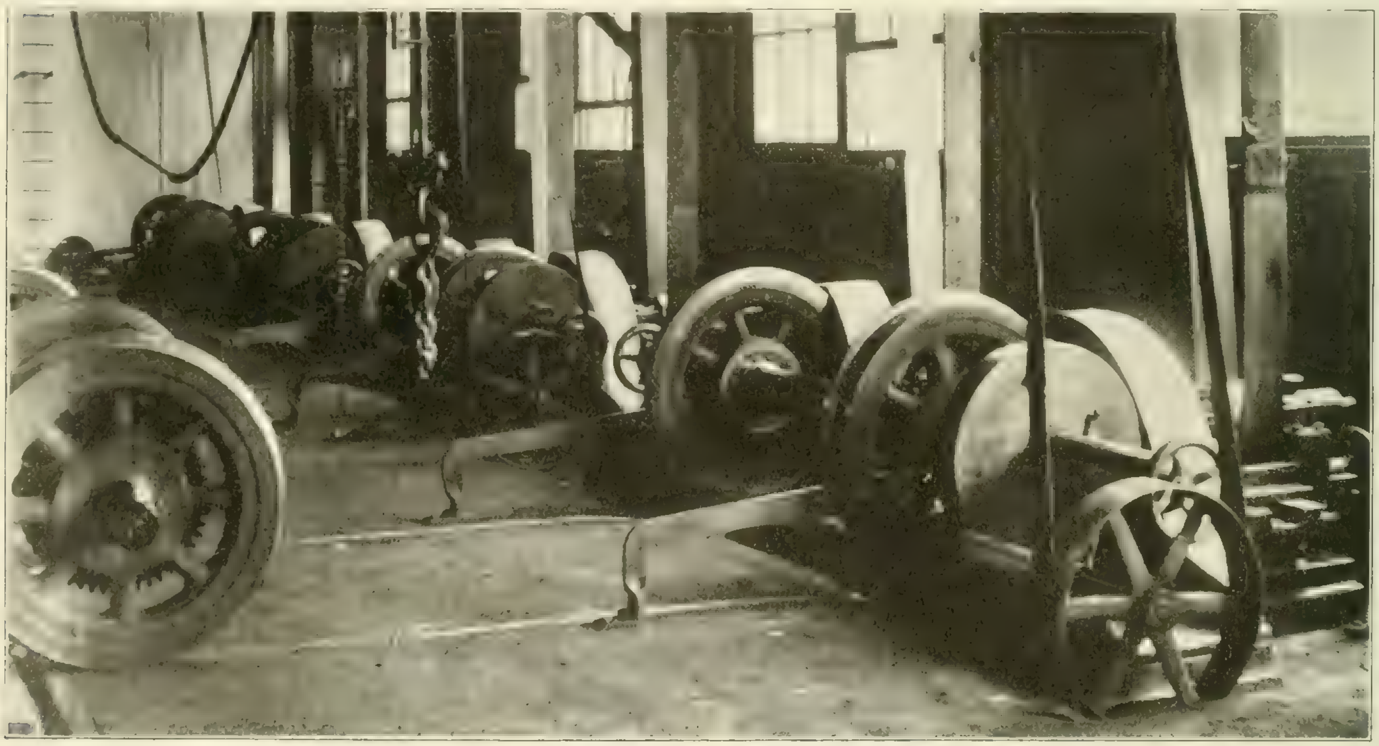


FIG. 3.—SPRINGFIELD WHEEL GRINDING MACHINES, BOSTON ELEVATED RY.

The principal repair shops of the Elevated Division are located at Sullivan Sq., Charlestown. The shops are divided into an upper and a lower floor. On the upper floor are storage and repair tracks on a level with the elevated structure, the lower floor being devoted to the repair shop proper. The shops are equipped with the best

modern tool and labor saving appliances for the maintenance of the rolling stock.

So great is the wheel wear upon the passenger cars that each tire has to be ground about every two weeks, the daily average number of tires ground being 48 pairs in 10 hours. In addition to this work it is occasionally necessary to turn down wheels to maintain the circularity and bring the wheels to an equal length of circumference. It is also necessary to reduce the flange to the proper section by turning once in two months. The wheels are all built up with cast steel, cast iron or wrought iron centers, the tires being of Midvale, Standard, Krupp, Latrobe and Cammell steel. An early analysis of a tire is:

Tensile strength	147,040 lb	
Elongation	9.0	per cent
Reduction of area	15.0	"
Carbon	.805	"
Phosphorus	.040	"
Manganese	.723	"
Silica	.270	"
Sulphur	.040	"

Both motor and trailer tires are 3 in. thick when new, the life averaging from 2½ to 3 years. The circumference of a new motor tire is 106.814 in., and it is permitted to wear down, be ground or turned, to 95.814 in. The new trailer tire is 97.389 in. in the circumference of its tread, and it may be worn down to 84.823 in. The wear is measured by a steel tape when the wheel is removed

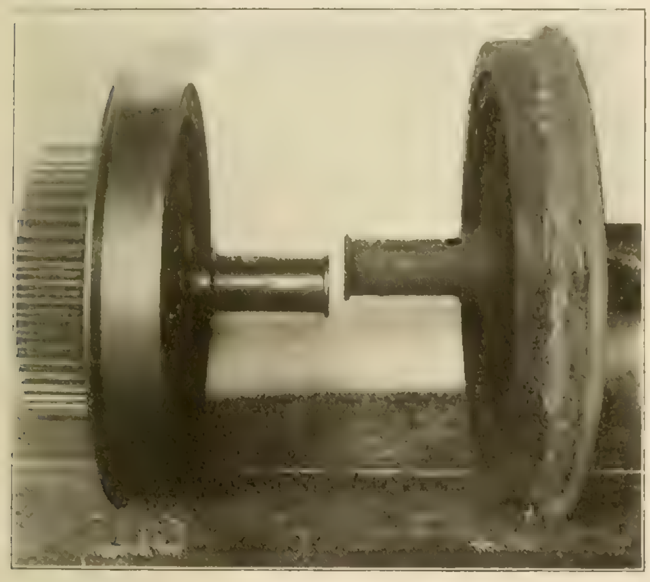


FIG. 6. OLD AND NEW TIRES.

from service and again when it is ready to be put in service. Fig. 2 shows the limit of wear on the tires first in service and the limit permitted with the thicker tires adopted in 1903. The present allowable wear is therefore 2 in. in the case of trailer tire thickness and 1¾ in. with motor tires, which means a reduction in diameter of 4 and 3½ in. respectively. The wheels are sent to the shops to be ground in routine order unless flat spots are reported from the operating department. The life of tires in miles varies from 106,-000 to 198,000. For the convenience of the mechanical department tires are numbered on the flange side, motor tires being given even numbers and trailer tires odd numbers. Axles are numbered on the end, even or odd according to the trucks.

The removal of trucks and wheels from the car body in the shops is effected with great promptness. The car is run upon an elevator in the upper floor of the repair shop, the elevator being provided with a track. As soon as the truck is in place the elevator is raised a little, which lifts the car sufficiently to enable posts to be slipped under the truss plates at the sides of the car to support it. The truck is then lowered to the floor below, a distance of about 19 ft. The elevator is operated by hydraulic power and has a capacity of about 25 tons. A dummy truck is run upon the elevator as soon as it is freed from the old one; the elevator is raised, and in less than five minutes the car is out of the way. When the elevator reaches the [illegible] a motor truck, [illegible] in the floor for [illegible] trucks are moved along the shop tracks by their own power, connection being made to [illegible] attached to the No. [illegible] time and great [illegible]

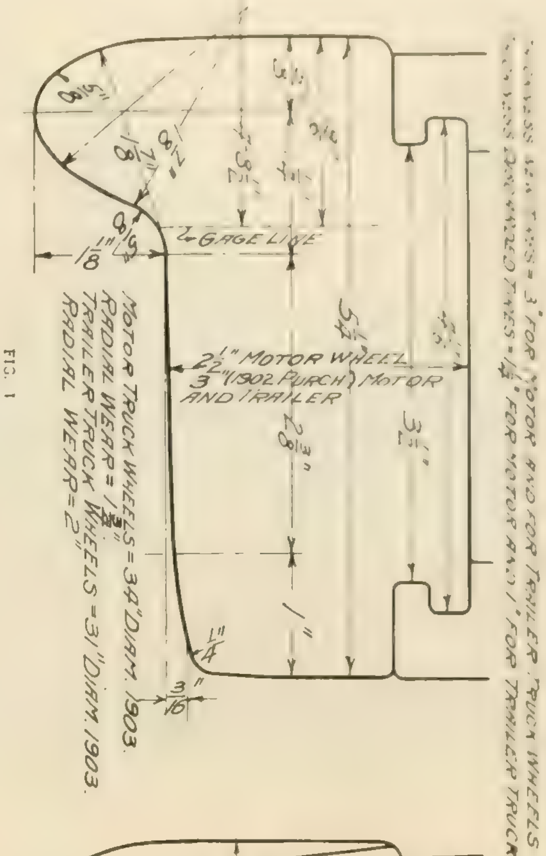


FIG. 1

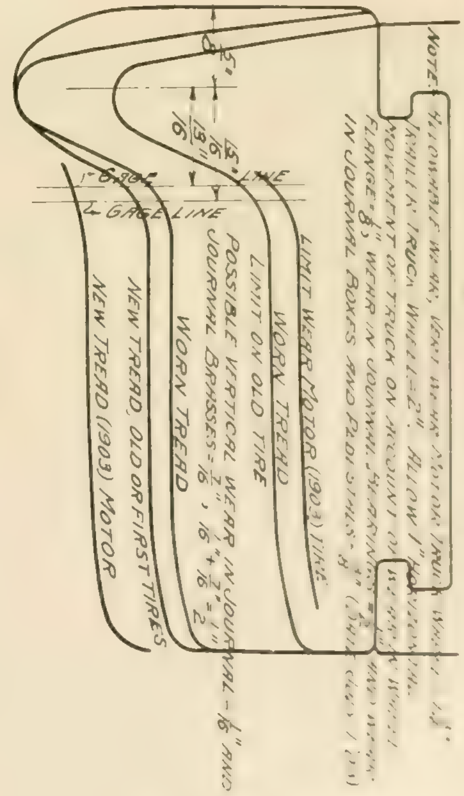


FIG. 2.

the occasion. An electric crane of 15 tons capacity is in use near the elevator, to transfer motor trucks or parts at pleasure.

After the wheels are dismounted from the trucks they are raised from the floor by a [illegible] to the

grinders, Figs. 3 and 4. A pair of motor wheels, axle and gear weigh 4,808 lb., the trailer axle and pair of wheels weighing 3,010 lb.

There are four grinding machines which occupy a floor space 60 ft. long and 15 ft. wide. These machines were manufactured and furnished by the Springfield Manufacturing Co., Bridgeport, Conn. The grinders are each provided with a set of inclined guides up which the axle and its pair of wheels are run to be placed between the centers. The grinder wheels are of corundum, outside diameter 16⅞ in.; face, 6 in.; thickness, 2 in. The corundum wheels last from two to three months. The grinders are driven by belting from a countershaft run by a 40-h. p. motor. About 1-16 in. of circumference is taken off in each grinding, the operation taking from 15 minutes to half an hour. The flat spots are first taken out, and when these are removed—determined by the appearance of the tire—a finishing touch is put on by running the grinder along the tread of each side. About 1½ hours are required for turning unless the wheels have already been ground, when the flanges are turned in about 45 minutes. If the wheel circumferences differ by ¼ in. when measured upon being taken from a car, they are turned in this lathe to the same size. The maximum difference in circumference permitted for wheels on the same axle is ⅛ in., but wheels on two different axles may be ½ in. difference in circumference. The Pond lathe is driven by a 15-h. p. Westinghouse motor at 550 volts direct current, and the speed range is from 675 to 925 r. p. m. The power consumption of the lathe is 3.9 kw. h. per pair of wheels.

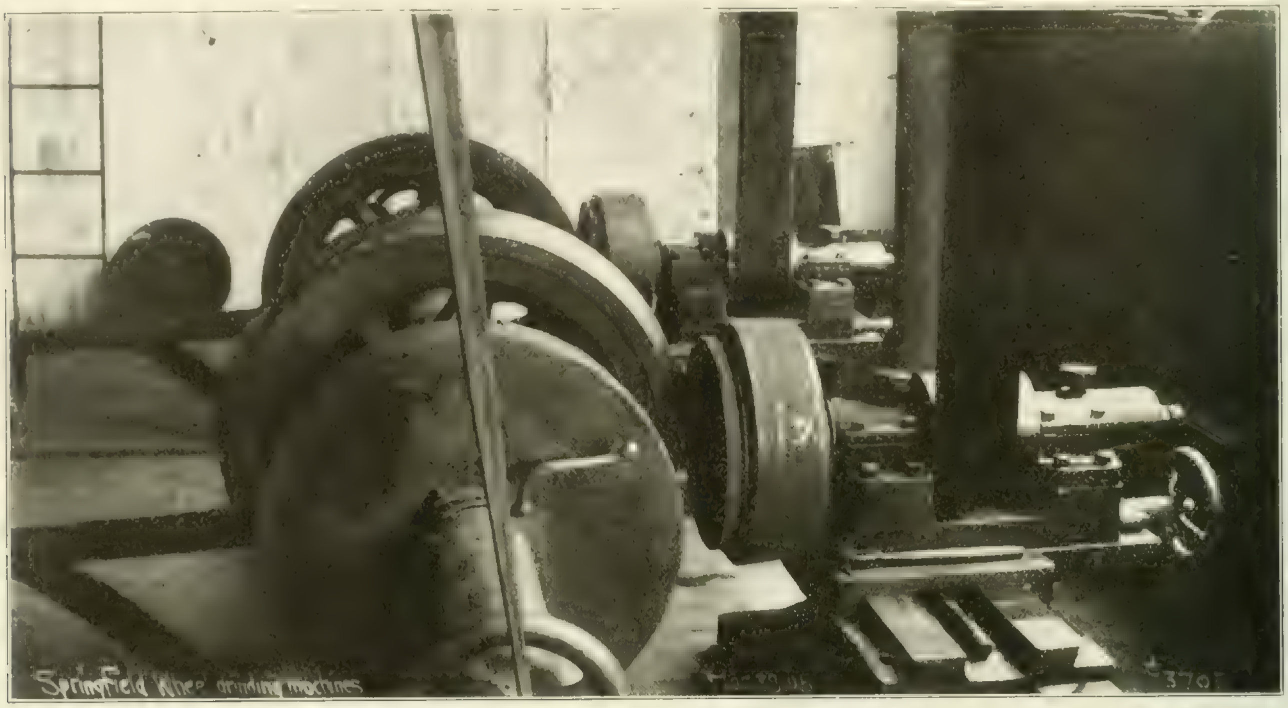


FIG. 4. SPRINGFIELD WHEEL GRINDING MACHINE

The dust ground from the wheels in the tire grinding process is drawn into a 12-in. by 8-in. duct set in the floor at the bottom of the grinders. Thence it is drawn out of the building by a 36-in fan driven by a 3-h. p. motor. Two men are required to oversee the grinding, look after the belts, etc.

Form 934 1000-12-04	Diameter of Centre	Material Cast Iron	Wheel Fitted by	Pressed on by
Wheel No. 479	Made by A B C	Purchased	Put in Service	Tons Pressure
	Diam. / Material	Made by	Purchased / Put in Service	Fitted by
Axle No. 237				
Tire No.	30"			

Put In			Removed			No. Days	Tire			
Car No.	Date	Measurement	Date	Cause	Measurements	in Service	Loss	Turned	Ground	Work Done by
41	7-20-04	7 ft. 3½ in.	8-3-04	Track Wear	7 ft. 3$\frac{7}{16}$ in.	13	$\frac{1}{16}$ in.		8-3-04	X and Y
45	8-3-04	7 ft. 3[illegible] in.	8-24-04	" "	7 ft. 3[illegible] in.	21	$\frac{3}{16}$ in.		8-24-04	" "

FIG. 5. SHOP RECORD OF WHEELS GROUND.

the tire to give the proper slope. The amount of metal taken off is thus very small for each grinding, and it has been found that by grinding the tires as often as once in two weeks a considerable increase in their life is obtained, as the amount of metal necessarily taken off in removing "flats" is less. Further, the noise of the trains is diminished through this earlier attention to flat spots. The power consumption of the grinders averages 14.75 kw. h. per pair of wheels by wattmeter test.

When tires are to be turned the work is done in a 42-in. Pond lathe. The wheels are brought to this lathe on a special truck, and the lathe is designed to turn two tires at once, with one tool on

Records of each wheel are kept in the shops on cards about 5 in. by 8 in., of which a sample is shown in Fig. 5. The columns headed "Measurements" refer to the wheel tread, circumference as taken just before being put into service after grinding, and to the circumference as measured upon removal from service prior to grinding or turning. Fig. 6 shows an old and a new tire side by side for purposes of comparison.

When a tire is worn out it is sold as scrap, a motor tire being worth about $1.78. To remove the tire from its wheel, the rivets are knocked out by a pneumatic hammer, loosening up the retaining rings; the tire is then heated by a gas burner, and knocked off. A

new tire is then heated and slipped upon the old center, the new tire having been bored to within one one-thousandth of an inch, and being before heating .031 in. smaller in diameter than the center.

The axles are of open hearth steel with solid gear pressed on and keyed to the shaft. All axles are tested before being used and once every two months in the following manner: A pneumatic pressure of 25 tons is applied at the center of each motor axle and the deflection recorded on a gage. The spring should be about ¼ in. If there is a permanent deflection, shown by the pointer's not coming back to zero, the axle is rejected.

Recent records show that the average circumferential wear of a tire per 1,000 miles on the road is .0781 in., the maximum wear for 1,000 miles being .1033 in., and the minimum, .0554 in. The average life on this basis figures 147,762 miles. The average total first cost per tire put on comes to $30.94, the scrap value having been deducted, makes a cost of 22 cents per 1,000 miles. The average cost of changing, grinding and turning a tire per 1,000 miles of service is 27 cents. Hence, 49 cents represents the total average first and operating cost of a tire per 1,000 miles of service. The car mileage per car per day is 130, and the cost of changing, grinding and turning per tire per change is 56 cents. Tires are renewed at a labor cost of from $2.25 to $2.75 each. Earlier tests on motor tires showed a daily circumferential wear of from .014 in. to .019 in., while trailer tires were worn in the same period about 98 per cent as much.

In connection with the wheel wear a few figures on brake shoes are of interest. Of 24 motor shoes, the average weight when new was 66 lb. and the scrap weight 27.2 lb. The cost when new was 1.75 cents per lb. and the scrap value .53 cent per lb. The loss in weight per 1,000 miles was 5.34 lb., and the net cost per 1,000 miles 13.56 cents. Trailer shoes lost from .81 lb. to 2.7 lb. per 1,000 miles, with a net cost for this service of from 2.55 cents to 6.8 cents. In a test lasting over a period of 92 days of motor and trailer shoes the average cost per shoe was $1.76, the cost per car per day being 11.8 cents.

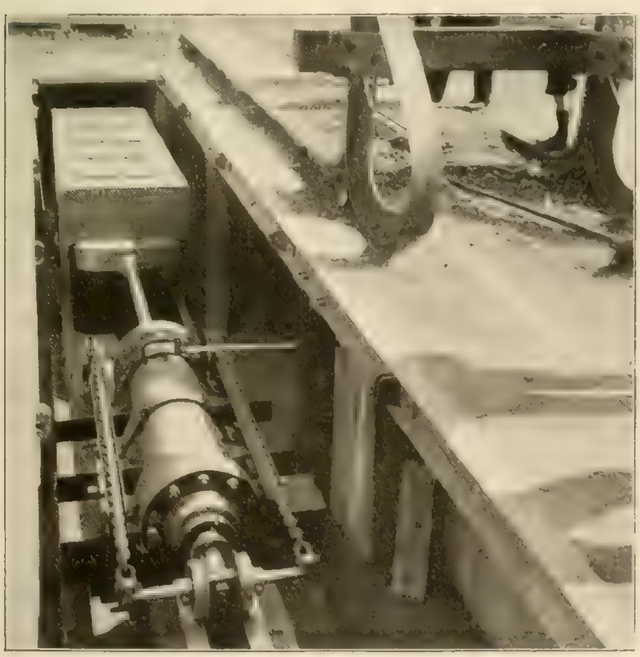
Acknowledgments are due to Mr. C. S. Sergeant, vice-president of the Boston Elevated Railway Co., for the courtesy of supplying the foregoing data.

Counter-Weight Tramway at Sydney.

BY E. GUARINI.

The extension of one of the Sydney, New South Wales, suburban lines to the shore of the harbor presented some difficulty because of a very steep grade near the terminal point. To meet these conditions a car with an underground counter-weight was proposed and eventually put into successful operation.

The track on this extension is built on one side of the road and



COUNTER-WEIGHT CAR APPROACHING THE HYDRAULIC BUFFER.

has [illegible] center [illegible] of the roadway [illegible] circular trolley [illegible] tributing the current. On [illegible] buffer trolley, provided with a grip which travels in a conduit below the surface of a roadway as in ordinary cable practice. At the upper end of this conduit is a 6-ft. horizontal sheave with 15-in. trailing sheaves. Carrier sheaves 12 in. in diameter are placed 30 in. apart in the grip conduit and the subway. Over these sheaves is led a steel wire cable, one end of which is attached to a counter-weight trolley loaded to about 10 tons and traveling in a subway on a track with a gage of [illegible] in 8.48 throughout. The other end of the cable after being led around the sheave is fastened to the grip of the buffer [illegible] the lower end of the subway a hydraulic buffer with a 10-in. cylinder and a stroke of 3 ft. 6 in. is placed in line with the buffer beam on the counter-weight trolley. This buffer cylinder is provided with suitable traveling weights to assist in drawing out the buffer rod after impact from the weighted trolley.

The system works as follows: When a tram car is about to descend the grade the buffer trolley is placed immediately in front of it, and as the two descend together the counter-weight trolley attached to the other end of the wire rope must travel in the subway up the grade of its track and therefore acts as a brake for the descending tram car. A suitable buffer [illegible] rails is placed at the foot of the tram car grade to limit the permissible travel of the tram car and thus prevent pulling the counter-weight trolley too far up its track.

When the tram car is to ascend the grade, the electric motors are started in the ordinary way and the tram car moves towards the top of the hill propelled by its motors and the buffer car which is now behind the tram car. This buffer car pushes against the rear of the tram car with a force equal to the pull of the counter-weight trolley which is descending the 1 in 8.48 grade of its subway track. The length of the wire cable is such that when the tram car pushed by the buffer car reaches the top of the grade the counter-weight trolley is just coming in contact and brought to rest by the hydraulic buffer cylinder. The momentum of the counter-weight traveling at the rate of about 7 miles an hour is absorbed by the piston forcing the water into diminishing waterways.

Movable covers are provided at both ends of the subway for admission and repairs to the sheaves, hydraulic buffer and counter-weight trolley and manhole covers are provided at suitable intervals along the subway to admit of inspection of the running parts, 16-c. p. electric lights being fitted throughout. The current for these lights is led from the trolley wire through a switch and fuse and down a trolley pole near the top of the hill.

The buffer trolley is built with an underframe of hardwood timber with a light wrought iron box cover, on top of which is fitted an ornamental lamp. This counter-weight system has proved itself entirely satisfactory during operation, not a single mishap having been reported.

New Terminal Station at Schenectady.

The grade crossing question has been agitated for some years in Schenectady and has terminated in the acceptance by the city authorities, the railroad commission and the New York Central & Hudson River R. R. management of plans for the construction of a new union station and the elevation of the steam railroad tracks where they intersect State St. On the acquisition by the New York Central & Hudson River R. R. interests of the interurban and street railway properties in and about Schenectady, an additional scheme presented itself, namely, the making of this new station a terminal for the interurban routes centering in the city, as well as a union station for steam traffic. With this plan in view negotiations are now under way for the construction of a double track Y at a suitable grade point below the present street level, so that the incoming and outgoing cars can run through a subway on tracks parallel with those of the steam roads but directly under them. The construction of an interurban and steam railroad union station according to these plans will offer, not alone many conveniences to the traveling public, but will be an added factor toward increasing the value of the interurban lines as feeders to the steam railroad traffic.

Tickets.*

BY R. E. NORVIEL, GENERAL AGENT, INDIANAPOLIS & NORTHWESTERN TRACTION CO.

That the use of tickets on steam roads has been a success and the proper way to handle the traveling public is proved by the great amount of money spent annually improving a plan already nearly perfect.

That this same rule should be applied to the electric line after it passes the point of a suburban and becomes the interurban; in other words, when the electric line becomes a railroad reaching from one city to another city, say from 25 to an indefinite number of miles away, then it does seems that the same conditions that make it necessary to have a system of tickets on a steam road would apply to the electric line of the same length.

Interurban railways are today in their infancy. The consolidation of properties, interchange of business and closer relations in business are bound to come, we all feel assured.

When the electric suburban lines were first thought of they were considered as simply elongated street car systems; the conductor was the whole thing, even to the auditor of his own accounts. I believe there is no general officer of an electric interurban railroad today but would take umbrage if someone should call his particular system a "street car line." The 40-mile road of today may tomorrow be the 80-mile road by the absorption of a line of equal length; the one set of general officers of today will tomorrow handle the 80 miles, and the next day the system becomes one of 120 miles, and so on.

The electric roads as first built did not contemplate a representative in each town of any size; they simply took such business as was offered them, and the steam lines paid little attention to them. Today we see the difference; they, the steam roads, are fighting for the business that they see has been slipping from them. This competition will become fiercer as more lines are built and the loss of business is felt over more territory. What the end will be we can none of us tell, but we all know the advantage of concerted action.

Whenever a line puts in a ticket system then the necessity of having agents comes up. This means expense, and the question is, does it pay? My answer to this is, Yes, because your prospective passenger then has someone he can go to and expect to get such information as he may want to complete his journey, not only over the one particular system that originates this travel, but to whatever point he may wish to go, and the farther the originating office can put that man on a through ticket the more sure we are that each electric road affected will get that customer's business. How can this condition be secured except by educating the agent, circulating appropriate literature and adopting interline tickets. You cannot do this and change your agents every month; make the inducement such that your agent is proud to be called such, and will not only go out and hunt for business, but get it, too. That all electric lines will eventually come to this, I do not believe that any railway officer will deny. We know there will be continually further consolidation of interests, which makes all the greater need for permanent organization of the passenger department.

As to the kind of tickets and their use, it would seem that inasmuch as the steam roads have paid for the best brains to be had during the last fifty years to devise a system, that we could at least adopt that system as far as it will fit our case.

We all know the use of a local card ticket, both one way and round trip; the rate of the steam road for a round trip fare is double the one way fare less 10 per cent. Why this reduction? First, because the road has the use of a certain amount of money before it is earned; second, by the purchase of a round trip ticket it is almost certain that the passenger will return over the same line. These card tickets should be used to every point to which there is any considerable travel, because of the ease in accounting and rapidity in which the tickets can be handled; to those odd points to which the sales are few, a blank stub ticket should be used. If there be excess-fare trains, then a special ticket should be provided for this class of trains.

The coupon tickets good over other lines should be provided with a sufficient number of coupons to meet the conditions.

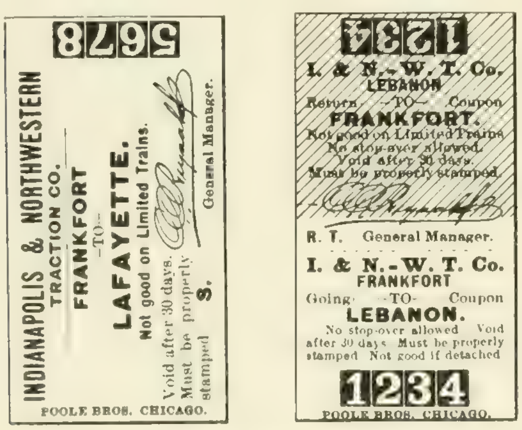
A mileage book is a good thing and it is a pity we have not one that is interchangeable, for the reason that a man holding a book of this kind will hardly consider the rival steam road in his calculations.

We have several other ticket forms on the Northwestern to meet local conditions, all of which, when delivered to an agent, means so much money for which he must account.

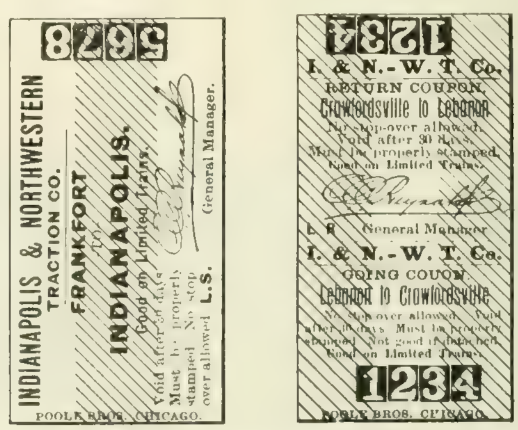
Another reason for the use of tickets is the comparative ease in which a conductor can handle a train when tickets are used, as compared with a train where a complicated system of cash fare registers is in use. As an illustration, the writer personally rode on cars on several of the lines using the Traction Terminal Building, and found that the time required to collect the fares from a given number of passengers was approximately as 4, when tickets were used, to 7 when registers were used.

It would seem to the writer that the same reason for making a way bill for freight or express, is an equally good one for the use of a ticket with a passenger, and a well regulated ticket system should reduce the cash fares to about 20 per cent of the business. There is probably no system of fare or ticket collection but can be manipulated for a time, but it certainly is a hard matter to either change tickets or do anything with them after they have once been punched and used.

In conclusion, the writer would offer the suggestion that 5 cents extra be charged on the train over the ticket rate and the cash fare receipt be worth 5 cents at any regular ticket office of the company if presented within 10 days from date of issue. This would, it is believed, reduce cash fare receipts to a minimum.



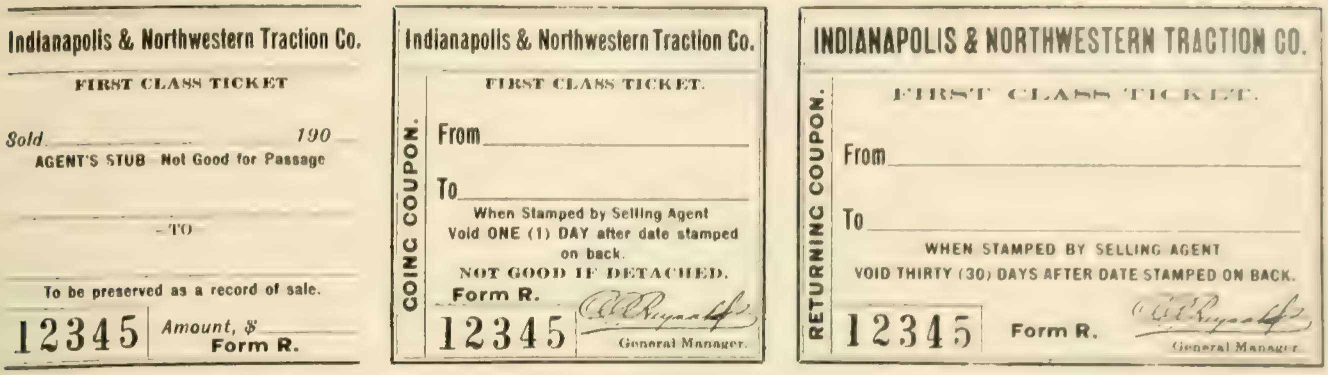
SINGLE TRIP AND ROUND TRIP LOCAL CAR TICKETS.



SINGLE TRIP AND ROUND TRIP LIMITED CAR TICKETS.

In connection with Mr. Norviel's paper on tickets it will be interesting to illustrate the various forms in use by the Indianapolis & Northwestern Traction Co., it having a very complete ticket equipment. Taking up first the card tickets, these are of four styles;

*Read before the Indiana Electric Railway Association, Indianapolis, Apr. 1[illegible], 1905.

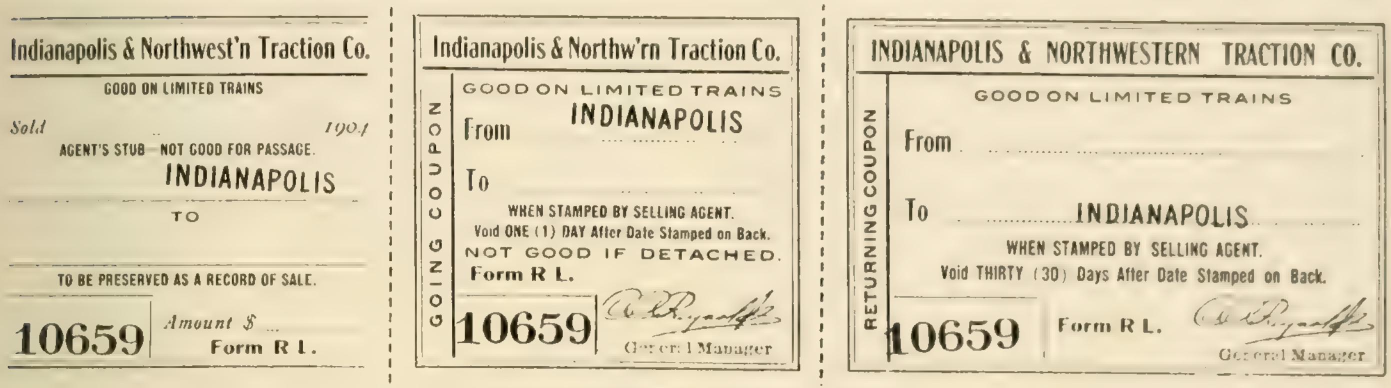


Indianapolis & Northwestern Traction Co.
FIRST CLASS TICKET
Sold 190
AGENT'S STUB Not Good for Passage
TO
To be preserved as a record of sale.
12345 Amount, $
Form R.

Indianapolis & Northwestern Traction Co.
GOING COUPON.
FIRST CLASS TICKET.
From
To
When Stamped by Selling Agent
Void ONE (1) DAY after date stamped on back.
NOT GOOD IF DETACHED.
Form R.
12345 General Manager.

INDIANAPOLIS & NORTHWESTERN TRACTION CO.
RETURNING COUPON.
FIRST CLASS TICKET.
From
To
WHEN STAMPED BY SELLING AGENT
VOID THIRTY (30) DAYS AFTER DATE STAMPED ON BACK.
12345 Form R. General Manager

ROUND TRIP LOCAL CAR TICKET. (BLUE.)

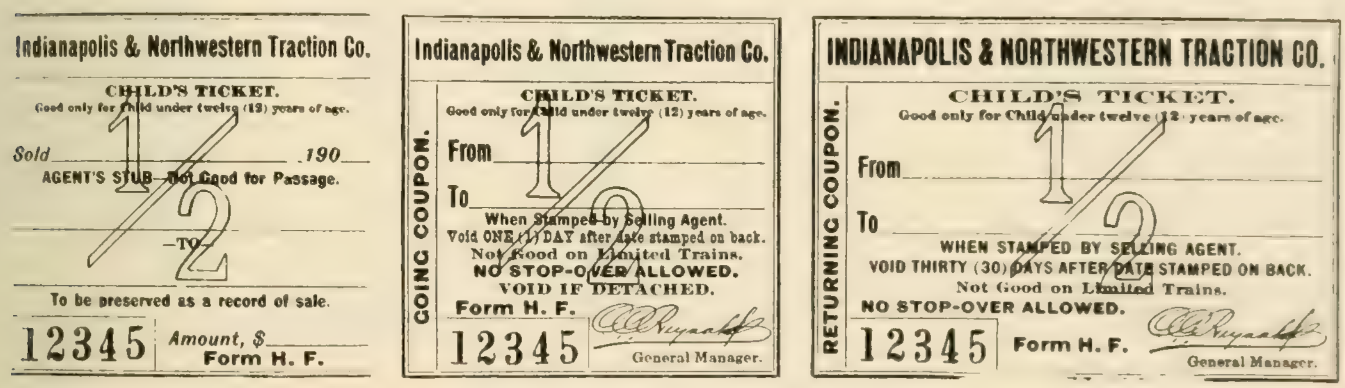


Indianapolis & Northwest'n Traction Co.
GOOD ON LIMITED TRAINS
Sold 1904
AGENT'S STUB NOT GOOD FOR PASSAGE.
INDIANAPOLIS
TO
TO BE PRESERVED AS A RECORD OF SALE.
10659 Amount $
Form R L.

Indianapolis & Northw'rn Traction Co.
GOING COUPON
GOOD ON LIMITED TRAINS
From INDIANAPOLIS
To
WHEN STAMPED BY SELLING AGENT.
Void ONE (1) DAY After Date Stamped on Back.
NOT GOOD IF DETACHED.
Form R L.
10659 General Manager

INDIANAPOLIS & NORTHWESTERN TRACTION CO.
RETURNING COUPON
GOOD ON LIMITED TRAINS
From
To INDIANAPOLIS
WHEN STAMPED BY SELLING AGENT.
Void THIRTY (30) Days After Date Stamped on Back.
10659 Form R L. General Manager

ROUND TRIP LIMITED CAR TICKET. (PINK.)

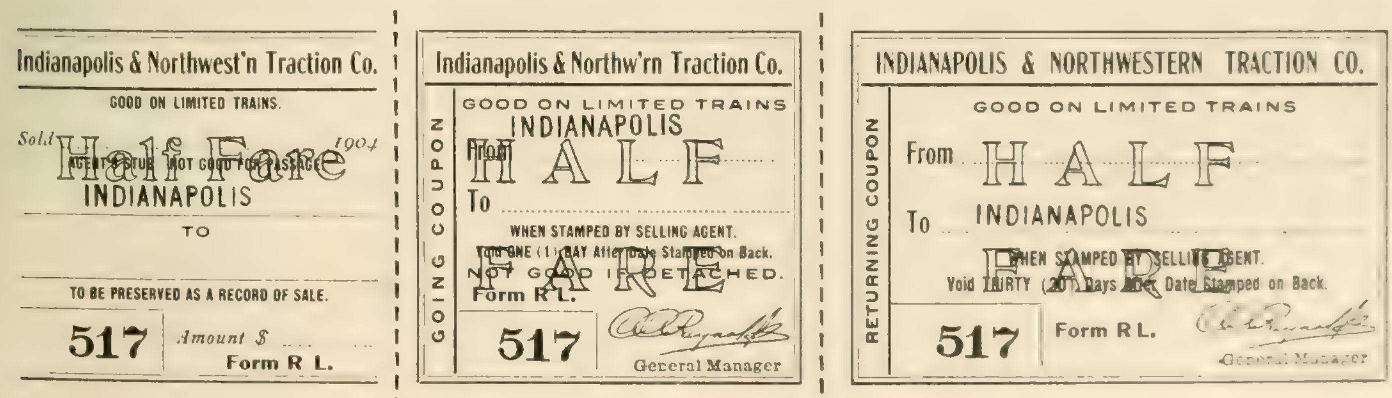


Indianapolis & Northwestern Traction Co.
CHILD'S TICKET.
Good only for Child under twelve (12) years of age.
1/2
Sold 190
AGENT'S STUB Not Good for Passage.
TO
To be preserved as a record of sale.
12345 Amount, $
Form H. F.

Indianapolis & Northwestern Traction Co.
GOING COUPON.
CHILD'S TICKET.
Good only for Child under twelve (12) years of age.
1/2
From
To
When Stamped by Selling Agent.
Void ONE (1) DAY after date stamped on back.
Not Good on Limited Trains.
NO STOP-OVER ALLOWED.
VOID IF DETACHED.
Form H. F.
12345 General Manager.

INDIANAPOLIS & NORTHWESTERN TRACTION CO.
RETURNING COUPON.
CHILD'S TICKET.
Good only for Child under twelve (12) years of age.
1/2
From
To
WHEN STAMPED BY SELLING AGENT.
VOID THIRTY (30) DAYS AFTER DATE STAMPED ON BACK.
Not Good on Limited Trains.
NO STOP-OVER ALLOWED.
12345 Form H. F. General Manager.

HALF FARE ROUND TRIP LOCAL CAR TICKET. (ORANGE.)

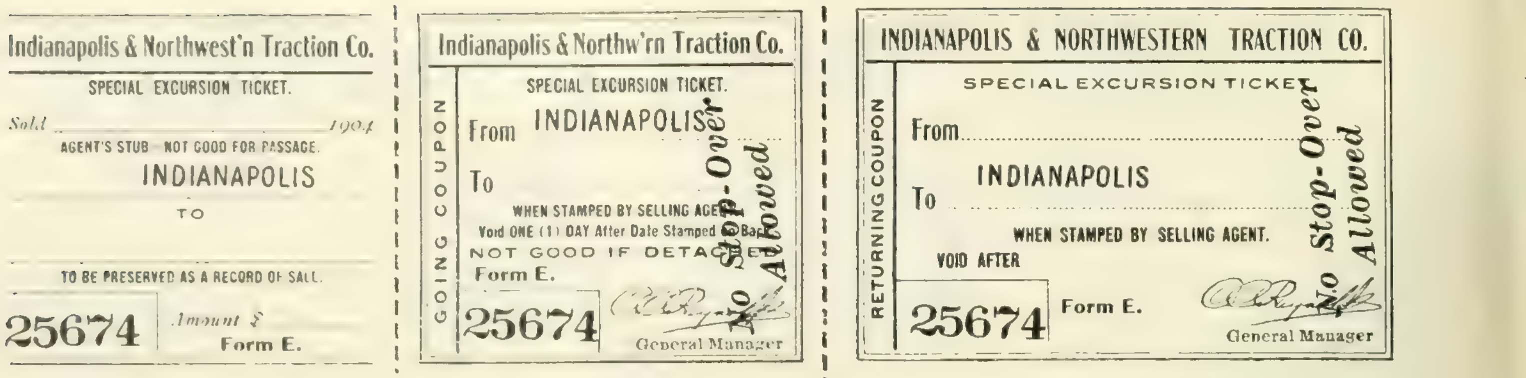


Indianapolis & Northwest'n Traction Co.
GOOD ON LIMITED TRAINS.
Half Fare
Sold 1904
AGENT'S STUB NOT GOOD FOR PASSAGE.
INDIANAPOLIS
TO
TO BE PRESERVED AS A RECORD OF SALE.
517 Amount $
Form R L.

Indianapolis & Northw'rn Traction Co.
GOING COUPON
GOOD ON LIMITED TRAINS
INDIANAPOLIS
HALF FARE
From
To
WHEN STAMPED BY SELLING AGENT.
Void ONE (1) DAY After Date Stamped on Back.
NOT GOOD IF DETACHED.
Form R L.
517 General Manager

INDIANAPOLIS & NORTHWESTERN TRACTION CO.
RETURNING COUPON
GOOD ON LIMITED TRAINS
HALF FARE
From
To INDIANAPOLIS
WHEN STAMPED BY SELLING AGENT.
Void THIRTY (30) Days After Date Stamped on Back.
517 Form R L. General Manager

HALF-FARE ROUND TRIP LIMITED CAR TICKET. (PINK.)



SPECIAL EXCURSION TICKET. (YELLOW.)

1. One way tickets good only on local cars.
2. Round trip ticket good only on local cars.
3. One way ticket good on limited trains. (The excess fare ticket referred to by Mr. Norviel.)
4. Round trip ticket good on limited trains.

The round trip local ticket has the going and return coupons in different colors, white and purple respectively. The card tickets for limited trains are distinguished by a stripe extending lengthwise of the card, the one way tickets having green center and white edges and the round trip tickets white center and green edges. These tickets are of uniform size, about 1¼ x 2¼ in., and fit the standard railroad ticket case.

The one way and round trip local card tickets are printed for use between any two of the following stations: Indianapolis, Alliance, Augusta, County Line, Zionsville, Whitestown, Lebanon, Mechanicsburg, Frankfort, Mulberry, Dayton, Lafayette and Crawfordsville. The excess fare tickets are printed for use between eight stations only, these being: Indianapolis, Zionsville, Whitestown, Lebanon, Frankfort, Mulberry, Lafayette and Crawfordsville.

Next come the blanket stub tickets, which are of nine classes:

1. A single trip local car ticket.
2. A round trip local car ticket.
3. A single trip excess fare or limited car ticket.
4. A round trip excess fare or limited car ticket.
5. A single trip half-fare local car ticket.
6. A round trip half-fare local car ticket.
7. A single trip half-fare limited car ticket.
8. A round trip half-fare limited car ticket.
9. A special excursion ticket.

The color scheme for these tickets is blue for Nos. 1 and 2; pink for 3, 4, 7 and 8; orange for 5 and 6. Half fare local tickets have the fraction "½" printed on the face in red, while the half-fare limited car tickets have the words "Half Fare" in red. The one way tickets are identical with the round trip blanket stub tickets illustrated, except that the middle coupon (here shown) is omitted and the words "Return Coupon" are omitted from the long coupon. Including the agent's stub, the form illustrated measures 2¼ x 8 in.

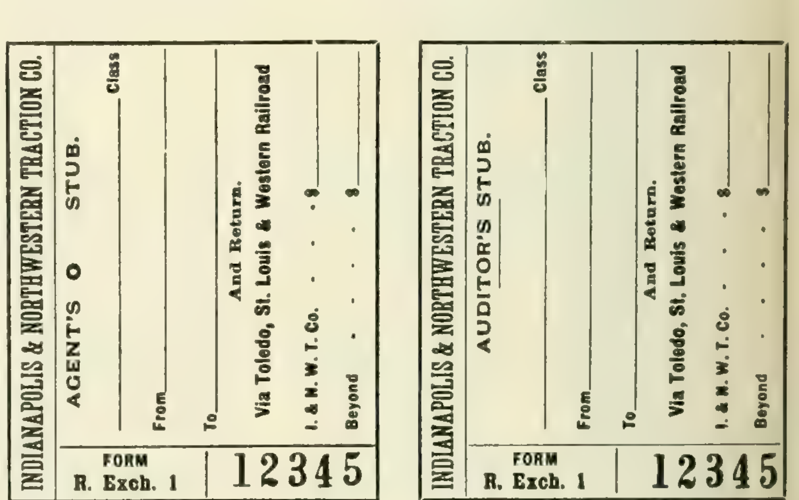
The yellow form, No. 9, is used for excursion and special car business, such as the Sunday excursions run between all points at the uniform fare of $1 for the round trip. By liberal use of rubber stamps this form of ticket may be used for almost any special service and is found to be a great convenience.

One of the interesting tickets is the 20-ride commutation ticket, good in either direction between stations specified. It may be used by 20 persons going in one direction or by one person making 10 round trips. A large number of this form is sold for use between Indianapolis and the Country Club. The rate at which this commutation ticket is sold is 10 times the round trip fare.

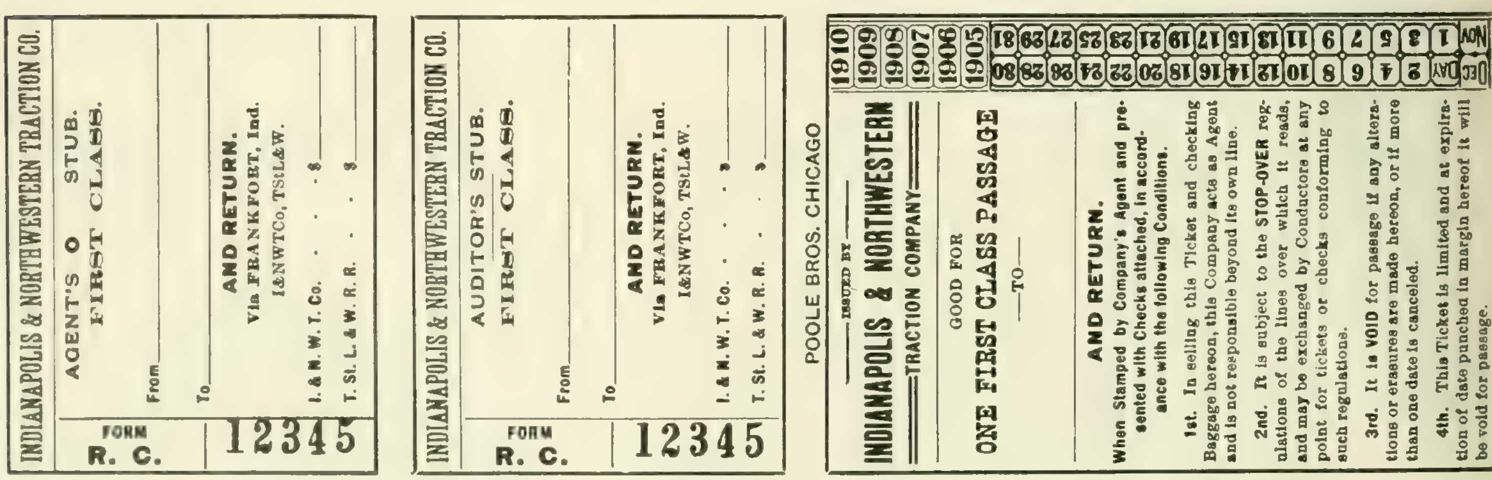
Besides these tickets for use on its own road only, the company has mileage books containing respectively 500 and 1,000-mile strips. The rate for the 500-mile book is $6.50, and for the 1,000-mile book $12.50.

For through business over foreign roads the company uses:

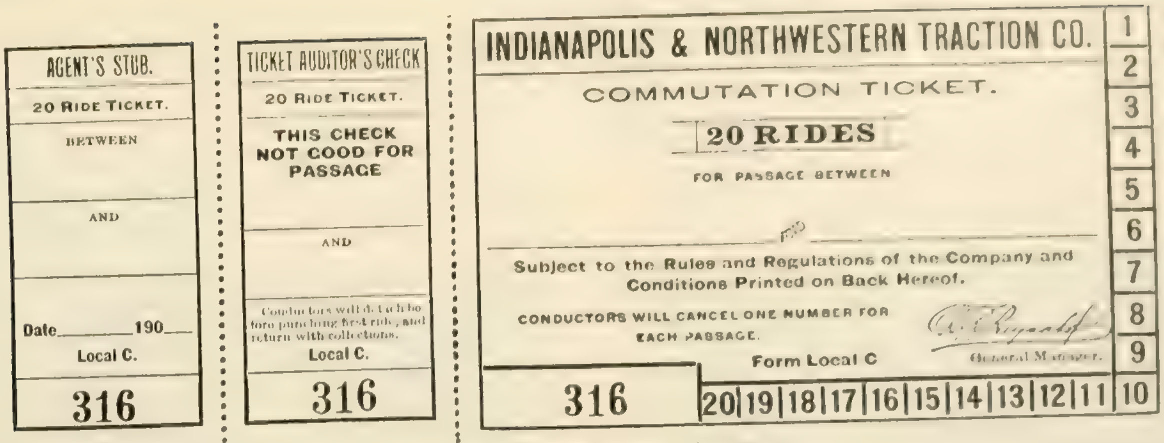
1. The Ohio Interurban Railway Association interline ticket form.



EXCHANGE ORDER TICKET



STANDARD COUPON TICKET FOR


AGENT'S STUB. 20 RIDE TICKET. BETWEEN AND Date 190 Local C. 316

TICKET AUDITOR'S CHECK. 20 RIDE TICKET. THIS CHECK NOT GOOD FOR PASSAGE AND Conductors will detach before punching first ride, and return with collections. Local C. 316

INDIANAPOLIS & NORTHWESTERN TRACTION CO.
COMMUTATION TICKET.
20 RIDES
FOR PASSAGE BETWEEN
AND
Subject to the Rules and Regulations of the Company and Conditions Printed on Back Hereof.
CONDUCTORS WILL CANCEL ONE NUMBER FOR EACH PASSAGE.
Form Local C General Manager.
316 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

20 RIDE COMMUTATION TICKET (WHITE.)

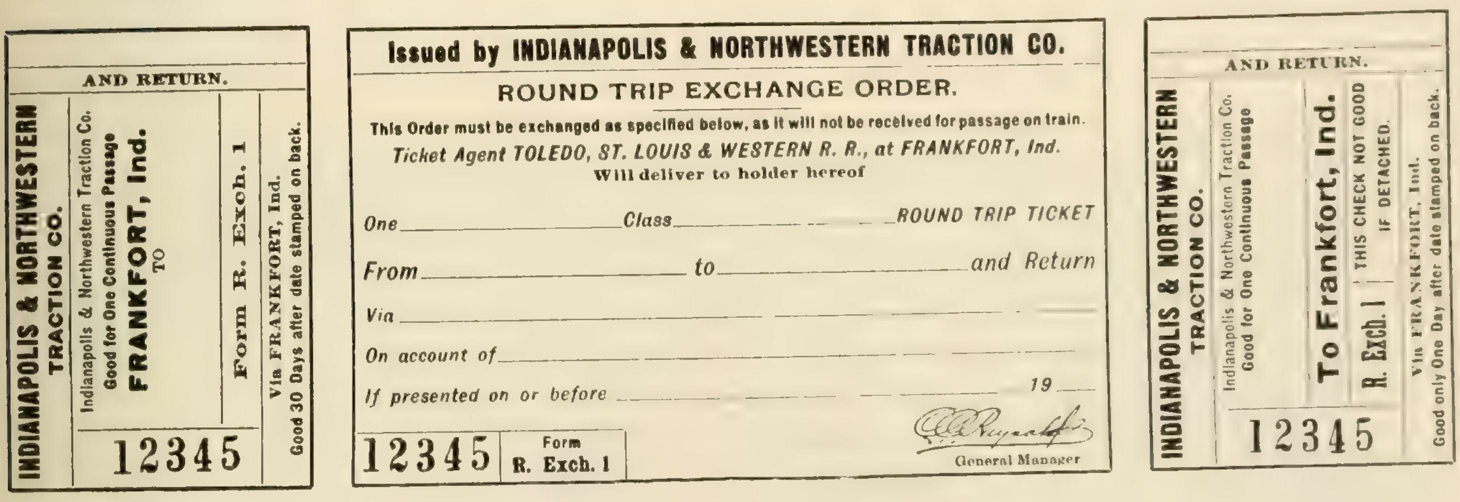
2. The standard railroad coupon ticket covering all points on the Clover Leaf (Toledo, St. Louis & Western R. R.). This class of ticket is for either one way or round trip.

3. The exchange order ticket which comprises a coupon from the selling point to Frankfort and an exchange order on the Clover Leaf for a ticket over its line and any and all connecting lines to point of destination. By using this form the Indianapolis & Northwestern can sell through tickets to New York or California, provided they can route the business over the Clover Leaf. Exchange orders for both round trip and one way tickets are used.

These forms, for use over foreign lines, are all printed on safety paper to prevent fraud.

Poole Bros., Chicago, furnished the greater portion of the tickets illustrated herewith.

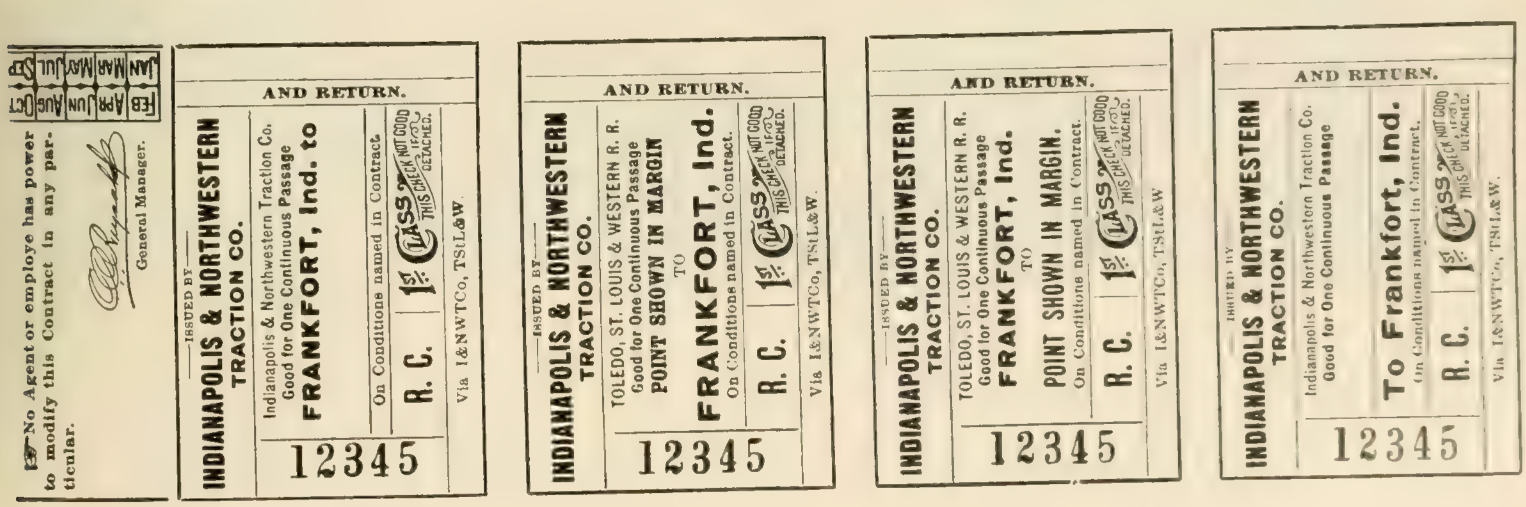
The Illinois Valley Railway Co. contemplates the construction of two extensions to its system now operating between [illegible] and Marseilles, Ill. This interurban line was described in the [illegible] for March and April, 1905. Plans are under way for [illegible] extension to Princeton, a town of 4,000 inhabitants, 14 miles distant from the nearest existing point of the present system. The second extension planned is from the present eastern terminus of the line at Marseilles to Seneca, a distance of 5½ miles. The building of this extension will leave a gap of but 17 miles between the tracks of the Illinois Valley Railway Co. and those of the Chicago & Joliet Electric Railway Co. It is hoped that the time is not far distant when passengers may travel in electric cars from Princeton to Chicago over this combined route, which has a total length of about 120 miles.


AND RETURN. INDIANAPOLIS & NORTHWESTERN TRACTION CO. Indianapolis & Northwestern Traction Co. Good for One Continuous Passage FRANKFORT, Ind. TO Form R. Exch. 1 Via FRANKFORT, Ind. Good 30 Days after date stamped on back. 12345

Issued by INDIANAPOLIS & NORTHWESTERN TRACTION CO.
ROUND TRIP EXCHANGE ORDER.
This Order must be exchanged as specified below, as it will not be received for passage on train.
Ticket Agent TOLEDO, ST. LOUIS & WESTERN R. R., at FRANKFORT, Ind.
Will deliver to holder hereof
One Class ROUND TRIP TICKET
From to and Return
Via
On account of
If presented on or before 19
12345 Form R. Exch. 1 General Manager

AND RETURN. INDIANAPOLIS & NORTHWESTERN TRACTION CO. Indianapolis & Northwestern Traction Co. Good for One Continuous Passage To Frankfort, Ind. R. Exch. 1 THIS CHECK NOT GOOD IF DETACHED. Via FRANKFORT, Ind. Good only One Day after date stamped on back. 12345

FOR THROUGH BUSINESS.


JAN FEB MAR APR MAY JUN JUL AUG SEP OCT No Agent or employe has power to modify this Contract in any particular. General Manager.

AND RETURN. ISSUED BY INDIANAPOLIS & NORTHWESTERN TRACTION CO. Indianapolis & Northwestern Traction Co. Good for One Continuous Passage FRANKFORT, Ind. to On Conditions named in Contract. R. C. 1st CLASS THIS CHECK NOT GOOD IF DETACHED. Via I&NWTCo, TStL&W. 12345

AND RETURN. ISSUED BY INDIANAPOLIS & NORTHWESTERN TRACTION CO. TOLEDO, ST. LOUIS & WESTERN R. R. Good for One Continuous Passage POINT SHOWN IN MARGIN TO FRANKFORT, Ind. On Conditions named in Contract. R. C. 1st CLASS THIS CHECK NOT GOOD IF DETACHED. Via I&NWTCo, TStL&W. 12345

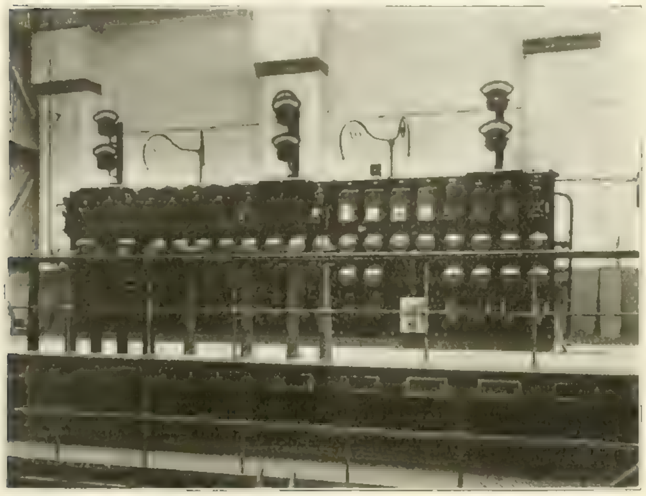
AND RETURN. ISSUED BY INDIANAPOLIS & NORTHWESTERN TRACTION CO. TOLEDO, ST. LOUIS & WESTERN R. R. Good for One Continuous Passage FRANKFORT, Ind. TO POINT SHOWN IN MARGIN. On Conditions named in Contract. R. C. 1st CLASS THIS CHECK NOT GOOD IF DETACHED. Via I&NWTCo, TStL&W. 12345

AND RETURN. ISSUED BY INDIANAPOLIS & NORTHWESTERN TRACTION CO. Indianapolis & Northwestern Traction Co. Good for One Continuous Passage To Frankfort, Ind. On Conditions named in Contract. R. C. 1st CLASS THIS CHECK NOT GOOD IF DETACHED. Via I&NWTCo, TStL&W. 12345

INTERCHANGE WITH STEAM ROADS.

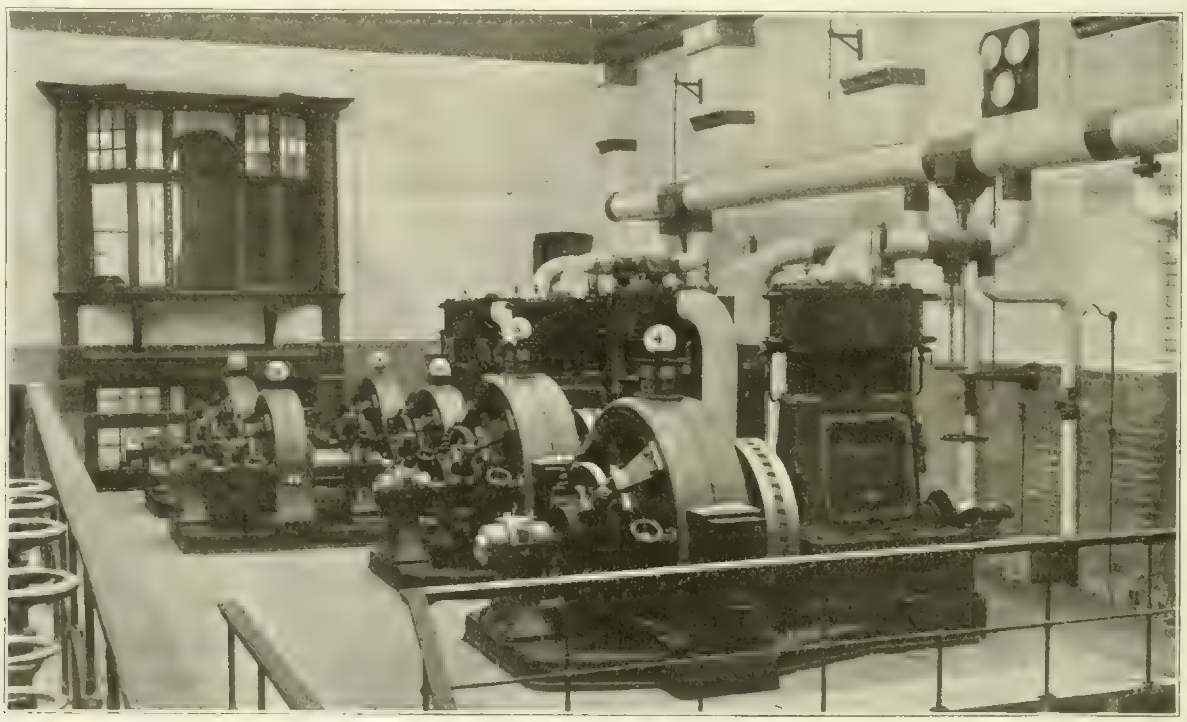
Kilmarnock Electric Tramways System.

The electric tramways at Kilmarnock, Ayrshire, Scotland, were built as a municipal enterprise under the management of an "Electricity Committee" appointed by the city council and have been in operation since Dec. 10, 1904. The construction work was completed in one year's time, under the direction of Mr. A. H. Burbidge who has been retained as tramways manager and electrical engineer.



SWITCHBOARD FOR TRACTION AND LIGHTING UNITS.

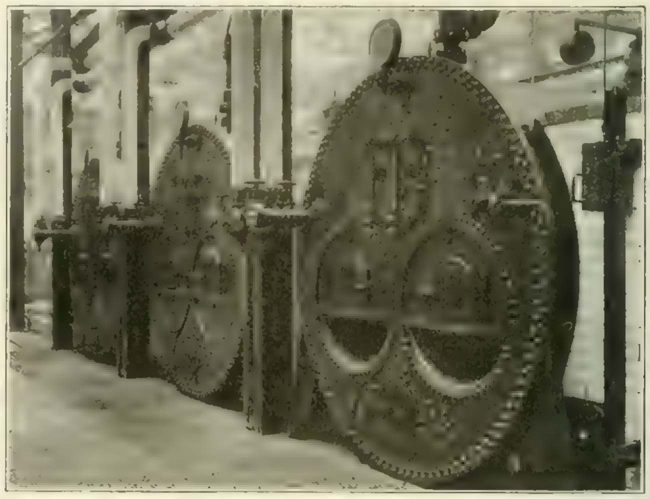
This enterprise required the construction of a power station which would supply current both for lighting the town of Kilmarnock and operating the tramway system. This power station occupies an extensive piece of ground on the north bank of the River Irvine, at Riccarton. The car sheds are located near the power station and ample space has been provided for the extension of both buildings.



DIRECT CONNECTED TRACTION AND LIGHTING UNITS.

The front elevation of the buildings is of red sandstone and white pressed brick, which, as may be seen from an accompanying illustration, presents a pleasing appearance. On the ground floor of the power station are the executive offices of the light and tramway departments, together with an office for the chief engineer.

The boiler house contains three Yates & Thom make of Lancashire boilers, 28 ft. by 18 ft., working at 160-lb. pressure, with space for the addition of two similar boilers at such time as they may be needed. The boilers are hand fired. At present the coal is brought to the bunkers opposite the boilers in carts, but negotiations are under way for the providing of a steam railroad siding which will enable hopper-bottom cars to unload directly over the bunkers. The boilers are fed by two Weir direct acting pumps which draw water either from the town mains or from the condenser discharge, and



YATES & THOM BOILERS.

can pump either direct to boilers or through a Green economizer composed of 192 tubes. A small motor-driven sump pump is placed alongside of the boilers. This pump will be used for taking care of the drains in times of flood as the foundation of the entire building is below flood level. The condensing plant is of the vertical jet type and was supplied by Mirrlees, Watson & Co., Glasgow. The whole piping system was supplied by Aiton & Co. and has been covered with Haacke's fossil meal composition packed up level with the flanges which are covered with planished steel plates. This covering presents a neat appearance.

The engine room is 71 ft. 6 in. long by 37 ft. 6 in. wide and contains 4 Belliss & Morcom 200-h. p. engines direct connected to Dick,

Kerr & Co. generators, provision having been made for an additional similar set.

The combined lighting and traction switchboard is placed on a gallery about three feet above the engine room floor, the rheostats being mounted immediately under the gallery and regulated by hand wheels in front of the switchboard. An interesting feature about the board and its connections is that practically no cable has been used. All of the connections including shunt leads, being made with solid drawn copper rods supported on porcelain insulators. A storage battery of 254 Tudor cells having a capacity of 300 ampere-hours is located at one side of the engine room. A booster is kept in circuit practically all the time, so that a very few regulating cells are used. On one side of the engine room a work shop has been provided and in this shop will be installed lathes and other necessary tools. In order to facilitate the unloading of machinery the tramway track has been built into the workshop.

A. H. BURBIDGE

Situated near the work-shop is the car barn which has a capacity of 12 cars and is so arranged that it may easily be extended in both length and width. At present one repair pit capable of accommodating four cars is provided. The 12 cars which have been supplied by Hurst, Nelson & Co., Ltd., are of the double-deck type with seats for 52 passengers and the usual type of stair case and extended canopy top. The bodies are painted olive green and cream with the burgh coat-of-arms on either side. Steel tired wheels are used. The motors and equipment were supplied by Witting, Eborall & Co., of London. In constructing the power station and car barn the different kinds of work were sub-let to nine different firms, the majority of these sub-contractors being local men.

The route of the Kilmarnock Tramways system consists of 3¾ miles of single track and ½ mile of double track, furnishing two main routes through the town.

One from Beansburn to Riccarton, and the other from the railway station through the town to Hurlford. The rails are of the 90-lb girder type, with "Dicker" joints and were rolled by the Northeastern Steel Works, Middlesbro. The track is bonded with solid-end bonds except at the switch points and crossings where drift pins were used. Turnouts have been laid about every 1-3 mile and the line, where single track, has been placed on one side of the center line of the street to allow for double tracking. Dick, Kerr & Co., of London were the contractors for all the track work.

GENERAL VIEW OF POWER HOUSE KILMARNOCK TRAMWAYS SYSTEM

Bracket arm construction is the standard for supporting the overhead work in the outlying districts, but in the center of the town the span wires are fastened to rosettes in the building fronts. The trolley wire is No. 00 S. W. G. and is suspended in the ordinary manner with bronze straight-line hangers and pull-offs. The trolley [illegible] covered with hard brick tiles. The wires for the telephone system, which has instruments connected at appropriate places, were installed in the conduits with the feeder cables.

The proposed schedule of operation furnishes a 10-minute service from end to end of either route, and 5-minute service in the center of the town when warranted by the traffic.

The total cost of the Kilmarnock Tramways system is placed at about [illegible] completely self-supporting, the cars must carry about 36,000 fare passengers each week, who pay an average fare of two cents each. In [illegible] a week. This is not an extravagant estimate because most tramways in this class of English towns carry the equivalent of the total population more than once a week.

The Lansing & Jackson Railway Co.

The organization of the Lansing & Jackson Railway Co. for the construction of an interurban electric railway between Lansing and Jackson, Mich., has recently been completed and the contract for construction has been let to the L. E. Myers Co., of Chicago, which will also equip this high speed heavy duty interurban railway.

The road bed is to be constructed in conformity with the Pennsylvania R. R. standard, using 70-lb. standard T-rail, "Continuous" rail joints, white oak ties, and ballasting with 18 in. of gravel. All water openings and culverts will be cast iron pipe or concrete construction. The bridges will all be of steel built to sustain a rolling load of 5,000 lb. per lineal foot. The overhead construction will be modern and of the highest possible grade, employing 40-ft. cedar poles with 8-in. tops. For the trolley, there will be employed two No. 0000 B. & S. wires, drawn to conform to a special design of the L. E. Myers Co., with necessary alternating current and direct current feeders. The cars will be of the most modern design, weighing equipped about 30 tons, making a maximum speed of 45 to 50 miles, with a schedule speed of 35 m. p. h. There will be two sub-stations located at intermediate towns. These sub-stations will be designed to serve as offices and depots also.

The corporation is capitalized at $1,000,000 and the following officers have been elected: President, Myron W. Mills, Port Huron, Mich.; vice-president and treasurer, George G. Moore, Port Huron; secretary, James R. Elliott, Lansing. The directors are the officers and David W. Mills, Cleveland, and W. A. Boland, New York. These gentlemen are also officers and directors of the Lansing & Suburban Traction Co., with the exception of Mr. Boland, who is president of the Jackson & Battle Creek Traction Co.

Construction work will be commenced immediately and it is expected the road will be opened for traffic by Jan. 1, 1906. The railway company will be represented in the work by its chief and consulting engineer, Mr. T. M. Keeley, master mechanic of the Lansing & Suburban Traction Co., while the work of the L. E. Myers Co. will be under the personal supervision and direction of Mr. C. E. Collins, its general superintendent.

Lansing is the capital of Michigan with a population of approximately 25,000, while Jackson has a population of 30,000. There are several intermediate towns and villages, all active, growing municipalities. This line when completed will connect with the Lansing, St. Johns & St. Louis road at Lansing, giving a continuous line in a northerly direction from Jackson to St. Johns of approximately 60 miles. The new line will also connect with the Detroit, Ypsilanti & Ann Arbor Railway, at Jackson, giving a continuous line from St. Johns to Detroit via Lansing. It will also connect with the Jackson and Battle Creek electric railway.

The Athens, Sayre & South Waverly Traction Co., of Waverly, N. Y., will build a six-mile electric railway. This company is closely identified with the Waverly, Sayre & Athens Traction Co., of Waverly, N. Y.

The Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co. has abolished its free parcel delivery and raised its freight rates. The old rates were 15 cents for 10 lb. or less and 25 cents for 100 lb. or less, while the new rate cuts out the 15-cent rate, making the new charge for any articles weighing 100 lb. or less, 25 cents.

April Meeting of the Indiana Electric Railway Association.

The Indiana Electric Railway Association held its regular April meeting at the Traction & Terminal Building, Indianapolis, April 13th. After the adoption of the minutes of the March meeting the secretary announced the approval by the executive committee of 36 applications for membership, all of whom were elected.

Mr. W. R. McKown then read the report of the committee on interchangeable tickets, which was as follows:

Report of the Committee on Interchangeable Coupon Ticket Books.

The committee to which was referred the matter of an interchangeable mileage, or coupon ticket, reports as follows:

After your committee was appointed, we immediately entered upon our duties, and have made a thorough investigation, as to rates, books and mileage books that are now in use on the roads operating in this state.

As made known to this association at its last meeting, we decided that an interchangeable mileage rate could not be adopted that would be equitable to all roads. We did think, however, at that time, and so stated, that we would recommend an interchangeable coupon ticket book, containing 200 coupons, to be sold for $9.00, which is a 10 per cent discount. This kind of a book would answer the purpose reasonably well, but, as you remember, the Transportation Committee of the Ohio association asked to be heard before this association adopted a book, as they were anxious to have any book that might be adopted by us, such that it could be used in exchange on Ohio lines, as well as on our lines.

This committee was given more time and ordered to meet with the committee from Ohio. We met the Transportation Committee of the Ohio Interurban Railway Association, at Cincinnati, Mar. 23, 1905, and went into the question with a view to reaching a compromise between their rate and ours. They are giving a discount of 16 2/3 per cent, and we had thought of recommending 10 per cent. After considerable discussion, the Ohio committee agreed to write us after we returned home, saying what they would do, so we give their letter, which explains the situation, and is as follows:

"After thoroughly canvassing the members of the Interchangeable Coupon Ticket agreement of the Ohio Interurban Railway Association, I find it necessary to advise you that the consensus of opinion necessitates my reporting not favorable to a change from our present 16 2/3 per cent discount.

"While all of the Ohio members are exceedingly anxious that one book be good in both states, they feel, however, that it will be practically impossible to sell any of the books in Ohio if any change is made in the discount on account of the general practice to sell round trip tickets at a 10 per cent reduction, from the regular one way fare, which fare is based on from 1½ cents per mile on roads out of Columbus, and 1¾ cents out of Dayton, and to 2 cents per mile out of Cleveland and Toledo.

"Trusting you will recommend to your association the adoption of the Ohio book on a basis of 16 2/3 per cent discount from your regular one-way fare, I am,

"Yours truly,

"J. H. Merrill, Chairman."

We desire to say that we have given this matter a great deal of thought, have secured all the information on the subject we could, have advised with a great many people well up in transportation companies, have worked hard and earnestly to provide a book that would be useful and remunerative, but have failed to accomplish our purpose. Since having been fully advised in the matter, we are of the opinion that if we were to adopt a book such as we had thought of recommending, the 10 per cent discount book, it would have a number of bad features.

1. A 10 per cent discount is not a sufficient reduction to induce the passenger to invest $9 at one time. He, of course, would not consider the low rate per mile, but would expect as great a reduction as though our lines were charging 2 cents per mile; and while we would not sell many books, we would all have to go to the expense of having the books printed and put on sale, and the settlements between all companies would have to be made just as though a great many were sold.

2. If we were to put this book on sale, it would make two separate and distinct books, as it would not be the same as the one used in Ohio, and commercial traveling men would be compelled to have two books, as they nearly all travel in both states, and owing to our close relation with Ohio lines, two books would sooner or later have to be consolidated into one. We think that this can be done easier before the book is put on sale, than afterwards. A book that could be used on Ohio lines with the present rate of discount would give Indiana companies only 1¼ cents per mile. Your committee is of the opinion that if we were to recommend a 16 2/3 per cent discount, that it would not be adopted by more than a few lines, if any, in this state. Besides, owing to our present rate of fare being one 1½ cents per mile, we decline to recommend such a reduction.

3. It is impossible to agree upon a book which would be satisfactory to the Indiana companies and also to the Ohio companies, because the latter companies do not believe that it would be good policy to offer books for sale at a less discount than 16 2/3 per cent, which is more than the Indiana companies could bear.

For these reasons, the committee recommends that no interchangeable mileage book be adopted by the Indiana companies at the present time, but that each company be left to sell mileage books good on its own system, or interchangeable with other companies, as it may see fit.

We wish to say, in conclusion, that we have given this question our best attention, have learned considerable about rates that we did not know, and which will be of value to this association in the future, have applied the different rate of reductions to nearly all roads, have tried to arrange a ticket that would apply equally well to all lines, and have come to the conclusion that so long as one line is charging 1¼ cents per mile, another 1½ cents, another 1¾ cents, another 2 cents, and yet another 2¼ cents per mile, that no committee could arrive at any rate of reduction that would apply to such a variation of rates without being unjust to some particular line or lines, and so, while we were not appointed to investigate and report upon the advisability of readjusting rates, so as to have all conform, we have met this question so many times and in so many ways in our work, that we feel to withdraw from this work without a suggestion on this subject, would be out of order. If our rates had some uniform basis, the work of this committee would be easy, but until such is the case, nothing can be done. Therefore, we ask to be discharged from further duties.

Respectfully submitted,

C. A. Baldwin, F. D. Norviel,
W. R. McKown, E. C. Folsom.

In discussing the report of the committee a number of gentlemen urged the necessity of an attempt to revise the rate of fare throughout the state, bringing them to a more uniform basis. Mr. C. A. Baldwin made the point that a 10 per cent reduction on mileage books is not sufficient; first, because most companies give a reduction of 10 per cent on round trip tickets; and second, because the discount is so low in comparison with mileage discounts in effect on steam railroads. It was suggested that a number of the Indiana companies, which now have a basing rate of 1½ cents per mile, and sell their own coupon books at a discount of 16 2-3 per cent, could use the Ohio books if they so desired.

Mr. Norviel suggested that while a 5-cent coupon book did harmonize the varying rates, that a mileage book proper issued at 1¼ cents per mile would better meet the conditions, because by pulling an arbitrary number of miles between given stations the company would secure the advantage which is now lost by reason of local rates being computed to the nearest 5 cents. He also suggested that while a 1¼-cents mileage rate would be more convenient if the roads concerned could agree upon a uniform basis, that it would be

possible to meet existing conditions by the adoption of 1 [illegible] cent mileage rate and then let each company have its arbitrary scale as to the number of miles to be pulled between stations.

On motion the association approved the recommendations of the committee that the association adopt no interchangeable mileage book at this time, and the committee was discharged.

On motion of Mr. J. W. Chipman, a committee to consist of one representative of each company in the state desiring to join in the use of interchangeable tickets and coupon books was appointed to consider the adoption of a uniform basing rate and to further consider the subject of interchangeable tickets and interline tickets. The members of this committee include: W. G. Irwin, Indianapolis, Cincinnati & Southern, temporary chairman; C. C. Reynolds, Indianapolis & Northwestern; J. W. Chipman, Indianapolis & Eastern; C. C. Wood, Angola Railway & Power Co.; J. A. Barry, Indiana Northern; C. D. Emmons, Ft. Wayne & Wabash Valley; G. F. Wells, Terre Haute Traction & Light Co.; H. A. Nicholl (C. A. Baldwin, alternate), Indiana Union Traction Co.; L. J. Shlesinger, Muncie, Hartford & Ft. Wayne; W. Parry, Richmond Street & Interurban Ry.; H. F. Dicke, Ft. Wayne, Van Wert & Lima; T. C. McReynolds, Kokomo, Marion & Western; R. P. Wood, Lebanon & Thornton; A. A. Anderson, Indianapolis & Cincinnati Traction Co.

Mr. F. D. Norviel, general agent Indianapolis & Northwestern Traction Co., then read his paper on "Tickets," which will be found on page 278.

Commenting upon Mr. Norviel's paper, Mr. Irwin expressed the opinion that the greatest objection to the ticket system is that it would impose a hardship on a considerable number of regular patrons who live in the vicinity of a flag station and more or less remote from ticket stations where agents are maintained. For this reason he favored collecting fares on the car. In his opinion a 5 cent penalty for paying cash would be a similar hardship on rural patrons.

Replying to this criticism, Mr. Norviel urged that the 20-ride ticket such as used on his road would meet the objection of Mr. Irwin and confer a benefit upon the regular patron by giving him the round trip instead of the one-way rate.

Mr. H. A. Nicholl, general manager of the Indiana Union Traction Co., was elected to succeed Mr. A. L. Drum on the executive committee of the association. The meeting then adjourned.

In the afternoon the members of the association were the guests of the Indianapolis & Eastern Railway Co., which provided a special car to take the party over the line from Indianapolis to Dublin, stopping to inspect the power house. The car was one known as the company's "Spring Lake Special," and left Indianapolis at 1:20 p. m., arriving at the power house at 2:06 and at Dublin at 3:40. On the return trip the car left Dublin at 3:42 and reached Indianapolis at 5:30. The schedule showed the time of passing 38 points, and at none of these was the car as much as one minute off time.

Municipal Administrative Ability.

A glaring instance of municipal incompetence is furnished by the Urban District Council of Beckenham, a high class residential district in the south of London. The council having taken a poll of the ratepayers, which showed an overwhelming majority in favor of electric trams, obtained the necessary parliamentary powers, and entered into an agreement with the British Electric Traction Co. Ltd., whereby the latter would construct the lines, supply the cars, and carry out the necessary street widenings and improvements, at the same time giving the council the option of supplying current. The agreement was regarded by everyone as being particularly favorable to the council, the company agreeing to such terms as would result in a substantial reduction in the rates, besides paying the greater part of the expenses incurred in purchasing property along the route to widen the roads. By selling current to the company the council would also have secured a very substantial return to go in the reduction of rates, and altogether things looked very hopeful for the residents in this district.

At about this time, just when everyone was expecting work to be commenced, the sensational articles on motor buses, declaring that tramways were already obsolete and would stand no chance with automobile traction, appeared in certain papers, and the local council took fright at these, and in spite of very vigorous protests in the local press on the part of indignant ratepayers, abandoned the [illegible] with the British Electric Traction Co. whereby the latter would run a [illegible] expected tramway [illegible] benefit from the [illegible] satisfactory and adequate, but could never hope to serve the district anything like so well as the system of electric tramways which had been agreed upon.

Testimonial to Mr. Brockway.

At the first meeting of the executive committee of the Street Railway Accountants' Association, which was held after Mr. Brockway's retirement as acting secretary, in which position he had kindly consented to serve until Jan. 1, 1905, resolutions in recognition of Mr. Brockway's services to the association were adopted, and the earliest opportunity taken of presenting a handsomely engrossed copy to him. The text of the resolution and preamble is as follows:

Whereas, Mr. W. B. Brockway has held the office of secretary and treasurer of the Street Railway Accountants' Association of America since its organization in 1897, and

Whereas, The formation of this Association was due in large part to the suggestion and initiative efforts of Mr. Brockway, and

Whereas, The present highly satisfactory condition of this association is due in a very large degree to his zeal, undivided interest and discriminating judgment, uniformly exhibited in the discharge of his duties as secretary and treasurer of this Association, to his activity and success in securing and retaining the interest and support of the street railway fraternity of this country in the work of this Association, and to his valuable aid and energetic and capable handling of the work, and

Whereas, He has found it necessary, owing to the pressure of his business, to resign from the office of secretary and treasurer of this Association, therefore be it

Resolved: That the Executive Committee of the Street Railway Accountants' Association of America, on behalf of the Association, express to Mr. W. B. Brockway its appreciation of his skill and knowledge so freely placed at the disposal of the Association, and its thanks for his time and energy so unbegrudgingly offered during the years he has acted as its secretary and treasurer.

W. G. Ross, President. Elmer M. White, Secretary.

National Electric Co. Reorganized.

President Beggs, of the National Electric Co., Milwaukee, April 27th, issued a statement announcing the reorganization of the company as follows:

"At a special meeting of the board of directors of the National Electric Co., held this forenoon, the resignations of S. W. Watkins as director and president, F. G. Bigelow as director and chairman of the board, F. C. Randall as director, vice-president and general manager, and Gordon Bigelow as director, were presented and accepted.

"The vacancies were filled by the election of John I. Beggs, Charles F. Pfister, Frederick Vogel, jr., and J. H. Van Dyke, jr., as directors. John I. Beggs was then elected president of the company and J. H. Van Dyke, jr., vice-president.

"The resignations of A. N. McGeoch and B. T. Becker were likewise presented, but were not acted upon by the board.

"The business of the National Electric Co. will be actively continued and all contracts now on the books of the company promptly completed. The indebtedness of the company is now being ascertained by the new management and as soon as it is fully known a meeeting of the creditors will be called to consider the best course to be pursued for the protection of all creditors and for the future welfare and progress of the company.

"The National Electric Co. is one of the important and promising manufacturing industries of Milwaukee, employing a large force of skilled mechanics, and the new management will make every effort to preserve and increase the business of the company, believing as they do that it can be made one of the most profitable manufacturing enterprises in the city of Milwaukee."

Mail service was instituted on the lines of the Conneaut & Erie Traction Co. beginning May 1st.

Some Operative Features of the Aurora, Elgin & Chicago Railway Co.

Nearly three years of exceptionally successful operation, with a steadily increasing passenger and freight traffic, has brought about some few necessary changes in the engineering details and operation methods on the system of the Aurora, Elgin & Chicago Railway Co. At the time this road was put in operation a comprehensive description of its construction details was printed in the "Review" (Aug. 20, 1902, p. 441). It may be of interest, however, to review briefly the general description of the installation, and in connection with the description enumerate changes and additions which have been made since the former article was written.

The territory served by the Aurora, Elgin & Chicago system, extending westward from the Loop district in Chicago to the several terminal cities in the Fox River valley, 40 miles distant, was at the time this road was built very well served by five nearly parallel

RURAL STATION

steam railway trunk lines, but being constructed with a view to exceptionally high average speeds, this electric road has been able to offer a schedule between its terminal cities equaling the time of the limited trains on the paralleling trunk lines and furnishing more frequent service.

The general plan of the road conforms to the outline of the letter Y, with the Fifth Ave. terminus in Chicago as the base of the Y; the Metropolitan West Side Elevated Railway Co.'s two and four track lines to city limits and the double track route of the third-rail line to Wheaton as the vertical portion of the Y, and the two single track branches, one from Wheaton northwest to Elgin, 16½ miles, and one from Wheaton southwest to Aurora, 14½ miles, as the upper portion of the Y. A seven-mile branch connects the city of Batavia on the Fox River with the main line of the Aurora branch at Eola Junction.

These western termini are all served by the Elgin, Aurora & Southern Traction Co., whose north and south line parallels the Fox River from Yorkville north through Aurora, Batavia, Geneva, St. Charles, Clintonville, Elgin and Dundee to Carpentersville. This Fox River line is 40 miles long, and is controlled by the same interests as the Aurora, Elgin & Chicago, as are also the city lines in Aurora and Elgin.

The distance from Chicago to Aurora is 39.5 miles, to Elgin 41.5 miles, to Wheaton 25.4 miles, from all of which points competing steam lines offer transportation on limited express trains. There are in all about 20 towns which are served by this system, half of which may be said to be purely suburban resident towns, whose inhabitants make the journey to and from the Loop district of Chicago each day. The system also serves four large cemeteries 10 miles west of the Chicago terminus, two other cemeteries 15 miles west of Chicago, and several country clubs and recreation parks, among which are to be mentioned the Harlem Race Tracks, Glen Ellyn Lake and Park, Chicago Golf Club, Wheaton Golf Club, Riverview Park and Mill Creek Park near Aurora, Lords Park near Elgin, and Glenwood Park near the power house at Batavia. The four latter named parks are operated by the electric railway management, and have been found to be successful ventures. The natural beauties of these parks, located on the banks of the Fox River, renders them suitable locations for the annual picnics of the large fraternal societies of Chicago, and the company thus profits by the long haul of 40 miles from the city.

The final location of the right of way for this system was not decided upon until exhaustive surveys and reconnaissance work had been completed. During the period of preliminary engineering and estimating all plans were made with a view for high speed operating conditions, with all proper safety. From the western limits of Chicago to the Fox River valley exceptionally few breaks occur in the alignment, and the roadbed was built with a limiting gradient of 1 per cent, this being exceeded in but one short climb out of the Fox River valley. All intersecting tangents have been joined by curves having the longest possible radii, so that there are but few portions of the line which cannot be taken at high speeds. At all railway crossings, where possible, the grades of the intersecting lines are separated. Those crossings at which the grades are not separated are protected by derails and interlocking signal apparatus, maintained jointly with the intersecting steam lines.

Track and Roadbed.

The construction of the roadbed followed the most thorough and up-to-date standards of single and double track steam railway practice. Wherever there was sufficient head room, bridges were built with ballasted floors. All piers, abutments and retaining walls are of concrete with steel reinforcement where necessary. The line is

CABLE AND TRENCH.

laid throughout with 80-lb. T-rails of the A. S. C. E. standard section, in 60-ft. lengths. The joints are made with 4-bolt angle bars and bonded up to the equivalent cross section with concealed, expanded terminal bonds. The entire line is gravel ballasted except on the sections near the Fox River, where crushed limestone, taken from the cuts, is used.

A special 0.10 per cent carbon steel weighing 100 lb. per yard and supported at a distance of 19⅛ in. from the gage line of the surface rail, and 11 3-16 in. above the ties, serves for the working conductor. There are several types of third-rail insulators used on different parts of the system. Each type has its advantages and disadvantages. Those having wood as an insulating medium have occa-

sionally caught fire and burned, while those using special insulating compounds have developed a mechanical weakness.

At the wing fences of all highway crossings and at [illegible] and similar places it was necessary to discontinue the third rail and allow the car to cross the break under its momentum. At the farm crossings these breaks are 33 ft. long, one rail length having been left out of the third rail. Wherever these breaks occur the ends of the third rail are electrically joined by insulated underground cables varying in cross section from 1,500,000 to 50,000 c. m., depending upon the probable carrying capacity needed at the individual points. Part of these cables are insulated with rubber and part with paper, covered with sheathing of lead and protected by woven jute. Some trouble has been experienced with leakage and burning out of the cables as originally installed. This is thought to be due to electrolysis of the lead sheath and a possible admission of moisture to the special terminal which protects the end of the cable and furnishes a connection point for the bond between the ends of the cable and the third rail. Several different methods of installing these cables and different terminals have been tried with varying success.

SUBWAY NEAR ELGIN

The following described method of installing crossing cables has now been used for a year and has proven itself to be a safe one: The lead and jute covered insulated cable is drawn through a conduit of bituminized fiber and placed in the trench about three feet deep. This conduit is in 7-ft. lengths with special joints and elbows for turning the angles at the terminals of the cable. When the conduit and cable are made up and finally placed in the trench, all the joints of the conduit are grouted and anchored in a bed of concrete. In place of the old scheme for running the vertical portions at the ends of a cable in cast iron pipes strapped to ties buried in the ballast, the present arrangement has substituted for this a plank box, rectangular in section, which furnishes drainage for the cable terminal and a firm base for the lower collar of the cable-head to rest upon. A special design of cable terminal manufactured by the Ohio Brass Co. is now used.

The third rail is bonded at each joint with two 500,000 c. m. solid terminal foot bonds expanded hydraulically into holes hydraulically punched through the base of the rails. These were furnished by the Mayer & England Co. At the sub-stations the third rail is broken and fed in each direction. On the double track portion of the line no electrical connection is made between the two third rails, which are both in the "devil's strip." In event of third-rail short circuits, this allows the troublesome portion to be more easily cut out.

At all important highway crossings, and other points where cars stop, platforms of plank with a protecting railing have been built, and at nearly all of these platforms small wayside shelter houses have been erected. An accompanying illustration is a typical view of such a stopping point. Warning signs are placed at all crossings, and those stations at which limited trains do not stop are indicated by a neat sign about two feet square. The crossing signs are of a permanent design, being made of steel throughout and securely set in the ground. Pedestrians are cautioned against trespassing on the tracks by [illegible] on a black background [illegible] tected by [illegible] and a series of five lights enclosed in a suitable box. These are automatically [illegible] is connected to [illegible] crossing [illegible] rail and energized with current from the shoes of a passing car.

Terminals.

There are terminal buildings at the ends of all branches of the system. The Chicago entrance for the line is over the Metropolitan West Side Elevated structure from the incline at 52d Ave. to the new joint terminal station at Fifth Ave. near Jackson Boulevard. This terminal [illegible] March, 1905, page 182.

In the center of the cities of Aurora and Elgin, at the terminus of each of these two routes, terminal stations are operated jointly with the Elgin, Aurora & Southern Traction Co. At Aurora a store front is used and in it are located a restaurant, a notion store, waiting room and ticket office. All the city cars pass this building. It serves as a terminus of the Aurora, Elgin & Chicago line, the Fox River lines and the Joliet, Plainfield & Aurora Railroad Co.

The terminal building in Elgin extends through the block from the main street, where the city cars and those of the Fox River lines pass, to the right of way of the Aurora, Elgin & Chicago line, which is between the rear of the building and the Fox River.

In order to gain an entrance to the center of the city of Elgin and remain on a private right of way, it was necessary for the company to purchase a mile of river front, from the terminal station south, and build a roadbed high enough to avoid trouble from floods. An accompanying illustration shows the roadbed at nearly the southern end of this piece of construction work. There were in all about 200,000 cu. yd. of embankment required at this point. This filling material was obtained from the deep cuts which it was necessary to make in order to obtain a gradual rise out of the Fox River valley. Within a few miles south of Elgin the line intersects the Chicago Great Western Ry. and the Chicago, Milwaukee & St. Paul Ry. At each of these crossings the electric track passes under the steam track and substantial subways have been built, one of which is illustrated.

The terminal of the Batavia branch is on the main street of the city and at the east end of the highway bridge over the Fox River.

ROADBED NEAR ELGIN

This building, which is illustrated, is of native stone, three stories in height. The lower floor is on a level with the tracks which extend under the shelter of the building. On this floor is a restaurant. The second floor is on a level with the street and is utilized as a waiting room, ticket office and news stand. The third floor is leased to a telephone company for its Batavia central office. The Fox River line is about three blocks west from the Aurora, Elgin & Chicago terminal and across the river. This line also has a waiting room and station on the same street as the one which has just been described.

Train Service.

Since May 11, [illegible], when a new schedule was made effective, both limited and local service has been offered between the Fox River terminals and the Fifth Ave. terminal, in Chicago. Trains are also run for handling milk, freight, express and newspapers. The first train in the morning arrives at Chicago at 6 o'clock and

INTERIOR OF BUFFET CAR.

trains leave Chicago at night up to 1 o'clock in the morning. The week day schedule furnishes hourly trains from Elgin and Aurora, to Wheaton and Chicago. The trains leave Elgin at the even hour and Aurora at 30 minutes past the hour. There are two limited trains from each of the Fox River terminal cities, towards Chicago at the morning and from Chicago at the evening rush hours. These are sandwiched between the regular hourly trains from each of these termini. This combination furnishes regular half hour service between Wheaton and Chicago throughout the day, except during the morning and evening rush hours, when the addition of limited trains makes the headway 15 minutes. The local cars are scheduled to make their run between Elgin or Aurora, and the Fifth Ave. Terminal, in Chicago, distances of 41.5 and 39.5 miles respectively, in 1 hr. 25 min. The limited trains make but three stops between the Fox River valley points and Chicago; these are Wheaton, Glen Ellyn and Lombard. The limited running time is 1 hr. 10 min. A shuttle car on the Batavia branch furnishes hourly service during the middle of the day and half hourly service at rush hours, connecting at Eola Junction with the trains running between Aurora and Chicago.

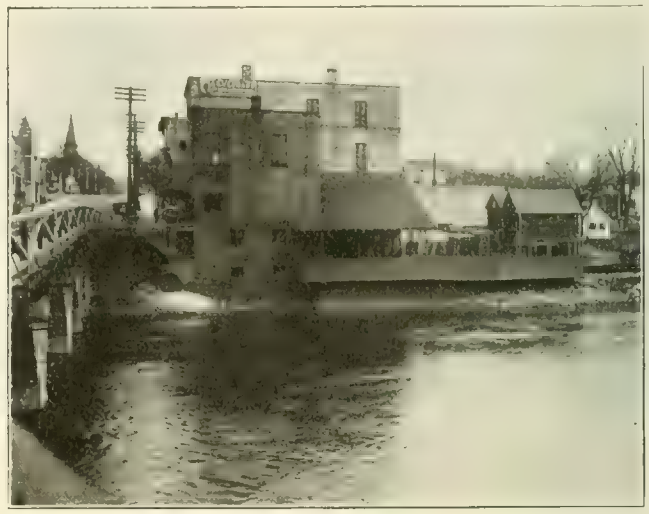
The General Electric Co. Type-M multiple unit control with which all cars are equipped, allows great flexibility in making up the trains for the different classes of service. During the morning and evening rush hours two and three car trains are needed in and out of Chicago. Part of these trains are broken up so that it is not necessary to dead-head any cars to the terminals for the limited service. This arrangement of schedule is such that during the entire day there are only 14 passing points on the single track portions of the road and these passings all occur on one of two sidings.

The Sunday schedule furnishes half hourly service between Elgin, Aurora, Batavia and Wheaton, and 15 minutes service between Wheaton and Fifth Ave., and all passings are made at the same two sidings, one of which, at Eola Junction, is a mile long. There are no limited trains on Sunday.

This week day schedule operating 24 regular trains each way and having only one passing point on each branch, which is used as a passing point but seven times during the day, and then only by limited trains, greatly reduces the element of danger from collision, and except in case of disarrangement of schedule, always assures a clear headway with but one car on each single track branch and a half hour headway on the double track branch. This allows for extra high speeds when necessary to make up time, the value of which condition is illustrated when it is stated that during the first month of operation no train was late into the Fifth Ave. terminal at Chicago. Extra cars are, however, kept at this terminal so that in event of incoming trains being delayed the regular train may still be sent out from the terminal at its schedule time. A car starter and an inspector are kept at the Chicago terminal to care for this end of the service and otherwise assist the dispatcher and repair department.

All excursion, theater, milk, paper, express and freight trains are run as specials. There are 34 standard passenger cars, 24 of which are equipped with four 125-h. p. motors and all are equipped with multiple unit control. Five of the trail cars which were last received are 53 ft. 3 in. long, 5 ft. longer than the earlier type, and are fitted with toilet rooms. The equipment for handling freight consists of a motor car and standard freight cars. This motor car weighs 40 tons and has four 125-h. p. motors geared to 40 miles per hour with Type-M control and M. C. B. couplers.

A passenger traffic soliciting department with an office in the Fifth Ave. terminal has charge of all arrangements for special



BATAVIA TERMINAL.

business and advertising. Illustrated pamphlets and standard folders are used. Time cards, showing the arrival and departure of all trains, are issued for each town served and the interesting points on the system are being illustrated on a set of souvenir postal cards. Several combination trips are specially advertised: The "pan handle" route from Chicago to Elgin, Elgin to Aurora on the Fox River line, and back to Chicago from Aurora via the third-rail line; the "Loop-the-loop" trip from Chicago to Joliet on the Chicago & Joliet electric railway, Joliet to Aurora on the Joliet, Plainfield &

FARM INSTALLATION.

Aurora line, then return to Chicago from Aurora via the third rail line; joint excursions by the third rail line and boats to the Lake Michigan points served by the excursion steamers. These special trips are advertised in the Chicago newspapers and by large posters on the bill-boards in the several terminal cities.

Both special and general freight are handled. The special freight consists of a milk business of about 225 cans each day, the transportation of express for the West Suburban Express Co. from Chi-

cago to the outlying towns where it is unloaded to delivery wagons and the carrying of the early morning newspapers from Chicago to all towns on the line. This newspaper train carries between 4 and 10 tons of papers each day. These are loaded by means of a special elevator, which raises them from the street to the level of the car floor on the elevated structure at Canal St. The company is [paid] for handling the newspaper and express matter at a set rate of so much per pound carried an unlimited distance.

The general freight handled consists of standard railway car loads which are transferred from the connection with the Chicago Junction Ry. and Chicago Great Western Ry., at Bellewood, to the Fox River valley. The Aurora, Elgin & Chicago has connections with six steam railways; Chicago Great Western Ry., Chicago Junction Ry., Chicago, Burlington & Quincy Ry., Illinois Central R. R., and two with the Elgin, Joliet & Eastern Ry. Some of the steam roads are now quoting freight rates into the electric railway company's cities and over its tracks; this traffic is initiated by the steam road solicitors and the proper mileage credited to the electric road.

All the train service is handled by a dispatcher in the office at Wheaton who records the time of each train as it passes the different points on the road and is reported to him by the sub-station and terminal attendants. A standard train sheet is used with additional ruling for recording the time during which the power may be off and the limits between which work trains are allowed to operate. One of these sheets suffices for 24 hours' operation. A combination train number and run number is used to designate the trains. Each motor car retaining the same numbers throughout the day, even for the east bound and odd for the west bound. This does away with the using of numbers running above 100 which would be needed ordinarily in designating in the usual way the large number of trains which are operated daily.

Train orders are issued by telephone and are copied on a special manifold blank. Each section of this blank consists of three sheets similarly printed, with proper spaces for the train numbers, meeting point, order number and signatures. The upper two of these sheets are made with carbon backs, so that when the order is written on the top sheet a like impression is made on the other two sheets. After having been repeated and checked, one of these sheets is given to the motorman, one to the conductor and the third is deposited in a locked box, to which no one but the superintendent of transportation has access. A train clearance order printed on yellow paper with space for the train number, date, signatures and time of leaving of the last train ahead is used.

Street and Residence Lighting.

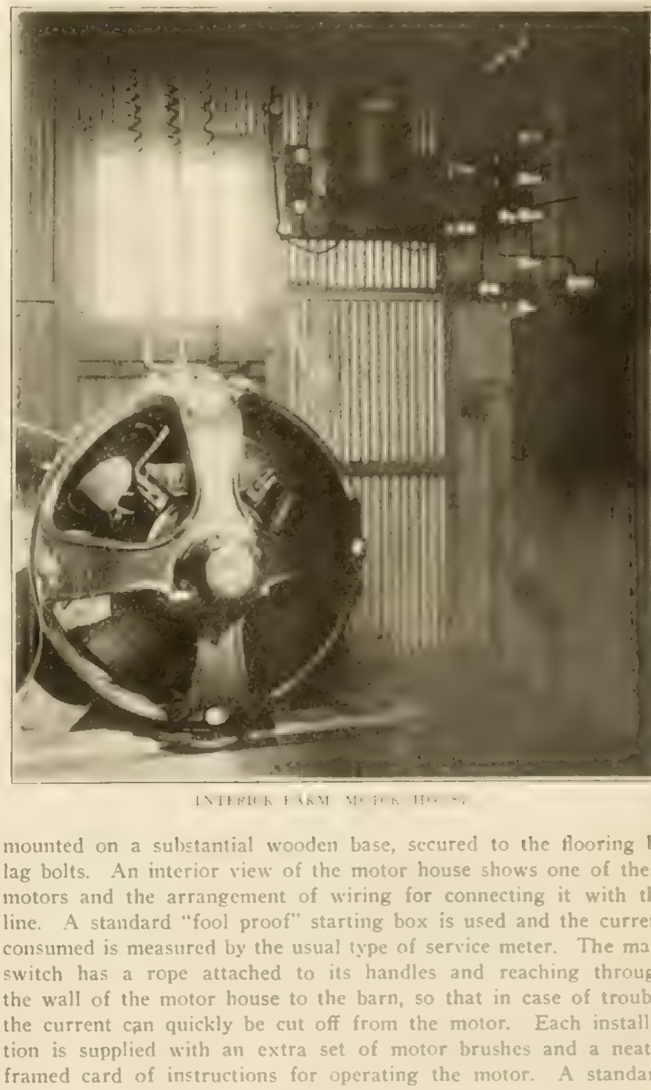
Steps are being taken to build up a lighting business in the many small towns along the route of the railway system. The company is now supplying alternating current for lighting the houses and streets of Wheaton, which city has heretofore been lighted by a municipal plant. This current is supplied by two motor generator sets with 220-h. p. induction motors and 150-kw., 4,000-volt self-exciting alternating current generators, which have been installed in one end of the Lombard station. This end of the station is entirely given over to the lighting apparatus. Current for operating the motor generator sets is taken from the 26,400-volt railway feeder circuit and reduced to 370-volts pressure by two three-phase air-cooled transformers. A neat switchboard of blue marble fitted with the controlling apparatus and feed wire switches stands between the transformers and the motor generator sets.

The distance from the Lombard sub-station to Wheaton is about eight miles, and the current is carried on a 3-phase 4-wire line between the two towns. Three aluminum wires carried on porcelain insulators are placed on a single cross-arm just below the railway high potential feeders, and the track rail is used as the grounded neutral for this 3-phase 4-wire feeding circuit. For adjusting the voltage at the point of distribution and for regulating it for lighting service, a General Electric Type-TA regulator is used, compensated for the line drop in the eight miles. This regulator so adjusts the resistance in the field circuit of the exciters of the fields of the alternating current generators in the motor-generator sets that very slight variations in voltage occur at the distribution point of the lighting service wires.

Farm Installations.

At many points along the line current is being taken from the third-rail for use in driving motors for operating farm machinery. There are now about 20 such farm installations scattered throughout the direct current distribution system. The current consumption of the motor [illegible] per month. [illegible] near Elgin [illegible] line, carrying the feed [illegible] one-half mile. In connecting these installations with the third-rail, it has been found necessary to run a second wire back to the track rail because of the difficulty in obtaining a ground of sufficient conductivity to at all times of the year handle the return current, some of the installations being 1½ miles distant from the railway track.

The motor house shown is about 6 ft. sq. and 8 ft. high, placed about 30 ft. from the barn. A corrugated iron belt box connects the motor house with the barn, and inside the barn mounted on brackets is a line shaft with a number of different pulleys for driving the several kinds of farm machinery, such as feed cutters, fanning mills, corn shellers, circular saws or force pumps. A belt connects the pulley on the line shaft with the pulley on the motor. Fifteen and 20-h. p. motors are used for this class of service. These are the standard [illegible]



INTERIOR FARM MOTOR HOUSE.

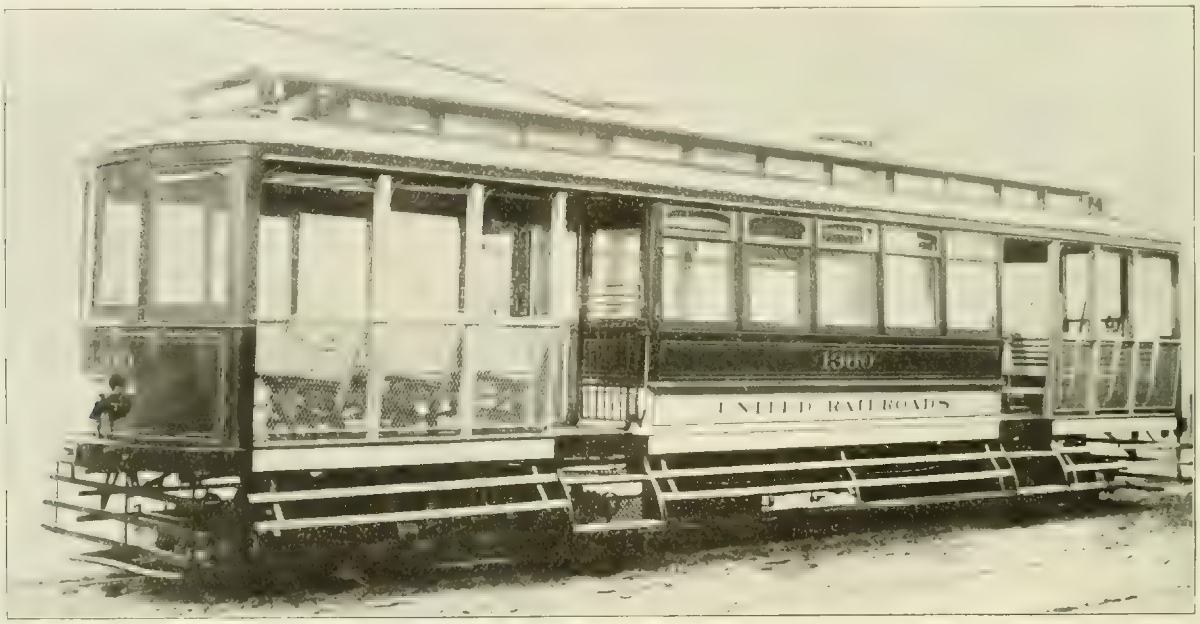
mounted on a substantial wooden base, secured to the flooring by lag bolts. An interior view of the motor house shows one of these motors and the arrangement of wiring for connecting it with the line. A standard "fool proof" starting box is used and the current consumed is measured by the usual type of service meter. The main switch has a rope attached to its handles and reaching through the wall of the motor house to the barn, so that in case of trouble the current can quickly be cut off from the motor. Each installation is supplied with an extra set of motor brushes and a neatly framed card of instructions for operating the motor. A standard railway lighting railway arrester mounted on the pole nearest the motor house protects the apparatus.

This method of operating farm machinery is not an expensive one where such work must be done as on the large diary farms in this district, the expense of course varying with the amount of work done. It is stated that the average cost to each farmer is about $3 per month, and even though the cost of installation be charged to the first year operating expenses, there will still be shown a saving of about $400 for the year, over and above that ordinarily spent for manual labor and traction engine power. In each case the expense of installing the motors and other apparatus and the cost of construction of the feed line, outside of the right of way, is paid by the customer. Current is sold at flat metered rate with a specified minimum amount. It is thus seen that very little extra office work and outlay are required to bring in a steady income from the sale of this class of power.

Standard Type of Cars for City Service for United Railroads of San Francisco.

Among the various improvements which the United Railroads of San Francisco has made within the past two years, is the adoption of a standard type of car for city service. The style which was adopted after careful consideration is that shown in the accompanying engravings.

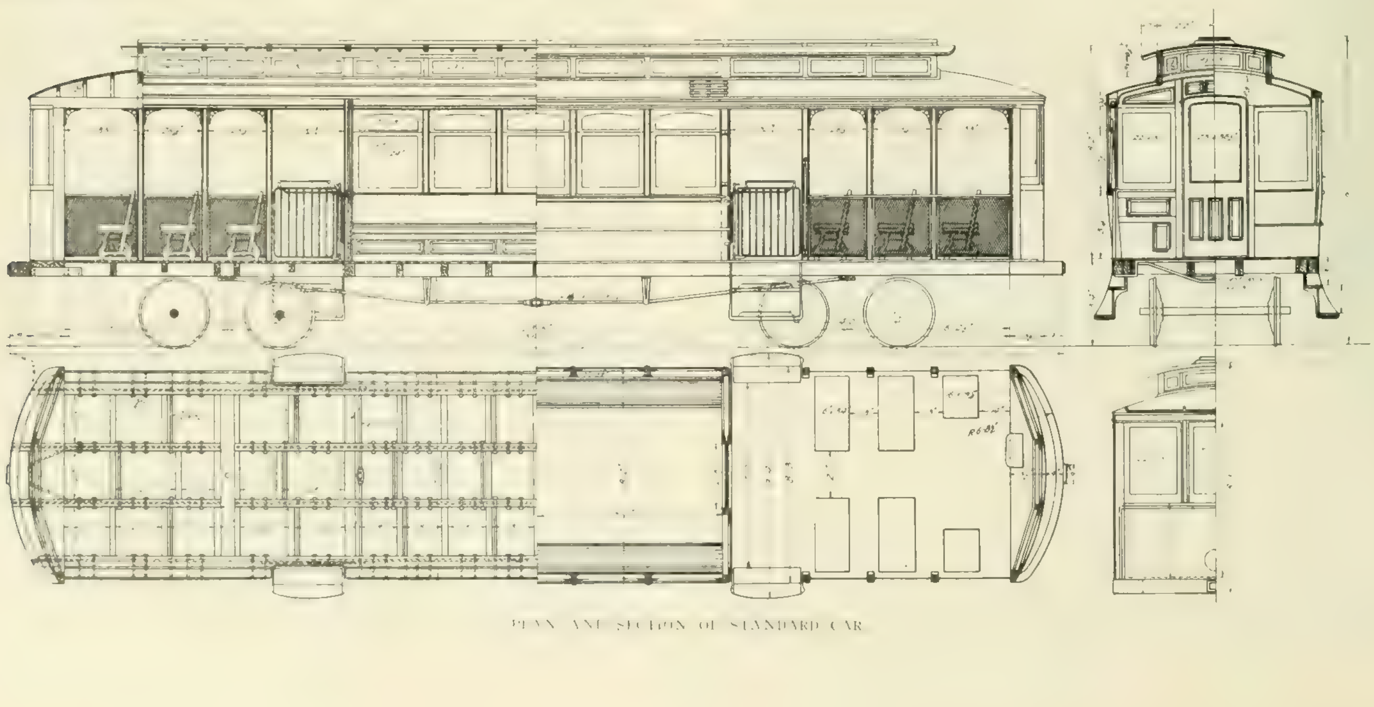
This car is a combination car with a closed section in the center, and an open section on each end, with the steps next to the closed section. This type has been adopted to accommodate the many



STANDARD CAR FOR UNITED RAILROADS OF SAN FRANCISCO.

open air riders and smokers. The climatic conditions are such that a person can ride in the open section during the most severe weather, without extraordinary discomfort. In case of heavy rain the duck curtains in the open sections may be drawn down. The steps are placed next to the closed section so as to allow the greatest rapidity for loading and unloading. Passengers get on and off at both ends, on the right hand side, the gates on the left hand side being closed except when the car at the terminals. The screens and gates on open sections prevent passengers from falling off on curves, as was often the case with the old style of car.

The cars illustrated were built by the St. Louis Car Co. The bottom framing of these cars consists of four 6-in. I-beams with .23-in. web and 3.33-in. base, running the entire length of the car. The two center I-beams are 11 in. from the center, and the two outside ones are 39 in. from the center. Each I-beam is filled with Oregon pine in one piece, for framing in the cross sills. In addition there is an outside sill on each side of Oregon pine 4 x 6-in., in three pieces, one extending the entire length of the closed section, and the other two extending from steps to corner vestibule posts. Outside of this there is a steel plate ⅝ x 6 in., extending the entire length,

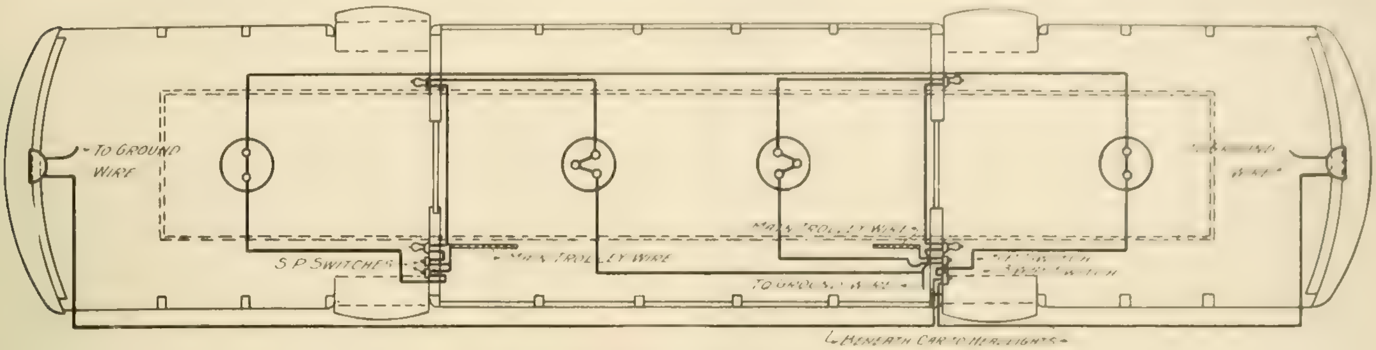


PLAN AND SECTION OF STANDARD CAR.

and bent in where the steps cut into the sill. The [illegible] white oak 2¾ x 6 in., framed into the wood fillers of the I beams about every 27 in. The whole framing is tied together with [illegible] countersunk head bolts.

The posts are concave both in open and closed section. The corner posts are 3¼ in. and all side posts are 3 in. thick. Straight grained white ash is used for posts.

The moldings, panels, sash, etc., are of cherry. The ceilings are three-ply birdseye maple veneer. The closed section has longitudinal rattan seats, and open sections contain cross wooden seats. The seats are of the Hale & Kilburn make.



CAR WIRING FOR LIGHTING CIRCUITS.

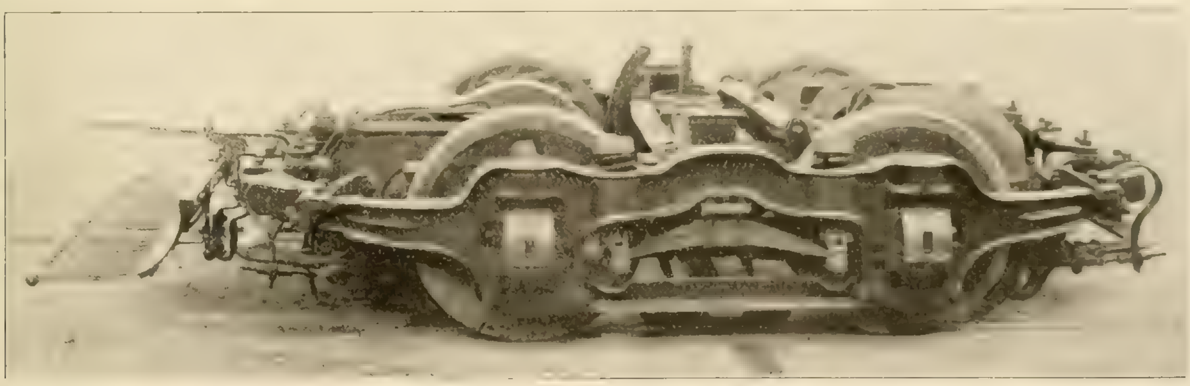
Sterling Meaker Co. double registers are used; the "Never Slip" detachable register handles were also furnished by the Sterling Meaker Co.

The trucks were built by the Peckham Manufacturing Co., and are known as the 14-B-3 "San Francisco Special" type. The wheel base is 4 ft. 1 in., 30-in. wheels being used. The trucks are equipped with the Douglas track brakes and fenders. A few of the special features of the trucks are the special heavy ribbed side frames, with ends bent in to give clearance for the car steps on sharp curves; coil springs under and over journal boxes, and the arrangement of brake rigging; heavy springs. The fenders may be dropped by an object striking the guard attached to bumper of car, or by the motorman's trip.

Four G. E. 1000 motors, K-12 controllers, M. Q. circuit breakers, grid resistances, etc., comprise the electrical equipment. The gear ratio is 16:67. National Electric Co's. air brakes are used in addition to hand lever track and wheel brakes.

The total weight of car is 40,000 lb. and it has a seating capacity for 42 persons; the full load capacity is about 100, although as many as 140 have crowded on the car. The average speed is 10 miles per hour including stops, for regular city service. Grades up to 12 per cent are successfully operated over.

Owing to the strike of Chicago teamsters and the difficulty in getting freight hauled to the freight depots, an electric car was loaded with fruit and other perishable goods and shipped to Joliet.



PECKHAM 14-B-3 "SAN FRANCISCO SPECIAL" TRUCK.

Correspondence.

MUNICIPAL OWNERSHIP AND OPERATION.

Editor Review:

I [illegible]

I [illegible] but possibly it may be, at least after a while, and under really good civil service regulations which are hard to maintain in a country where the public is without discipline or habit of obedience. To me a plan preferable to municipal operation would be for the municipalities to own the track and generating plant, feed wires, etc. They could then absolutely control the traffic, including its locality and direction, and in case of traffic being stopped or interrupted by an improvement or alteration of any kind the people would be satisfied to hold themselves or their representatives responsible. Owning the tracks, the city could lease their use under proper arrangements for a reasonable number of years to the party operating, who should own the rolling stock. Such a plan gives the municipality a certain revenue without unjust burden on the operating company, which is enabled thereby, being relieved of paving, cleaning, street watering charges, etc., or taxes on what it does not own or control (the streets) to give the people lower fares and better service.

This is the plan pursued in Manchester, England, and it works well and in my opinion is much better than placing the operating men in the hands of American politicians, although, as Mayor Dunne intimates, they are generally and often very much controlled by the same people at present. I have had a great deal of this kind of humbug to contend with to the detriment of the service.

Municipal control may work all right with water, gas and light but my opinion is it will be a failure with street surface railways, or railways in general. Belgian railways are controlled by the government and they are terrible as compared with privately operated railways of France, though the people are similar in their leading characteristics.

T. J. Nicholl.

INSURANCE FUND AND DEPRECIATION RESERVES.

Editor "Review":

In [illegible] information as to the plans of the Augusta-Aiken Railway & Electric Co. for taking care of depreciation and providing an insurance reserve fund, I would reply as follows:

As stated in our annual report, beginning with Jan. 1, 1905, a depreciation fund has been provided, the plan being set out more in detail in the following extract from the report:

"Your company has been carrying $435,104 of insurance upon Hampton Terrace Hotel and contents. The premiums thereon amounted annually to $13,053.12. On your railway companies you have carried insurance in value to $243,750, and paid premium annually amounting to $2,334.76. Upon investigation your board deemed it wise to reduce some of the insurance, and in lieu thereof to organize some of the employes of your hotel into a fire brigade. The organization of this brigade will result in very little excess cost in point of wage, and will reduce the amount of premiums paid by a very considerable amount. A certain sum per annum in the past has been set aside by your company to meet depreciations, and an arbitrary monthly charge has been set aside to meet accident liabilities. Beginning with January, 1905, a committee of Insurance Fund Trustees has, by resolution, been created. Into their hands it has been decided to pay a fixed sum as a guarantee against accident loss, and a percentage of gross receipts as a renewal or depreciation insurance. There will also be paid to these trustees the difference in premiums for fire insurance heretofore paid and what will be paid under the new plan. It is intended to found an insurance fund which it is hoped may in course of time be able to protect the company to a considerable extent against possible fire and other loss."

The plan as proposed in our annual report has been with me the outgrowth of a study of years in connection with the question of fire insurance, accident liability and depreciation or renewals These are all conditions that cannot be avoided; they have to be met daily. It has been the custom with most roads to meet this form of fixed charge by an annual appropriation at the end of the fiscal year, which appropriation has depended almost entirely upon the surplus earnings of the year. To the writer's mind, these charges are so necessarily "fixed" as to make it most advisable that they be charged monthly in the nature of an operating expense.

First, as to the accident feature: This company has found, after an experience of years, that the sum of $12,000 per annum has been more than sufficient to meet its accident liabilities. We have therefore adopted the policy of paying arbitrarily to the Insurance Fund Trustees the sum of $1,000 monthly on account of accident liability and from these deposits it is expected settlement of damage claims will be made.

Second, as to the question of fire insurance: These companies own considerable real estate, particularly Hampton Terrace Hotel. On this latter property we have had to pay very large insurance premiums annually. Much of the insurance was surplus line, and had to be carried in foreign companies, and companies not recognized by the Tariff Association. In the event of fire it might have been possible to have collected all of such insurance, but, upon investigation, I doubted it. We have improved the fire service—if I may so call it—by organization of our watchmen into a fire company, and have installed all fire-fighting appliances that could be made available in case of fire. We have reduced the sum total of insurance carried so as to bring the insurance within the limit taken by old line companies, leaving out a greater part of the surplus lines. We charge ourselves with the full premium; the difference, however, between the premiums actually paid and the premiums charged is paid into the hands of the Insurance Fund Trustees.

Third, as to the item of depreciation: On the railway property we are charging 2½ per cent of the gross income as an annual operating expense, this 2½ per cent being paid into the hands of Insurance Fund Trustees. Extraordinary renewals will be paid for out of this fund. Ordinary maintenance, however, will not be relieved by calling upon such a fund. The Insurance Fund Trustees deposit the money in their hands as a saving fund account, which draws interest, and any surplus that they have they will invest preferably in the securities of the company.

Fourth, as to the items charged for depreciation: That has been fixed for this year, as stated, at 2½ per cent of the gross receipts on the railway department; another percentage on the lighting department, and still another percentage on the realty holdings of the company. Time may demonstrate that this percentage is too small or too large; it can be fixed by the Board of Directors, however, at any time to suit the requirements and needs of the company.

We anticipate that at the end of the fiscal year 1905 we will show quite a surplus in the hands of the trustees.

Yours truly,

John Blair MacAfee,

Augusta, Ga. Pres., Augusta-Aiken Ry. & Elec. Co.

PURCHASING AND STOREKEEPING.

Editor "Review":

Among the various departments of a traction system there is one, the purchasing department, that deserves more recognition than it receives. The important part it plays can be only too readily realized by glancing over the store room records, power house logs, and track and line reports. One need only to catch a glimpse of the folios in the bill book or voucher record to satisfy himself what accounts for a good portion of "expense."

The vital question is not necessarily how much is bought or how much is paid for what is purchased, but how long and well that lasts which costs the price, because the best things are the cheapest in the long run. It is for the purchasing department to answer this question. In charge of this department should be a man who has had practical experience along both clerical and mechanical lines, who is generally enlightened on the traction business in all its branches. It is often the case that the purchasing agent is an office man, possessing little or no knowledge of the mechanical and electrical features of rolling stock, track, line or power equipment. A purchasing agent should follow up the material as closely as possible in order to ascertain whether or not the goods bought are giving satisfactory service and lasting their time. Without that knowledge he cannot do these things. With it, and by keeping in touch with current market prices, he is enabled to buy the best quality of material for the least money, thereby making the purchasing department as nearly self-supporting as possible, and simultaneously earning money for his company, for money saved is money made. Aside from these advantages, he is able to buy intelligently, as he knows whether or not he is getting his money's worth. The purchasing department is of benefit not alone to the company, but to the commercial world at large. It is the go-between of buyer and seller, affording the latter a better opportunity to make his quotations and demonstrate the merits of his goods. All this, of course, could probably be accomplished through other departments and capacities, but not with that clearly defined resultant "system."

There are too many other duties and details presenting themselves, and the correspondence becomes more or less divided. Then, too, it may be added, that without this system there is a tendency to hold over orders, which is often detrimental to the successful operation of the road, as certain repairs must be left undone and rolling stock probably tied up until the material is on the ground. This, however, is not always due to negligence on the part of the one who may be supposed to perform such work, as he may have good reasons for holding certain orders, and may not be aware of the fact that the material is urgently needed. For that reason it is good policy to keep well stocked by ordering supplies ample time in advance. This gives the buyer a better opportunity to secure quotations, with the results that he will know where to buy the most and best goods for the least money, and make the purchasing department or its equivalent an expense reducer instead of producer.

Yours truly,

Wheaton, Ill. D. C. Hinstorff.

Under the direction of their professors, 78 students from the engineering department of the Ohio State University made a complete efficiency test of the system of the Scioto Valley Traction Co., April 21st. Men were placed at the power station and upon each of the cars on the Lancaster and Circleville divisions. The number of passengers, the amount of fuel used, the distance traveled and the load carried were carefully recorded.

United Railways Co. of St. Louis.

April 10th, the North American Co. assumed control of the United Railways Co. of St. Louis, electing a new board of directors. The officers and directors of the company as reorganized are as follows:

President, John I. Beggs, succeeding Murray Carleton; vice-president and general manager, Robert McCulloch, re-elected. Directors: John I. Beggs, succeeding A. D. Brown; James Campbell, Robert McCulloch and Murray Carleton, re-elected; H. S. Priest, succeeding C. H. Spencer; W. V. A. Powelson, succeeding G. L. Edwards; George R. Sheldon, succeeding E. H. Conrades; W. H. Thompson, succeeding O. D. Smithers; Festus J. Wade, succeeding F. E. Marshall; C. W. Wetmore, succeeding James Brown.

Photographic Contest.

The Boston & Northern and the Old Colony street railways have a plan for making the people of Massachusetts acquainted with the beauty spots along their lines by means of a photographic contest, open to amateurs only. These two roads run through scenes of natural beauty which cannot be surpassed in Massachusetts, and it is to find out what spots appeal most to lovers of beauty that this contest has been started. There are everywhere, along the routes of the trolley, scenes that only need the appreciation of the photographer to bring them into prominence, and it will be interesting to observe what particular sections of these two lines are most favored. On every hand there is plenty of artistic material waiting for the appreciative to bring it into notice. The companies offer liberal prizes in cash and goods to those who take pictures that have real artistic merit and which show the most beautiful spots along their lines, no other restrictions being placed upon the field of the amateur photographer's operations. We are advised by R. H. Derrah, the passenger agent, who has the contest in charge, that the following conditions will be observed. Photographs must not be less than 4 by 5 in., nor larger than 8 by 10 in. in size. They must be printed on matte surface paper and mounted, and on the back of each must be plainly marked the location of the photograph and the name and address of the sender. Thomas Harrison Cummings, editor of the "Photo-Era;" George R. King and F. E. Bowman, all three well-known in the photographic world, will act as judges. The contest will close Sept. 1, 1905, and all photographs are to be addressed to the Boston office of the Passenger Agent, 309 Washington St., Boston, Mass.

Mayor Johnson's Plan.

Mayor Johnson, of Cleveland, has proposed a scheme to secure what he calls practically municipal ownership of the street railways in that city, which is substantially as follows: The street railway company is to surrender all its franchises and receive a new grant for a 25-year franchise covering all lines, on a 5-cent fare basis. The company is then to lease this property to a trust company with a nominal capital to have for its members from six to ten men, each of whom must be acceptable to both city and company. The present owners to receive a guaranteed dividend on a capitalization to be agreed upon. The city to have the right to buy the property, in case it be given authority so to do by the state, at a price to be named in the lease. The operating trust to keep the property in first-class condition and make needed improvements and extensions. In event of default in rental or failure to properly maintain the property, it will revert to the present owners until the expiration of the franchise term.

Park Improvements at Baltimore.

Mr. W. A. House, general manager of the United Railways & Electric Co., of Baltimore, advises us that the company plans to expend about $10,000 in improving its pleasure resort called Riverview Park. To the present dining hall in the park which now has over-all dimensions of 106 x 105 ft., will be added a large shelter pavilion of a pleasing design. The front of this addition will extend for 135 ft. along the river bank, and the depth of the new portion will be 95 ft. This shelter pavilion will be built in the form of a rectangle, closely joined to the dining room building so that in event of shower a large [illegible] available. The main floor of the [illegible] the level of the ground and [illegible] from the ground to the porch floor [illegible] part of the building and extending [illegible] This porch will be 15 ft. wide and [illegible] will afford protection from the weather. [illegible] for its outer support a row of posts extending around the building and spaced about 11 ft. between centers. [illegible] part of the building will be supported on six combination wood and steel trusses spanning the room from side to side. The roof will be covered with a sheathing ⅞ in. thick by 3 in. wide. The columns which support the roof trusses will be of wood 8 x 10 in. in section and will stand upon concrete piers [illegible] deep.

European Notes.

At Potsdam, Germany, there has recently been an agitation for the substitution of electric traction to replace the present animal traction. In the preliminary plans it was found that it would be necessary to cut down an old historical lime tree, but the Emperor has opposed this plan and will not allow the lines in the neighborhood of his palace to be operated by mechanical traction. The cheapest alternative plan will call for an expenditure of £60,000, of which the Emperor declines to contribute more than half. As the other half could only be obtained by tax on the residents of Potsdam, at the rate of £1 each, they feel that this method of preserving historical objects is too expensive.

At Monheim, Germany, there has been put in service a trackless trolley system, the details of which are interesting. The new line connects Monheim on the right bank of the Rhine with the Langenfeld station, about 2½ miles distant. Current is supplied for this line and for lighting and industrial power purposes from a central station at Solingen. The present rolling stock of the road consists of one motor car for passengers and one freight locomotive with freight cars. The passenger car is provided with one 45-h. p. motor and has a seating capacity for 25 persons. This motor car is arranged to pull a trailer having a like seating capacity, at a speed of 12 kilometers per hour. Tho locomotive is equipped with two 40-h. p. motors and pulls a fully loaded train at a speed of 7½ miles per hour. During the four months of working this line has carried 13,000 people paying at the rate of 6 cents for adults and 4 cents for children.

It is rumored that the electrically equipping of some portions of the Siberian railway is now being considered, but no definite plans for proceeding with the work and supplying the power have been made.

In a recent report on Electric Traction for Tramways, written by Mr. F. Paul Du Bois, engineer of the Orleans Railway Co., France, some interesting operation figures are included. On the Quai d'Orsay-Austerlitz line, in 1903, the cost per train-kilometer was .8268 franc, and by adding to this the interest and sinking charges at 5 per cent, the total expenditure per train-kilometer was 1.32 francs. It is stated that for steam operation this cost would have been at least 1.35 francs. The Orleans company is considering the electrically equipping of its Paris-Juvisy line to be supplied with power from the present generating station.

On the Paris Metropolitan railway, in 1903, the cost per train-kilometer was 1.04 francs, not including the interest and sinking charges, which are fairly large.

The operating of the Monza-Milan line in Italy by the use of storage batteries has been abandoned because the undertaking did not prove financially successful.

It is stated that many applications for concessions for operating electric railways in Italy are being presented. Among the most recent ones may be mentioned schemes for operating between Milan-Lecco, Varese-Lurno, Modena-Leghorn, and the trams from Pallanza and Chieti.

It is reported from Vienna that plans are being arranged for hydro-electric generating stations to supply current for operating the new railways in the Alps. The managements of these railways have petitioned the Government for an engineering report on the different available water powers throughout the empire, and it is stated that when this report has been made the Government will set aside a certain number of these water powers for its own use and release the others for industrial use.

THE
STREET RAILWAY REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch. Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV MAY 15, 1905 No. 5

CONTENTS OF THIS NUMBER.

ACCOUNTANTS' TRIBUTE TO MR. BROCKWAY.

The resolution passed by the executive committee of the Street Railway Accountants' Association, at its first meeting after Mr. W. B. Brockway surrendered the active duties of the office of secretary and treasurer of the association, and which will be found upon another page of this issue, is a well-deserved tribute to a faithful worker and one which serves to close in a proper manner the record of his services in an official capacity. We doubt whether there are many persons, excepting Mr. Brockway's intimate personal friends, and those members of the Accountants' association most active in its work, who realize the time and labor he devoted to up-building the association during his nearly eight years as permanent executive officer. The successful administration of a society of this kind requires that a man's whole heart be in the work, and that he stand ready to make many personal sacrifices—the results achieved by the Accountants' speak for themselves and show what Mr. Brockway did.

COMPETITION IN ILLINOIS.

Within a few weeks two steam railroads operating in Illinois have made announcements indicating that they purpose entering the "interurban" field and competing with electric lines in the matter of service as well as rates. April 9th the Chicago & Alton put in effect a new time table showing eight trains each way daily between Springfield and Girard, a distance of 25.7 miles, and six trains south and five north between Pontiac and Bloomington, a distance of 34.6 miles. Of these six trains each way between Springfield and Girard, and four each way between Pontiac and Bloomington are designated "Interurban Trains" and it is stated that they "will stop on signal to engineer and on application to conductor at all public road crossings at which it is safe to take and discharge passengers. They will also stop on signal or on application at street intersections in transit through towns or cities through which they pass. Single-trip and round-trip tickets will be sold at greatly reduced rates for transportation on interurban trains."

Announcement is also made as follows: "Interurban single-trip and round-trip tickets sold at greatly reduced rates will be honored on all interurban and local trains running locally between above stations. Special 250-mile tickets, good for bearer, limited to 30 days, will be honored only on strictly interurban trains Nos. 92, 93, 94, 95, 96, and 97, between Pontiac and Bloomington, and 71, 72, 73, 74, 75, 76, 77, and 78, between Girard and Springfield. It is the intention of the management to extend this service to all thickly populated portions of the railway line."

The Illinois Central also purposes putting on similar service between Freeport and Amboy, a distance of 47.5 miles, and between Bloomington and Decatur, a distance of 43.6 miles.

This looks like war. The reason for the steam lines taking such action doubtless is that the modern electric railway, because of more careful location and better construction, is too serious a factor, both actual and potential, in the freight situation to be ignored, and the new-comer is to be attacked in its passenger traffic.

A rate war even of the most relentless kind, over a section of 50 miles, is merely an unimportant incident for the big road, but may be very serious for the shorter electric line. The latter can scarcely hope to win in a rate war and should rely upon the other advantages which it offers to patrons: A train every 30 or 60 minutes, instead of only every 3 or 4 hours. More convenient location in the cities and towns served. Freedom from cinders and smoke.

As we see it the electric lines should keep up their rates and win the fight by continuing to give superior service. The steam train that stops at all crossroads, large trees and important fence corners is not a popular one and a trunk line soon reaches its limit as to frequency of local trains.

THE VALUE OF A NAME.

In connection with the development of electric traction there has been quite a marked evolution in the character of the names chosen to designate the operating companies. Few only of the older city roads retain their original titles—the "Quincy Horse Railway & Carrying Co. (operated by electricity)" is one of the striking examples of a concern that has retained its old name. Newer companies have displayed considerable ingenuity in devising what have been called "new names for a street railway." The word "Electric" was

most naturally one chosen by both new corporations and old ones changing the motive power used because it was accurately descriptive and because those interested were proud to identify themselves with a progressive step. "Traction" made its appearance in company names only a few years ago and at first was not welcomed over-cordially. This term has steadily increased in popularity, and notwithstanding that a teaming company or a steam railroad is quite as much a traction company, the term is recognized as implying the use of electricity as a motive power—although there are a few cases where other power is used by "Traction" companies. "Interurban" is another widely used term which in practice distinguishes electric railways from steam railways, although both classes of companies operate between cities.

Doubtless the names taken by electric railway companies were chosen for one of four reasons, they were descriptive of the business to be conducted, they were pleasing to the eye or ear, they were new and offered attractive possibilities in the way of effective advertising, or they were the only names available to identify a reorganized company with its predecessor where it was desired to retain the "good will" incident to the old name. And perhaps in every case the name chosen is considered a matter of no serious moment—not a thing that will earn or lose dividends.

It was developed in the discussion of Mr. H. H. Polk's paper before the Iowa Street and Interurban Railway Association, however, that the name of an electric railway company has a very important bearing upon its relations with its neighbors and competitors in the transportation field. Specificially, several managers found an electric "railway" can enter into contracts with a steam railroad which the latter will not make with a "traction" or an "interurban" or an "electric" railway company. There are, of course, no legal objections, but the steam railroad passenger and freight traffic associations are at present opposed to recognizing electric railways. Individual companies, members of these associations, may be convinced of the advantages of making interchange agreements in certain cases, but are unwilling to make such contracts when the publication of a tariff shows to the world that it, the steam road, is in alliance with a "traction" or "street car" line. If this condition obtains in Iowa where the field for electric lines carrying freight in car-load lots is especially good because of the advantages steam roads can derive from joint tariffs, it would appear to be well worth while to consider the material advantages of a neutral color in choosing a name.

"JIM CROW" LAW IN TENNESSEE.

Within a few years several southern states have enacted laws providing for the separation of the white and the colored races in public vehicles, particularly street cars. These laws and city ordinances designed to secure the same result have been attacked in the courts on various grounds, and opposed sometimes by the railway companies, sometimes by patrons and in one case by the railway employes. The methods of separating the two races in street cars that have been tried are the use of separate cars, the use of cars with separate compartments, the use of a readily movable screen by means of which the space assigned to one class of passengers can be easily changed to meet changing conditions, and the reservation on the ordinary cars of certain seats for each class.

The requirement that street railway companies operate separate cars is a hardship, and on the small systems would bankrupt the company; and even in large cities to meet this requirement in a manner at all satisfactory to patrons would involve such an increase in the number of cars operated, without corresponding increase in receipts, as to make the plan impracticable. Street cars must be run at such short intervals and are of such limited capacity compared with railroad trains that the separate car law acceptable for steam railroads cannot be applied without injustice. In the case of the Virginia "Jim Crow" law, calling for separate cars, passed in 1902, the street railway employes objected that no desirable motormen or conductors would accept work on the "Jim Crow" cars.

The use of separate compartments to separate the two races is also open to serious objections. The proportion of white passengers is constantly varying and widely varying according to the time of day, and to have the compartment for one class crowded while the other is practically empty is to invite altercations between passengers and the car crew, or else abandon enforcement of the law. In Louisiana the law passed in 1902 providing for movable screens to be adjusted by the conductor to meet varying requirements for [illegible] in practice [illegible] of enforcement.

The most recent "Jim Crow" [illegible] which becomes effective [illegible] shall seat white passengers [illegible] up seats from front to rear, and seat colored passengers in the rear seats, filling seats from rear to front [illegible] passed in 1903, applying only to the city of Memphis [illegible] unconstitutional on technical grounds. The 1903 law was opposed by the Memphis street railway, but the new enactment is believed to have the approval of street railway interests. The companies find that since each passenger on entering [illegible] seeks a place by a window, and [illegible] the effect where the majority of seats [illegible] seriously reduce the capacity of the car because white passengers will not share seats with negroes. The loss of traffic from this cause is most marked in summer when pleasure riding is heaviest.

The Tennessee law prescribes what is believed to be the most simple means of securing separation of the races in street cars, and the same plan has been followed with success in several southern cities where the street railway companies have made rules without the special sanction of law. Legislation of this character has been found in nearly every case to subject to annoyance and inconvenience the race it was designed to favor, and has been difficult to enforce for that reason, and if a satisfactory solution has been found the railways confronted with the race question are to be congratulated.

AUXILIARY BUSINESS.

We note with pleasure the steps that progressive interurban managers are taking toward increasing the receipts by what may be called "auxiliary business." In this issue of the "Review" are described some of the novel and interesting operating features on the third-rail system of the Aurora, Elgin & Chicago Railway Co. This company which since its trains first began running has been giving a most excellent high-speed passenger service, is making strong efforts not only to increase the regular passenger traffic by offering many attractive excursion trips over rail and water, but is also building up a healthy freight and express business and is developing a regular income by the sale of 600-volt current for use in farm work along the line and by converting the 25-cycle railway feeding current to 60-cycle current for lighting the streets of towns and residences along its route.

With its generously designed power station and its well built double track roadbed it is possible for the company to handle a large amount of special traffic and in no way interfere with the regular passenger schedule. As a means for systematically increasing the special business the company employs a solicitor or advertising manager with an office at the Chicago terminal whose sole duty is to initiate special traffic, such as the annual excursions of societies, combination trips by electric cars and lake steamers, funeral trips to the cemeteries along the route and similar business. This class of business is advertised by the usual form of folders, time cards and souvenir postal cards, and by providing unusual conveniences, such as special buffet theater cars, checking parcels from the department stores and delivering them to passengers at the terminal station, and arranging for cab service to meet incoming parties. Although having been in working order but two months, the returns from this department have clearly shown its value.

As earlier mentioned, current is furnished for lighting and power. There are some twenty small towns along the route varying from mere groups of farm houses to thrifty suburban villages. By installing motor-generator sets in the existing sub-stations, using synchronous motors and 60-cycle, 4,000-volt generators, no added sub-station attendance is required for operating the lighting apparatus and several of these towns may be supplied with lighting current from each sub-station with but comparatively small outlay for equipment, while there is created a steady demand for current during the evening when the railway load is light.

The sale of current direct from the working conductor for operating farm machinery is believed to be as yet unique with this road. The original outlay by the railroad company is practically nothing, as the customers install their own apparatus, and since [illegible] ample generator, sub-station and feeder capacity, it is easily [illegible] that with no operating cost except for [illegible]

tion the income from this source is largely profit. This is a service which can be offered to the farmers by nearly all interurban roads and one which will assure substantial returns for practically [illegible] and [illegible] small operation cost.

STREET RAILWAY EVOLUTION IN MASSACHUSETTS.

That the modern street railway is still undergoing a process of evolution cannot be doubted by anyone observing the trend of practice at the present time in more than one section of the country. It requires but a short memory to recall the lighter cars, smaller equipments, slower speeds and moderate power facilities of a few years ago in comparison with the rolling stock and substantial physical plant of today. Although urban street railway practice is pretty well standardized, there remain many unsettled problems bearing upon the broader aspects of electric transportation outside city limits. Conspicuous among these is the development in New England of the high speed interurban line from the simple beginnings of a cross country trolley route connecting a series of cities or towns and occupying the highways wholly or in part between termini.

The problem of electric railway transportation between populous centers is radically different in eastern Massachusetts, in particular, from the situation obtaining in the middle west. The high population density of the region within 50 miles of Boston is reflected by a large number of suburban cities and towns, most of which are joined by a network of trolley lines that make a brilliant showing on a colored map, but which are inherently incapable of giving very high speed service. In comparison with the steam railroad service of the territory the trolley lines supply cheap, frequent, comfortable and reliable facilities for the transport of passengers from town to town, but when long distance travel is attempted the schedule speed falls far below that of the best examples of interurban practice in the West. In fact, Massachusetts has as yet but one line which properly falls under the interurban designation—the Boston & Worcester. This curious condition in a state which ranks as one of the pioneers of street railway development arises largely from the extension of early city systems into the suburbs along the lines of least resistance—the highways—and from the relatively great density of population in the territory served. The private right of way has therefore received but limited encouragement in eastern Massachusetts, the nearest approach to it, as a rule, being a location on a boulevard or reserved right of way in or adjoining the main highway traversed. Such locations are not fenced in, but under favorable conditions speeds of from 25 to 45 miles per hour are attained, the latter figure being frequently reached on the boulevard section of the Boston & Worcester.

While this extension of facilities from one town to another is a natural growth, as is the adoption of the boulevard location, it is evident that the time has arrived in Massachusetts when higher standards of practice are needed in special cases like the building of an interurban line between Boston and Providence. There is a growing opinion among practical electric railway men that the private right of way should be adopted as nearly as possible, to the utter exclusion of highway running, the sole limitations being those of land damage. With this goes the abolition of nearly all grade crossings except those with connecting electric lines, where stops are invariably made. Further than this, one of the Boston and Providence projects pending in the Massachusetts legislature plans for a maximum grade of 3 per cent and a minimum curvature of 1° between Hyde Park and the Rhode Island line. With an estimated running time of an hour and three-quarters from the heart of one city to the center of the other, a probable interval of 15 minutes during times of heavy traffic and half an hour at other times, and a fare approximately half the steam railroad tariff, allowing for frequent stops also, it is evident that such a line would easily take its place among the interurbans of advanced type.

The question as to legislation regarding the right of eminent domain for electric railways is a broad one. In the case of interurban lines projected between important population centers there is little doubt that provision should be made whereby the companies will not be required to pay unreasonable prices for the land which they need. It is readily conceivable that a few obstinate property holders may cause great annoyance and expense to new projects of this character under the existing conditions in Massachusetts—in fact, the experience of the Boston & Worcester road amply bears this out. The steam railroad interests at the recent legislative hearings on the Boston and Providence projects maintained that the right of eminent domain should be granted only to electric roads incorporated under the general railroad law of the state, claiming that the proposed high speed interurban lines ought not to be given steam railroad privileges without assuming steam railroad responsibilities. Whether the right of eminent domain should be granted by special legislation or by the framing of a general law is a question for the legal specialist under the present conditions of electric transportation in Massachusetts; the fact remains that it is a vital necessity in advanced high speed work. The claim that the interests of the property owners are not safeguarded by the statutes relating to eminent domain is preposterous. Although in certain particulars the interurban railway of the type proposed between Boston and Providence resembles a steam road, it differs radically from it in other respects, occupying in reality a sort of middle vantage ground between the steam road and the street railway. For this reason, the details of which are familiar to every railroad man, it is manifestly unjust to lay all the burdens of either class of road upon the interurban line. Electric railway history is still being made in the Bay State, and the future will be well worth watching.

Convention Preparations.

The Executive Committee of the American Street Railway Association held a meeting at the Bellevue-Stratford Hotel, Philadelphia, Pa., April 7th.

At this meeting, Mr. Newcomb Carlton, fourth vice-president of the Westinghouse Electric & Manufacturing Co., was elected to succeed Mr. Calvert Townley as the representative of that company, and Mr. C. C. Pierce was chosen to succeed Mr. John H. Lovejoy as the representative of the General Electric Co.

Article III of the by-laws was amended to read as follows: "Each member, upon payment of the annual dues for that year, shall be entitled to receive at the annual convention four badges, each of which shall entitle the person to whom it is issued to all the privileges of the convention and to such entertainments as may be provided. Other similar badges may be obtained by a member upon the payment of five dollars extra for each badge. Each holder of a badge may obtain without charge a badge for a lady to accompany him."

The following proposition from Dr. Wilson, director of the Philadelphia Museums, was accepted:

"That he would recommend to his board that, for a sum not to exceed $1,000, the American Street Railway Manufacturers' Association would be given the exclusive rights to the entire ground floor of the south pavilion, to be used as an exhibition hall at the twenty-fourth annual convention, to be held the fourth week in September, 1905; also such space in the west end of the second floor as may be required for assembly and committee rooms; also such space in the vacant lot south of the pavilion as may be needed for outdoor exhibits, the Museums to furnish all necessary light (except for special exhibits), heat, guard protection, elevator service, etc., and to grant the use of all the above space to the association for the five days preceding and the five days following the week of the convention, for the purpose of receiving and re-shipping the exhibits, and that the association be granted an option for the above proposition to extend until July 1, 1905."

It was proposed that exhibitors using more than 100 sq. ft. of floor space for their exhibits should be required to pay extra for such additional space, the amount to be determined by the committee. This proposition was laid upon the table, however.

Designing relatives of a 14-year-old girl, brought suit against the Louisvillle Railway Co. for $15,000 damages, claiming that a street car accident had caused a permanent injury to the girl. The court awarded judgment of $6,500 against the railway company. After the matter had apparently been satisfactorily settled, the father of the girl, being preyed upon by his conscience, made an affidavit to the effect that the girl had never been injured, but was suffering with sciatic rheumatism, with which both he and his wife, who are third cousins, have been afflicted for years. From the first the Louisville Railway Co. maintained that the girl had never been injured on its line.

Piping and Power Station Systems.—VI.*

[illegible]

Live Steam Drips.

The system for supplying live steam will next be considered and along with this topic will also be described the live steam drips. A general arrangement which will serve these purposes is illustrated in a preliminary way by Fig. 10; the different lines being subject to revision upon more careful consideration. The general detail of the location of the drips will now be considered, even before determining the main steam connections.

In Fig. 36 is illustrated a gravity drip return system. The branches of the piping system which carry live steam from the

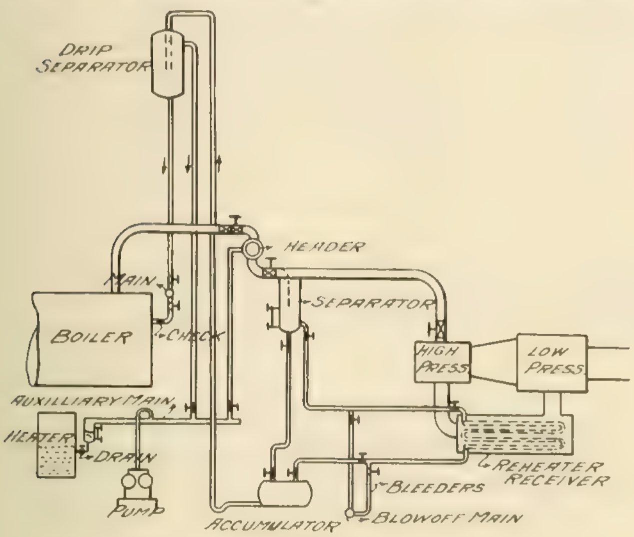


FIG. 36.

boilers drain into the header and this in turn drains into the separators which are placed in the engine branches. The steam used in the low pressure reheater receiver is led off a short distance above the bottom of the separators and, as shown in Fig. 36, the separator drips are run to an accumulator, each pipe having a regulating valve in it. If by accident the drain leading off from the bottom of the separator be closed too much to take away the drip, then a

[illegible] sure than the main steam line. The discharge from the drip sepa- [illegible] difference in the pressures in separator and steam heater is greatest just before a "slug" of water is carried up the standpipe into the drip separator, then as soon as the water is out of the way the difference in the two pressures is only that due to friction. The chief advantage of such a system is, that neither floats nor automatic devices are required for its operation, in fact there is no mechanism employed. To start the system the leader to the heater is opened in order to clear the lines to the point of receiving steam, then the auxiliary is started and as long as there are auxiliaries running this system will remain open.

Another method of returning drips to the boilers, illustrated in Fig. 37, is by using a drip receiver in which is placed a float so connected that it regulates the speed of the pump. This system has the advantage that it is easily understood and therefore will be more likely to be operated properly than the system shown in Fig. 36, which requires someone to instruct the attendants what to do and see that these instructions are properly obeyed. Careful watch must be kept over the system shown in Fig. 36 if the drip is to be returned to the boilers and not be wasted into the sewer. The difference in the costs of these two systems is not sufficient to be considered. The initial cost of the system shown in Fig. 37 is less than that of Fig. 36, but the maintenance for Fig. 37 is greater. The maintenance for Fig. 36 is very slight.

There is still another system which combines as low first cost, low maintenance cost, simplicity and high efficiency as can be arranged for a condensing plant not using economizers. This system is illustrated in Fig. 38 and discharges the drip into an open heater when so arranged that exhaust steam and drips do not raise the temperature to 210° thereby allowing a waste of steam. Traps are not very desirable pieces of station apparatus, but by using two as shown and the by-passes, a very reliable system is obtained.

It will be noticed that Figs. 36 and 37 show steam drips dis-

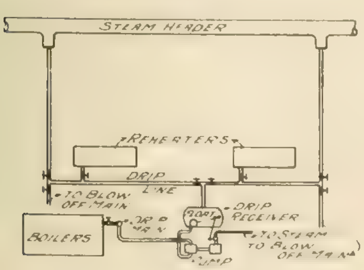


FIG. 37.

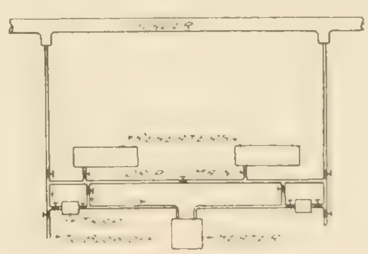


FIG. 38.

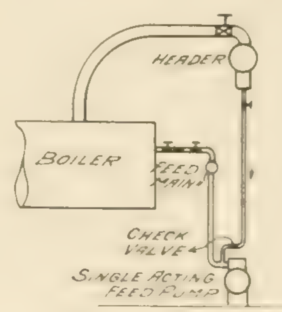


FIG. 39

passage will still be open by the way of the pipe to the reheater receiver and thence to the accumulator. The elevated drip separator is placed at a sufficient height to insure that the drip will flow into the boilers.

For part or all of the auxiliaries steam is taken from the upper portion of the receiver and the small amount of condensation which may be in the auxiliary main is led to the heater by means of a bleeder.

charging direct to the boilers and not by way of the feed main. This is an essential feature because the feed main pressure may be lowered at any time until it becomes less than the steam pressure. Such a condition may be caused by the stopping of the feed pump, thus allowing the water pressure to escape through the pump valves, or it may be due to the filling of an empty boiler, or the blowing off of an economizer. In any case, whenever the pressure in the feed main is lower than the steam pressure, the steam if not checked will force the feed water back and cause very serious damage. An [illegible]

[illegible] because the [illegible] of boiler pressure will open and pass through the pump [illegible] even when the pump is not running. For the same reason an automatic drip pump cannot be used to discharge into an open heater or another receptacle which is under less than boiler pressure. The discharge pressure must always be be obtained in case the discharge pipe is closed. Unless the lines and pumps be built for such pressures breakdowns must occur, because when shutting down the boiler it is quite a simple oversight for an operator to close the automatic pump discharge and not notice that there is no other way of discharge.

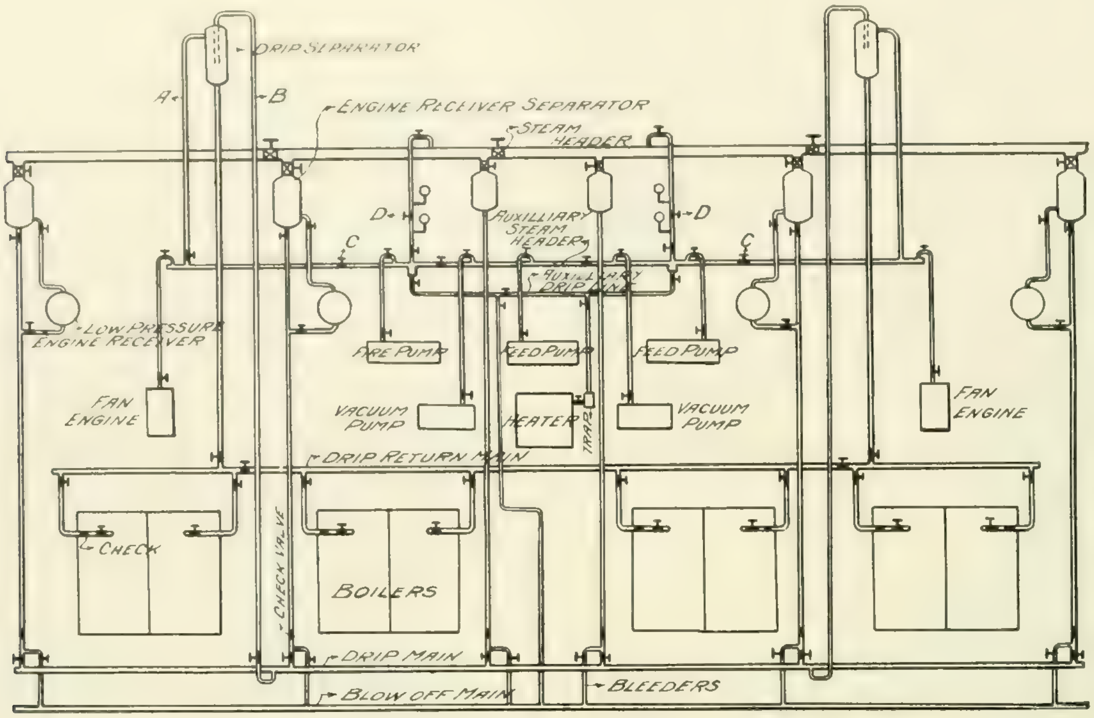


FIG. 40.

greater than the suction, even though it be caused by only a short column of water additional. The discharge line from the automatic pump should have a relief valve placed between the pump and any valve that may be placed in this line and the discharge should then be piped to a catch basin where the end of the pipe is open so that any discharge which is taking place may be seen. This relief valve

Another method of returning drips to the boilers is illustrated in Fig. 39. This arrangement can only be used in connection with single acting pumps and in systems where there is but one pump on the line and the header is not less than 5 ft. above the water line of the boilers. The operation of this system is made possible by the pulsating pressure which is present during the operation of

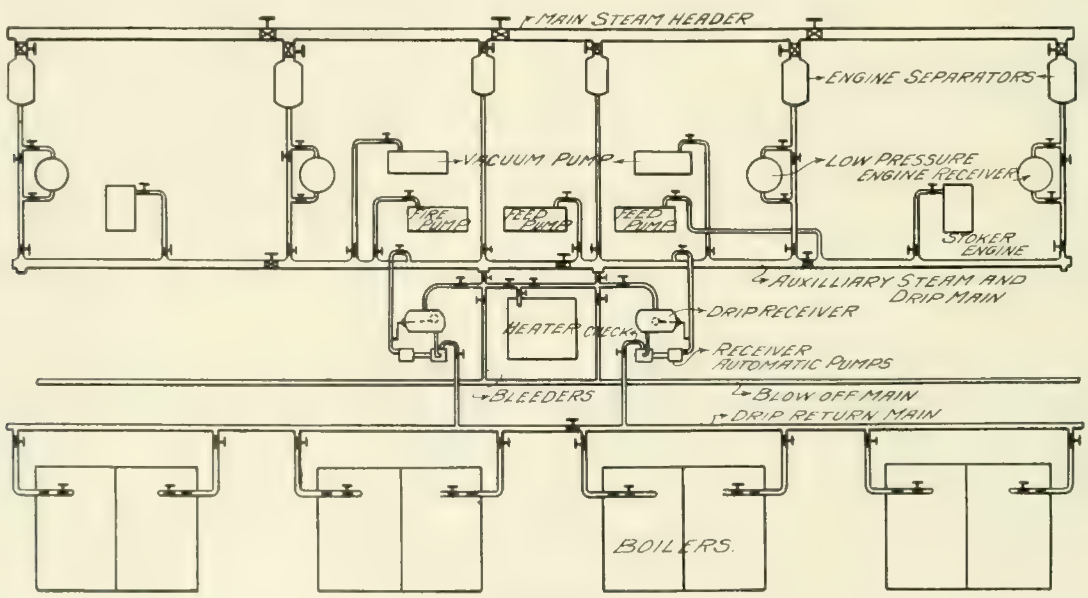


FIG. 41

is very essential in order that the pump and pipe line may be protected in case all discharge valves should be closed. It is possible for the automatic pump, which receives its suction under boiler pressure, to more than double the steam pressure on a discharge; the steam end of the pump ordinarily has twice the area of the water end and therefore when the steam pressure is but 175 lb. per sq. in. a pressure of from 350 to 400 lb. per sq. in. can easily

single acting pumps. If such pumps carried a uniform pressure this system would not be feasible. A single acting pump discharges a cylinder full of water, then stops at the end of the stroke and the inertia of the water is only overcome by meeting the boiler water which has a higher pressure; while the discharge from the pump is being brought to a state of rest and the pressure in the part of the system next to the pump is lower than the boiler pressure, the

drip line which is at boiler pressure flows into the part of the system and before the returning stroke of the pump, the pressure in the discharge is again returned to boiler pressure. For a small installation this method of draining the steam main would appeal to an engineer on account of its extreme simplicity, but for a large plant it might be found difficult to maintain the entire arrangement as shown. This pounding action in the feed mains would not be considered very favorably in large station work, and without the pounding this system would necessarily be inoperative. This system also has a bad feature because it discharges into the feed main and not into the boiler.

For the station being studied, Fig. 36 may be used as the drip system, and when this figure is arranged in a flexible form it appears as shown in Fig. 40. It will be noted that any or all of the auxiliaries can be supplied with steam through this drip system. Ordinarily steam required for one or two of these machines should be taken from the drip system, to avoid reducing the pressure in the drip separator to such a point that the drips will not flow back to the boiler. In event that no auxiliary is taking steam from the circulation pipe A it would then be necessary to blow steam into the heater or to the atmosphere, and unless this operation is properly carried out the steam thus blown through the system would be more than that required to run a portion of the auxiliaries. In riser B, pressure is required to elevate the drips, as is a pressure also necessary in the drip separator to return the drips to the boiler. The pressure in the separator, however, is but very few pounds less than boiler pressure, and so within the maximum and minimum limits of the allowable flow of line B the return of drips is possible.

In case the steam for one fan engine is found sufficient to handle the drips, then valve C may be closed; in case the fan engine requires more steam than can pass through lines B and A, and at the same time maintain sufficient pressure in the drip separator to dis-

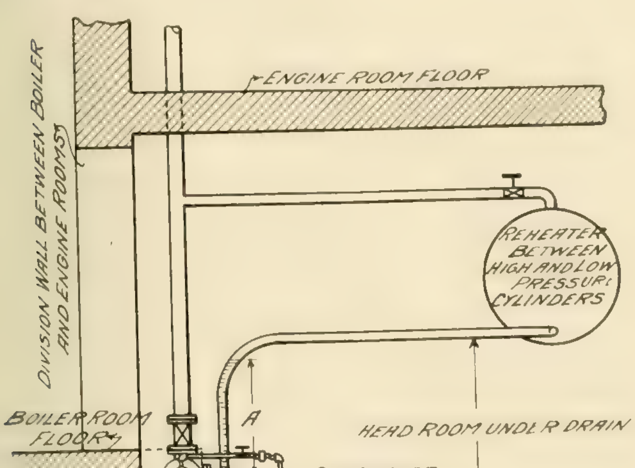


FIG. 42.

charge water to the boilers, then it would be possible to make C a reducing valve allowing, say, 3 lb. difference on the two sides of the valve thus furnishing a portion of the steam for the fan engine direct from the auxiliary steam header. This reducing valve may be placed at D in the branches from the main header, thereby keeping the entire auxiliary steam main at about 3 lb. lower pressure than the main steam header. Such a reducing valve may be a heavy cushion check valve and if the port has a diameter of 4 in., the valve would weigh about 40 lb. or the valve could be spring loaded, the same as a safety valve. With reducing valves at the points marked D, the system would at all times be ready for operation. Even after shutting down, in case there should be one pump running very slowly, this pump would be able to take steam through the drip system, and if the fire pump should at any time be put into full service the two relief valves would open and supply the auxiliary main. By [illegible] of their being opened and the pressure run up on the drip system.

The [illegible] well drained to a [illegible] dependently drained to the heater, an overhead receiver into which drips discharge, a connection from the drip receiver to the auxiliary steam mains, and a connection from the main header through a resistance to the [illegible] steam from flowing except when the auxiliary main pressure and the receiver pressure are enough lower than the boiler pressure to overcome the resistance and allow water to be returned to the boilers. In Fig. 41 are [illegible] down auxiliary steam main, which main is large and serves for both the drip and steam mains. This system is well drained and has the characteristic that [illegible] high speed or large units, trouble will make itself known by a cracking noise of water in the steam pumps and piping, but without any liability of injuring them.

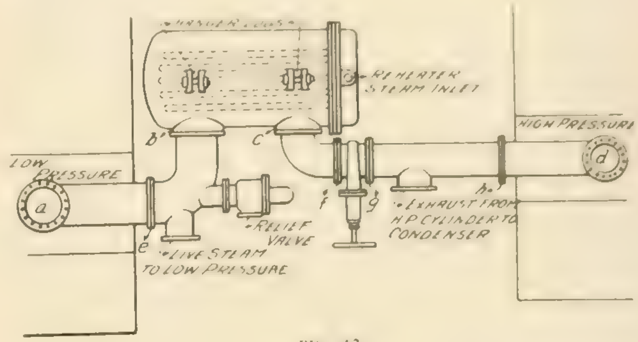


FIG. 43

The main point to consider in the disposal of steam drips is to keep them away from the large units and any system that will do this under all circumstances, even though it causes stoker engines, pumps and other auxiliaries to stop during the flooding, is far more preferable than a system which would flood the main units in case the removal of the drips be obstructed.

The system as shown in Fig. 41 would consist primarily of the main steam header and the auxiliary header, the auxiliary header being supplied with steam through the drip openings in the main engine receivers. The steam branches to the auxiliaries are taken off the top of the auxiliary steam main and drains are led from the bottom of the steam main to the receiver of the drip pumps. Emergency connections should be made from the auxiliary main to the heater and to the blow-off main so that they can be used in case the lines become flooded. This style of drainage has the great advantage that by means of the cracking noise the auxiliaries are positive indicators of the operation of the drip system. The auxiliary main shown in Fig. 41 would necessarily be placed below the reheater drain.

The reheater as ordinarily placed between the high and low pressure cylinders brings into the station layout a very troublesome detail. An ordinary form of reheater construction is a copper pipe coil with the inlet and outlet of the same size as the opening in the pipe and by using a small size tube for this coil of a very long length, a marked drop in the pressure as measured at the two ends of the coil is obtained. To properly drain such a reheater it is necessary to place the drip main far enough below the heater to provide a gravity column which will make up for the pressure lost in the receiver. If the reheater used were of a pattern similar to the bent tube Berryman closed heater, there would be an ample area for steam flow and therefore no appreciable drop in the pressure. The receiver should be placed horizontally, and as high as possible so that the drips can be properly taken care of. If an automatic receiver pump as illustrated in Fig. 41 is to be used, the intermediate engine receiver must be kept close to the underside of the floor as shown in Fig. 42. This is necessary for two reasons—to give ample head room between the basement floor and the reheater drip outlet, and to provide a sufficient gravity leg, A, to overcome the pressure loss in the reheater. In case the boiler room floor line is but a foot or so above the basement floor it would then be neces-

[illegible]

Unfortunately engine builders are not skilled pipe fitters or they would use better designed connections between their high and low pressure cylinders, and also place their reheaters at a relatively higher level. The reheater connection shown in Fig. 43 is a very simple arrangement which has the advantage that it can be varied about ¼ in. either way between the centers of the cylinder connections. This variation is obtained in the bolt holes at joints a, b, c, and d; if a is even ¾ in. higher or lower than d, the receiver can be kept level by sliding the joints on their faces at b, c, e, f, g, and h. The bolt holes should be ⅛ in. larger than the bolts. It is advisable for the engineer to arrange this detail when the engine is ordered because it is very difficult to make a satisfactory drainage system if a vertical receiver in the basement must be used, or if for any other reason the receivers should have their drain openings close to the floor.

The low down auxiliary system and drip main can be used with the gravity return as well as with the receiver pump. Fig. 44 shows such a main with a reducing valve at A. The pipe lines for the drain system as shown only need be of sufficient size to handle the drains, because when the plant is running, one fan engine must also run and this will take care of the drips. When the fan engine is shut down the condensation in the riser pipe will drop back into the auxiliary main. In starting up the plant, water can be run out of this main into the heater through the by-pass and any section of the auxiliary main or drain system may be shut down, and the drips be run through the bleeders either to the heater or the blow-off main. The steam connections leading from the auxiliary main should be long radius fittings and the main should be large enough to avoid the lifting of the condensation lying at the bottom of the line. The characteristic features of this system are, main steam header, auxiliary steam headers supplied through drip openings of the main header, auxiliary branches taken off the top of the auxiliary main, connection run from drip pocket on the underside of auxiliary main to overhead separator, steam taken from this separator to a constantly used auxiliary and another line run to this auxiliary which will supply it when the pressure drops below the set amount necessary to return drips to the boilers.

The system shown in Fig. 44 is quite simple, in fact, more so than that shown in either Fig. 40 or 41. The only appliance which must constantly be watched and kept in good order is the reducing valve and the operation of this valve can easily be checked by having gages on both sides of the valve so that the difference in pressures can be observed. In case the return system fails to operate properly the drips will give warning in the pump cylinders or stoker engines. This is a very valuable characteristic and the system should be so laid out that the station will not be dependent upon steam traps, bleeders or automatic devices for this service. With these things in view let it be assumed that Fig. 44 illustrates the drip system for the proposed station.

(To be continued.)

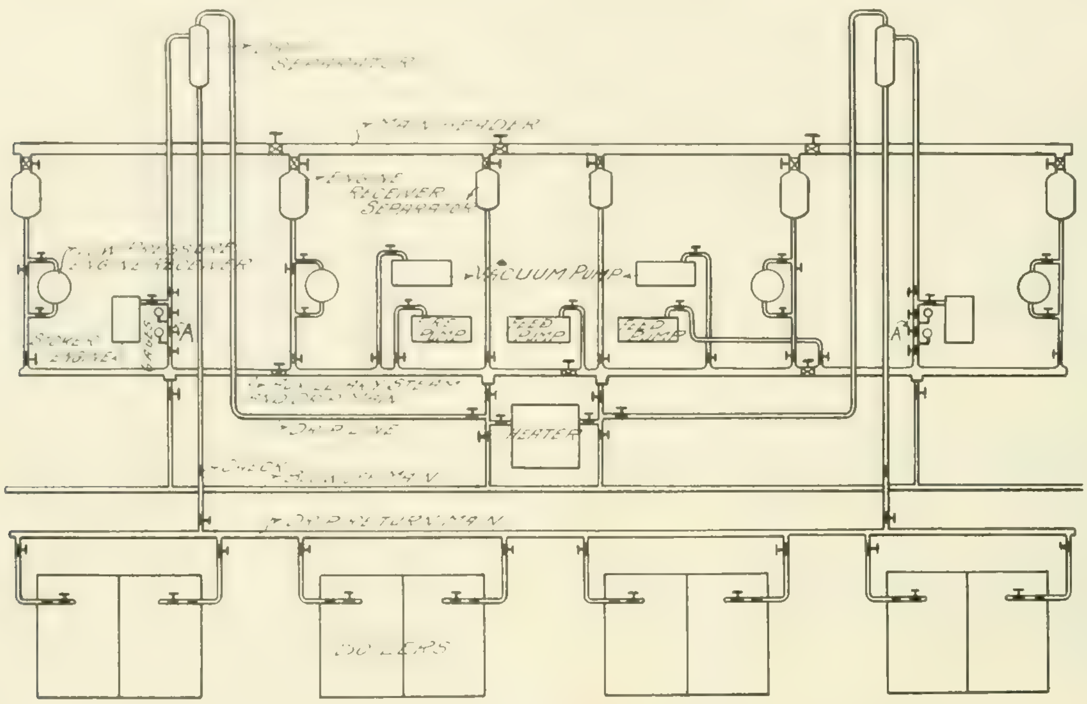


FIG. 44.

Biennial Report of the Railroad Commissioner of the State of Wisconsin.

The present struggle between the legislative bodies of the state of Wisconsin and the railroads within the borders of that state makes the biennial report of the state railroad commissioner for the year 1902 to 1903 one which will be carefully studied and its data much copied.

At the close of the year 1903, there was a total of 299.78 miles of single track and 99.53 miles of double track electric railway in Wisconsin. Of this amount, 241.97 miles were operated within the limits of the cities. At the close of the year reported there were 20 city and interurban electric railway systems in operation, upon which roads had been issued $5,231,700 preferred stock and $13,803,800 common stock. These roads had a total bonded indebtedness of $17,119,550 and a total other indebtedness of $3,054,949, making the total electric railway capital, including bonded debt, etc., $39,209,999, or $1,289,355 per mile of line. The items of operating expenses, as reported by the different companies, have totals as follows: General expenses, $191,137.59; legal expenses, $37,824.98; injuries and damages, $130,846.30; rentals and insurance paid, $7,613.47; conducting transportation, $1,232,816.44; maintenance of way and structures, $176,582.76; maintenance of rolling stock, $161,263.75; for producing power, $332,906.49; amount set aside for depreciation and reserve, $44,213.04; amount expended for miscellaneous purposes, $14,497.57.

The commissioner states that the interurban electric railways are becoming a force in the question of transportation in the state and that lines are projected which, if built, will change conditions in many sections of the state very materially. It is suggested by the commissioner that the attention of the legislature be called to these transportation companies for such action as may be deemed advantageous to the public and just to the companies. The railroad commissioner during the period reported was Mr. John W. Thomas.

The first of a series of monthly smoker talks for the employes of the Terre Haute Traction & Light Co. was held April 18th.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1893 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible]; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 190[illegible]. Vol. V [illegible]. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $6.50; single volume, $2.00.]

CARE WHICH MUST BE EXERCISED TOWARDS A PASSENGER GETTING ON OR OFF A CAR.

Lehner vs. Metropolitan Street Railway Co. (Mo. App.), 85 S. W. Rep. 110. Feb. 6, 1905.

It is a well established rule, the Kansas City court of appeals says, that a carrier must allow a reasonable time for its passengers to get off and on its cars before they are started. Street railways, as other carriers, are required to exercise towards passengers the utmost care and diligence of very cautious persons. And this duty applies where a passenger is getting off or on a car.

A DANGEROUS RATE OF SPEED.

Chicago City Railway Co. vs. Bennett (Ill.), 73 N. E. Rep. 343. Feb. 21, 1905.

Whether the rate of speed at which a street car is traveling is so high as to be dangerous, the supreme court of Illinois says, depends very largely upon circumstances. A street car may be propelled at a high rate of speed in the daytime, or along a street that is brilliantly lighted at night, with perfect safety, while the same rate of speed maintained after dark in an unlighted street would be extremely dangerous. It appeared here that the rate of speed, on a misty, dark night, was such that the motorman could not stop the car in time to avoid striking an obstacle on the track, after he was near enough to see it, if the obstacle remained stationary. From that proof it may be inferred, the court says, that the company was negligently propelling the car at a rate of speed high enough to be dangerous, and that proof warranted the court in denying a peremptory instruction to find for the company.

PRESUMPTION OF CONTINUED VIGILANCE ON PART OF PEDESTRIAN CROSSING STREET—QUESTIONS FOR THE JURY.

Haughey vs. Pittsburg Railways Co. (Pa.), 59 Atl. Rep. 1110. Dec. 31, 1904.

It was in evidence in this case that the man fatally injured was standing on the sidewalk at a street crossing talking with some one, and that, after looking "up and down" the track, he started to pass over the crossing. He was next seen lying against the curb of the street towards which he was going, thrown there by collision with the car. The supreme court of Pennsylvania holds that it was his duty, not only to look out for an approaching car before he attempted to cross the street, but also to continue this vigilance after leaving the sidewalk until he passed over the electric car tracks. In the absence of evidence to the contrary, it would be presumed he did his duty in this respect. How far the facts stated, if so found, and the inferences to be drawn from them, might show the exercise of care by the deceased, and that he reasonably believed he could safely cross the car track before attempting to do so, were clearly questions for the jury.

POWER OF CONSOLIDATED COMPANY TO PROSECUTE AN APPEAL IN CONDEMNATION PROCEEDINGS.

Union Traction Co. of Indiana vs. Basey (Ind.), 73 N. E. Rep. 263. Feb. 10, 1905.

No special denial of the right of a company formed by the consolidation of two other companies to prosecute an appeal in condemnation proceedings begun by one of such other companies having been filed, the supreme court of Indiana holds that the averments of the assignment of errors showing the consolidation of the two corporations under the laws of that state would be taken as true, and in consequence thereof the consolidated company, as a matter of law, by such consolidation succeeded to the rights of the constituent corporations, and was the proper party to prosecute the appeal.

Furthermore, when a street railroad company appeals from an award within the 10 days allowed, and pays the award to the clerk of the court for the purpose of entering at once upon the property described in the instrument of appropriation, the court holds that such payment is not voluntary in a legal sense, and will not estop the company from prosecuting its appeal.

NOT ASSESSABLE FOR WATER SUPPLY PIPE.

McChesney vs. City of Chicago (Ill.), 73 N. E. Rep. 368. Feb. 21, 1905.

An objection to the confirmation of a special assessment for laying a water supply pipe was that the right of way of a street railway company should have been assessed. The ordinance granting the right of way to the company provided that it should pave and keep in good condition and repair all streets in which its tracks should be laid 8 feet in width where there was a single track and 16 feet where there were double tracks, and when any new improvements to said streets or parts of streets should be ordered by the city council the company should, in the manner required of property owners, make such improvements for the width of 8 feet where a single track should be laid and 16 feet where double tracks should be laid. A proceeding for the purpose of improving a street, the supreme court of Illinois says, may include other than surface improvements; but in this case the contract clearly related only to surface improvements for the width of 8 feet where there was a single track and 16 feet where there were double tracks. The obligation assumed did not include a water supply pipe laid under the surface; and in this case it was to be laid on one side, and apparently not within the width limited by the ordinance granting the right of way.

LIABILITY FOR KILLING STOCK GOING FROM INCLOSED FIELD UPON UNFENCED TRACK—DUTY TO FENCE IN ROAD AND BUILD CATTLE GUARDS.

Iola Electric Railroad Co. vs. Jackson (Kan.), 79 Pac. Rep. 662. Feb. 11, 1905.

In an inclosed field through which there was located and operated an unfenced (electric) railroad, a cow rightfully in the field passed directly upon the railroad, and was struck and killed by a car without any fault of the employes of the railroad company in charge of the car. At the time, the general herd law was in force in the county wherein the cow was killed. The supreme court of Kansas holds that the cow was not trespassing or running at large when she went upon the right of way of the railroad company, and, as she was killed because of the omission of the railroad company to fence its railroad as the law required, it was liable for the loss.

Where a railroad passes through an inclosure, it is the duty of the railroad company, the court holds, not only to build fences on each side of the track, but also to complete the inclosure by building end fences and cattle guards across the right of way where the railroad enters and leaves the inclosure. A portion of the inclosure on one side of the railroad in question was platted, and lots, blocks, streets, and alleys were staked out; but as no lots or blocks were sold, nor streets and alleys used as such, and as the platted portion was still used for agricultural purposes only, the platting did not relieve the company from the duty of fencing its road, nor absolve it from liability for the loss.

FAILURE TO TENDER RIGHT OF WAY IN TIME—ASSIGNMENT OF VOID FRANCHISE.

Monarch vs. Owensboro City Railroad Co. (Ky.), 85 S. W. Rep. 193. Feb. 24, 1905.

By a contract between the plaintiff and the defendant the latter [illegible] extended its [illegible] property as soon as practicable after the necessary right of way could be procured from his property to the terminus of its line. By a subsequent agreement the time in which each of the parties was to perform his part of the contract was definitely fixed. The court of appeals of Kentucky says that the obtention of the right of way was a condition precedent to the extension of the line. The plaintiff's petition showed that this right of way was obtained by him and tendered to the defendant two years after the date fixed in the amended contract.

This tender, the court holds, was too late. It says that, having determined upon a definite time in which the contract was to be performed, it was necessary, before the plaintiff could maintain an action against the defendant for a breach of its covenant, to allege and prove, if it was denied, the performance by him on or before the date fixed for the performance of the contract of those covenants necessary to be performed to enable it to carry out its contract. Upon his failure to tender the necessary right of way by the stipulated time, the company had a right to consider the contract rescinded.

The granting to the plaintiff of a franchise to operate a street car line over certain streets of the municipality being in direct violation of a provision of the state constitution forbidding the granting of such franchises except to the highest and best bidder after due advertisement, the court holds that the grant of the franchise to the plaintiff was void, and his assignment carried no rights to the defendant.

MILEAGE TO BE USED IN COMPUTING ANNUAL GROSS RECEIPTS PER MILE FOR TAXATION.

Greenfield & Turner Falls Street Railway Co. vs. Town of Greenfield (Mass.), 73 N. E. Rep. 477. Feb. 27, 1905.

The question for decision in this case was whether the company's "annual gross receipts for each mile of track, * * * computed upon the aggregate of said annual gross receipts," within the meaning of the second paragraph of section 44 of chapter 14 of the revised laws of Massachusetts, were more or less than $4,000. If more than that sum, the percentage of 2 per cent used by the assessors in laying the tax for the year ending September 30, 1902, was right. If less than $4,000 per mile, the rate should have been 1 per cent instead of 2, and the company was entitled to relief.

The contention of the town was that, in order to obtain the percentages under the second paragraph of section 44, "the annual gross receipts for each mile of track" were to be computed by dividing the annual gross receipts for the year ending on the preceding 30th of September by the number of miles of track operated by the company in public streets only. It was agreed that that number of miles was 11 213/1000, and that the gross receipts were $49,349.11, or more than $4,000 per mile, so computed. The contention of the company was that the percentage was to be obtained by dividing the annual gross receipts of $49,349.11 by the whole number of miles of track operated, which, it was agreed, was 15 75/1000 miles, in which case the annual gross receipts for each mile of track were less than $4,000, and the true percentage was 1 instead of 2 per cent.

The question involved, the supreme judicial court of Massachusetts says, was of considerable importance, for the reason that in the year 1902 there were more than 60 street railway corporations in the state, having some part of their tracks outside of the public ways, and liable to assessment under the section in at least 281 cities or towns, and that the percentage of gross receipts to be used by the assessors of these places in laying taxes under section 44 might in any instance be made greater or less in accordance with the construction to be given to the section. It was conceded, the court goes on to say, that, if the decision depended upon the words of the second paragraph of the section alone, it must be held that the total length of all track would be the divisor and the entire earnings the dividend. There could be no question that such was the ordinary meaning of the words "gross receipts for each mile of track."

The argument in support of the contention of the town was that in return to the assessors required of the company the total length of track operated by it was not required to be stated, while the length of track operated by it in public ways in the particular city or town, and also the total length of track operated by it in all public ways, were to be stated. But the court says that other means of information were accessible to the assessors. They were not required to lay the tax upon the return made to them by the company. That return is like the list of taxable property required by statute to be made by every property holder for the information of the assessors, and no more limits or binds the assessors than does the taxpayers' list. The rule of assessment is given in section 44, and, in applying it, the assessors are to use any information within reach. Because there is within their reach material for making every computation necessary in assessing the tax as directed by the language of the statute, it is not a sound construction to impute to that language a sense other than the ordinary and usual meaning of the words.

Wherefore the court is of the opinion that the company was entitled to an abatement upon its petition of one-half of the amount of tax assessed against it.

LIABILITY FOR INJURY TO FRIGHTENED PASSENGER WHO ATTEMPTS TO FLEE FROM APPARENT DANGER.

Denison & Sherman Railway Co. vs. Freeman (Tex. Civ. App.), 85 S. W. Rep. 55. Jan. 28, 1905. Rehearing denied Feb. 18, 1905.

This action was brought by the latter-named party to recover for personal injuries sustained by his becoming frightened while a passenger on the company's car, and striking his head against the facing of the door of the car. There was evidence showing that while he was a passenger on the car, and the car was running at a rapid rate of speed around a curve, the trolley pole became entangled in the wires strung across from post to post, and which wires supported the trolley wires, and broke and dragged down some of the posts, which fell upon and broke in the roof of the car, and caused the plaintiff to fear serious danger to his life and limbs, and, in endeavoring to escape from the threatened danger, he ran and was thrown against the facing of the door of the car, and was injured; and there was evidence showing that it was only the trolley pole that struck the car and caused the trouble.

The jury were charged in relation to the degree of care which devolved upon the company as follows: "Negligence, when applied herein to the defendant's servants, means the failure to exercise that high degree of care that a very cautious and prudent person would have exercised under the same or similar circumstances." This was objected to on the ground that it placed upon the company too high a degree of care, and that in this character of case the company should only be held to use ordinary care to avoid frightening the plaintiff, and was not required to exercise the highest degree of care. But the court of civil appeals of Texas holds that the instruction as to the degree of care imposed upon the company was correct, and that the rule sought by the company was not the rule of the state. It says that the instruction announced the rule laid down by the decisions of that state as to the degree of care to be exercised by carriers for the protection of their passengers. In this case the plaintiff was trusting his safety to the carrier's means of transportation, and to the skill, diligence, and care of its servants. There was no active, voluntary movement on his part, unless his fleeing from apparent danger caused by the negligence of the defendant could be so called. If there was apparent danger, the court thinks his so fleeing could not be considered as voluntary, in his frightened condition, and the limitation of the general rule where the occasion of the hurt of the passenger was an active, voluntary movement on his part, combined with some alleged deficiency in the carrier's means of transportation or accommodations, had no application, and should not have been applied.

In charging affirmatively on the plaintiff's case, the trial court told the jury that if the circumstances caused the "plaintiff to believe he was in danger of being killed or seriously injured, and if you further believe from the evidence that plaintiff, while exercising ordinary care for his own safety, in endeavoring to escape from said danger, if you believe there was any, was thrown or ran against the facing of the door," and was injured, to find for the plaintiff. The charge was complained of in that it authorized a recovery if the plaintiff was in danger of being killed or seriously injured, without regard to

whether or not a person of ordinary care, prudence and temperament would have, under the same circumstances, so behaved. Complaint was also made of the trial court refusing a special charge, in effect, that if the circumstances were not such as to frighten an ordinarily prudent person, or that the plaintiff, after he became frightened, was guilty of negligence in acting in a manner that contributed to his injury, and that a person of ordinary prudence would not have so acted, then to find for the defendant. Complaint was likewise made of the court in refusing a special charge, in effect, that, before they could find for the plaintiff, they must believe that the defendant was negligent, and that such negligence caused him to become frightened and injure himself, and that such negligence would have caused the fright of an ordinarily prudent person and the injury. But, under the evidence, the court's charge, when taken as a whole, the court of civil appeals holds, was as favorable as the defendant was entitled to, and there was no error in refusing the requested charges, as complained of.

DISPOSITION TO BE MADE OF TRANSFER PENALTY CASES.

In re Transfer Penalty Cases (N. Y. Sup.), 92 N. Y. Supp. 322. Mar. 2, 1905.

In dividing into classes the cases pending in the appellate term of the supreme court of New York wherein recoveries had been had for penalties incurred by street railroad companies owing to their refusal to deliver transfers, that court says that the first class was comprised of those cases in which the plaintiffs had recovered only a single judgment, but that was for more than a single penalty. As to each of these judgments, they must be reduced to the sum of $62, representing a single penalty of $50 with $12 costs in the municipal court, and, as reduced, would be affirmed without costs in this court.

The second class was comprised of the cases in which the same plaintiff had brought two (and in one case three) actions for penalties, and in each case had recovered for more than a single penalty, but the second (and in one case the third) action had been begun for penalties which accrued after the institution of the prior action. Each judgment comprised within this class should be reduced to $62—one penalty and municipal court costs—and, as reduced, should be affirmed, without costs, in this court.

The third class of cases presented different considerations. It consisted of appeals from judgments, all but one being for more than a single penalty, recovered in two or more actions by the same plaintiff, of which the latter were based on refusals to issue transfers which occurred prior to the commencement of the first action. In some instances the same plaintiff had judgments for refusals which took place subsequent to the institution of the plaintiff's first action, but prior to the institution of some other actions embraced in the second class. The rule respecting the attempt to recover cumulative penalties in these cases has been thus stated: "A sound public policy requires that only one penalty should be recovered in a single action, and that the institution of an action for a penalty is to be regarded as a waiver of all previous penalties incurred." The application of this rule would forbid not only the recovery of more than one penalty in a single action, but the maintenance of a second or subsequent action for penalties incurred before the institution of a prior action. So far as concerned the first action, in point of time, brought by the several plaintiffs whose appeals were compromised within the third class, they must be reduced to $62, and as so reduced affirmed, without costs in this court.

It was, however, only as to the subsequent actions that any real difficulty had been suggested. The fact that they were by the same plaintiff for penalties incurred prior to the institution of another and earlier action did not (at least, in most cases) appear in the particular record of the individual judgment, and it was strongly argued by the several plaintiffs that this court might not look outside the record in any case for the purpose of reversing a judgment. But the court says that in each one of the second or subsequent judgments there had been a recovery for more than one penalty, and that it therefore appeared upon the face of the record that the judgment was erroneous, and could not stand as it was. It must be either reversed or modified, and whether it should be reversed or modified was a matter resting in the discretion of this court. While therefore this court should not feel at liberty to [illegible] notice of all the records actually before it in order to guide it in the [illegible] able exercise of discretion required that in each of the appeals embraced in this class, except that from the judgments in the action first commenced, the judgment should be reversed, and a new trial granted, without costs to either party in this court.

MAY BE REQUIRED TO LOWER TUNNEL UNDER NAVIGABLE WATER WITHOUT COMPENSATION.

West Chicago Street Railroad Co. vs. People, ex rel. City of Chicago (Ill.), 73 N. E. Rep. 393. Feb. 21, 1905.

In this case the city of Chicago filed its petition praying for a writ of mandamus commanding the street railroad company to proceed to lower its tunnel under the south branch of the Chicago river, so as to provide for a clear depth above said tunnel of at least 21 feet of water, or to wholly remove the tunnel, so that it should cease to be an obstruction to the free navigation of the river. It was contended that in no event could the defendant be required to lower or remove the tunnel at its own expense. It was said that it was incorporated under the general act concerning corporations, and was thereby authorized to own, possess and enjoy so much real estate as should be necessary for the transaction of its business. The supreme court of Illinois says that the act was passed in 1872, and a horse and dummy act was passed in 1874, by which any company which had been or should be incorporated under the general laws of the state for the purpose of constructing, maintaining, or operating any horse or dummy railway or tramway was authorized to construct its road across or over any waters in this state in such manner as not to interrupt the navigation of such waters. This act was an addition to the charter of any company organized under the general incorporation act, and its provisions have existed under some form ever since, conferring powers upon street railroad companies organized as the defendant was. It gave the defendant the right to construct its railroad either over or across the Chicago river, which included the tunnel, subject to the condition contained in it. The defendant could only hold real estate for the transaction of its business of maintaining and operating a street railroad, and the statute fixed the conditions under which it might use its real estate for building the tunnel. But it would make no difference if the defendant rested its right to build the tunnel on the fact that it owned the land on each side of the river, and therefore owned the soil beneath it, for the reason that the provision of the horse and dummy act was merely declaratory of the common law.

The title to land under a navigable river is not the same as the title to the shore land. The title to the upland is absolute and paramount, while the title to the lands over which the navigable water flows is subordinate to the public right of navigation. In a navigable stream the public right is paramount, and the owner of the soil under the bed of such a stream can only use and enjoy it in so far as is consistent with the public right, which must be free and unobstructed. It made no difference, therefore, whether the defendant, in building the tunnel, was attempting to exercise the right of a private owner or rights conferred by the horse and dummy act.

Under these established rules an owner who erects a structure, whether it be a tunnel or whatever it be, in the soil under the navigable water, does it at his peril, and if it becomes an obstruction to the paramount right of navigation he may be compelled to remove it. It necessarily followed that in requiring this tunnel to be removed no property of the defendant was taken or damaged. There was no interference with anything which the owner had a right to maintain, and the fact that it would require an expenditure of money by the defendant did not establish its right to compensation. There was no attempt to appropriate any property of the defendant [illegible]

The sole purpose of the proceeding was to protect the paramount right of the public to the navigation of the river. As there was nothing to be taken there was nothing to be compensated for.

Again, it was urged that the city could not insist upon the removal of the tunnel, for the reason that in granting the license no right was reserved for requiring a removal of the tunnel, and there was no contract by which the defendant bound itself to remove it when the navigation of the river might require such removal. The court says that the city could not, if it would, grant the right to obstruct the navigation of the river, or bind itself to permit anything which had become an obstruction to be continued. The state of Illinois had never attempted to grant such a right to the city or to the defendant. The power given to the city was to deepen the channel and improve navigation, not to destroy it. By section 1 of the horse and dummy act it was expressly provided that street railroad corporations, in crossing rivers, should not interrupt navigation.

It was also argued that the tunnel should not be lowered or removed because there were two other tunnels between the place where it was located and the mouth of the river which were equally obstructions to navigation, and therefore there would be no beneficial result from the execution of the writ. But the court thinks it clear that the fact of other obstructions in the river was no answer or justification for the defendant.

PARTIES TO CONDEMNATION PROCEEDINGS—RIGHTS ACQUIRED BY LOCATION OF ROAD BEFORE INCORPORATION OF CITY—TIME OF FILING PETITION—MEASURE OF DAMAGES

Dowie vs. Chicago, Waukegan & North Shore Railway Co. (Ill.), 73 N. E. Rep. 354. Feb. 21, 1905.

Between the 20th and 26th days of March, 1902, the company located and staked out its line in question, and in the latter part of March or first of April filed its petition and plat of its right of way in the circuit court, and began this proceeding for condemnation. It was contended that Zion City, a municipal corporation, should have been made a party, and that, without having all the parties in interest before it, the court did not have jurisdiction to proceed and find the appellant's (Dowie's) damages. But the supreme court of Illinois holds that there was no reason for the rule contended for by the appellant. It says that one who had an interest in the property and who was not made a party was not affected by the proceeding, and lost no rights thereby, and it was of no concern to the appellant that other persons who might have interests were not made parties, as the appellant was in no manner affected or controlled by the rights of other persons as to his damages, and as to his rights under the petition. The proceeding would be as though no other party was defendant. In the case at bar, if the appellant's contention that the city of Zion was a municipal corporation, and was the owner of the streets and alleys over a portion of the lands through which the company condemned its right of way, was sound, he was not only not injured, but greatly benefited, by the fact that the city was not made a party, as he had been allowed compensation for the value of all the lands taken by the company that he claimed belonged to the streets and alleys of the city, and the only effect would be that if he received pay therefor, and the land did not belong to him, the city would still be at liberty to assert its claim.

The contention that the company could not condemn its right of way over the lands of the appellant lying within the present corporate limits of Zion City because it (the company) did not have a license to cross or traverse the streets and alleys of Zion City, the supreme court says, could not be admitted. If such license was necessary, the question only affected the rights of the company and the city, and the company might, if it became necessary, obtain the license of the city, at any time before it constructed its road. Besides, the evidence showed, beyond question, that the company had located, surveyed and staked out its route for its road over the land in question before the incorporation of Zion City, and the subsequent incorporation could not affect the company's right to the extent of depriving it of its priority of location. When Zion City became incorporated, it was bound to take notice of the company's rights and prior location by showing upon its plat the exact location and width of the company's right of way.

On March 28th or 29th (which of said dates being uncertain), the company, by special messenger, delivered into the hands of the circuit clerk the petition for condemnation, and the plat or profile of its right of way as located, with a written request, in the form of a letter to the clerk, to file both the petition and the plat, and issue summons against the appellant, and deliver the same to the sheriff, and stating that the attorney would remit. The clerk received the papers from the messenger, and retained the same till March 31, 1902, when he wrote the company's attorney that he doubted his right to file the survey or plat, and stated the docket fee was $16, but did not state whether he had filed the petition or not. The attorney for the company visited the clerk April 1st, and requested the clerk to file the papers as of the date delivered; but the clerk would not do so, but filed them as of April 1st. The clerk, at the time the papers were presented to him, did not demand the fee, but held the papers until Zion City had voted to be incorporated, and the appellant had filed a plat subdividing a portion of the territory through which the company's right of way was located. The testimony tended to show, or strongly raised the suspicion, that the clerk was fully aware of the nature of the papers and the importance attached to their filing, and of the proceedings that were being taken by the appellant to prevent the company from having the benefit of the proceedings, by the incorporation of part of the territory through which the line was to run.

The supreme court says that it is not prepared to hold that the failure of the company to advance or tender the fee, when not demanded, deprived it of the benefit of the prior presentation of the petition and plat to the clerk. It has been well said that one having an instrument to file in an office can only present it to the proper officer, and when he has done that he has all the benefit and advantage of the act, as though it had been formally filed, as he has no control over the person of the officer; and the court feels entirely warranted, on a well-established line of authorities, and under the facts established by the record, in holding that the company was entitled to the benefit of the filing as of March 28th or 29th, either of which dates was anterior to the incorporation of Zion City.

The question of the filing of the petition in this case became important in another aspect of the case. The appellant contended that Zion City was incorporated before the filing of the petition, and that the property sought to be condemned should have been recognized as blocks, streets and alleys, as shown by the plat, and that the company was entitled to have the court take into consideration the fact that at the time the petition was filed a large portion of the property belonging to the appellant that was proposed to be taken in the right of way, was within the limits of an incorporated and platted city. But the rule, the supreme court says, seems to be clear that the rights and interests of the parties date from the time of the filing of the condemnation petition.

The appellant, on March 29th, filed the plat of a portion of the territory that was afterwards included in the corporate limits of Zion City, and it was argued that, as that plat was filed prior to the company's plat or petition, the appellant had gained the priority thereby; and it was also contended that by the filing of the plat, and that being followed by the incorporation on the 31st of March, and later by the election of officers, by the principle of relation the whole incorporation would date as of the time of the filing of the plat. But the supreme court holds that these contentions were not supported by reason or authority.

The right to entertain any religious belief one or any number of people may see fit to adopt, so long as it does not lead to violation of law, the supreme court says, is one that is guaranteed by the very spirit of our institutions; but that right does not bring to it, or carry with it, increased or additional property rights to those held by other people adopting other religious views or no religious views. The rule of law as applied to the right of condemnation is alike applicable to the property of Dr. Dowie as it is to that of any other citizen, and the fact that he may have in his mind and may have formulated a great plan for the upbuilding and salvation of people cannot, of itself, impress his property with an increased value that must be recognized by the law when its use is demanded in the name of the state, but that property must be measured as other property owned by other people in the same vicinity, and similarly situated.

Iowa State Association.

The second annual convention of the Iowa Street & Interurban Railway Association was held at Dubuque, April 20th and 21st, April 20th being the last day of the convention of the Iowa Electrical Association. This arrangement of dates was chosen so that the railway association might participate in the work of the electrical association that was of particular interest to the former. The Hotel Julian was the headquarters.

The first session of the railway association was called to order at 10:15 a. m. Thursday by the president, Mr. George B. Hippee, of Des Moines.

Mr. J. R. Lindsay, secretary and treasurer of the Union Electric Co., of Dubuque, in a few well chosen remarks, welcomed the association to Dubuque. The minutes of the Des Moines meeting, held Apr. 20, 1904, were then read and approved. Next followed a report of the executive committee.

Mr. Hippee then delivered his annual address, which was as follows:

Address of President George B. Hippee.

In behalf of the members of the Iowa Street & Interurban Railway Association, we extend to you our hearty thanks for your kind words of welcome. It is a curious coincidence that Dubuque, the oldest city in this state, was settled in 1833, the same year that John Stephenson, the veteran car builder, was granted the first patent for a street car. He built the cars for the New York & Harlem Railway Co., now known as the "Fourth Avenue Line," of New York City, the charter having been granted this line in April of 1831, this being the first charter granted for a street car line in this country. The first car built was named "John Mason," this gentleman being president of the Chemical Bank and also of this street railway company. From this time began, and is still going on, a complete revolution in the street transportation of this country. I am not one that believes the end is yet, or in sight. While our eastern friends were first in the field as horse car roads, it remained for the bustling west to develop and make the electric railway a success. Dubuque, Davenport and Des Moines took up this electric problem in its early experimental stage. An exhibit of some of our early equipment would be interesting. How crude were the old 10-h. p. reduction, T. H. motors, the old Sprague double reduction, or the old "pet" that our Dubuque friends used—the Detroit motor, almost as large as a small size generator. These would be a curiosity to some of us now.

Senator Dolliver says civilization and mud go together. That may be true, but civilization keeps pushing the car of progress through the mud of today on to the firm steel highway of tomorrow. Civilization and mud means civilization and speed. Every good town in our state of any size has its street railway lines. We have many paper suburban lines and some real good, live, active, up-to-date interurban lines. In time, as the country grows and business expands, this state will be a perfect network of interurban railways. As more and more of these lines are built and connected with your city systems, we will find that our business will change and expand. Freight will be added to our passengers. I know that at the present time it is not considered by street railway men advisable to handle heavy freight on our city lines, but the time is coming when you are going to do this business, because you can do it better and cheaper than the long-haul teams. It will be better for the business man, better for the city at large. If for no other reason, it will take the heavy teaming off your pavements and thereby prolong their life. It will be good for you because it gives you other sources of revenue.

We cannot sit still and stop in this growing western state of ours. Street and interurban business is one of progress. Today we have the best and latest devices and appliances. Tomorrow these will be obsolete. To keep our place we must not only keep abreast of the times; we must lead. We must discard the old and adopt the new, or else be ground under the wheels of progress.

This association of ours was formed for the purpose of getting together and learning more about this revolution that we always have with us. We want to exchange ideas, we want to utilize the good things that each of us has and turn them to the best advantage possible for the benefit of our respective properties. All our interests are getting too large to go it alone. The more interurbans that are built, the more our interests are mutual and on common ground. I am sorry to say that we have some companies in this state that seem to think there is no common ground that we can get on [illegible] to do at the meeting [illegible] are perfectly willing to take the benefits of our work and steal all the good they get [illegible]

The [illegible] well afford to send a representative [illegible] tion. It [illegible] word that [illegible] properly organized [illegible] dent, the general manager, the superintendent or some delegate in authority to attend these meetings. Do not think your road is going to stop running [illegible] so you have a mighty poor organization and one that you had better correct at once. You will die some day, but your cars will run just the same. There are other men, and good ones, and some of them are probably working for you.

We have men managing companies in this state that have not even common courtesy to answer our secretary's correspondence. It got so your officers were surprised when they received an answer to their letters; not surprised if they did not receive it. It is not right that the labor and burdens should fall on only a few companies. Our interests are mutual, and what is for our benefit is also for your good. Representatives from every company should be here to join in the discussion of the papers that will be read. I verily believe that this association can be made to be of more good to companies of this state than the larger American Street Railway Association which takes in all the states of the country. Our questions and our issues are local. This pertains to all branches of our business, and the greatest good can come from this state organization of the local companies, if the local companies will only give it loyal support.

Before closing I want to extend my thanks to the members of the executive committee, and especially to our very efficient secretary. He has had a hard job and one at times very discouraging, owing to the lack of interest shown. As you know, he has been very busy arranging for the electric light as well as this meeting, and has had his hands full. If we only had more of his kind scattered throughout the state, it would be better for all of our interests. To you gentlemen who have aided and assisted him by your presence and contributions to this meeting, we extend our most sincere thanks, and only wish there were more like you.

Mr. L. D. Mathes, general manager of the Union Electric Co., of Dubuque, read his report as secretary and treasurer of the association, which showed receipts of the year for $250, expenses of $11.50 and a balance of $238.50 on hand.

The first paper before the convention was that of Mr. H. H. Polk, of Des Moines, on "Handling Freight by Interurbans and Interchange of Business with Steam Railroads." Mr. Polk's paper, which will be found on page 309, was discussed by a large number of those present, the subject being one of special interest.

Thursday afternoon delegates of the railway association attended the meeting of the Iowa Electrical Association at which were read a paper by Mr. W. E. Boileau on "Steam Turbines," treating the subject from the standpoint of the central station operator, and a paper by Mr. J. G. Boyd, of Sioux City, on "Gold Brick Finance," in which were discussed the fallacies underlying the movement for municipal ownership of public utilities.

After the conclusion of this session the railway men visited the plant of the Union Railway Co., which is a Curtis turbine station similar in its general design to that of the Chattanooga Electric Co., illustrated in the "Review" for March.

Friday, April 21st.

The meeting convened at 10:30 a. m., and the following papers were read: "Accounting as an Aid to the Operating Department," by R. A. Leussler, Council Bluffs; "Car Shop Methods," by John D. Fish, Davenport; "Rural Railways", by F. McDonald, Waterloo.

In the discussion of Mr. McDonald's paper especial stress was laid on the matter of providing a right of way of sufficient width, 100 ft. being considered the most satisfactory width.

Mr. H. H. Clarke, of Fairbanks, Morse & Co., was called upon to discuss the application of gasoline motor cars to street railway and interurban work. He briefly summarized experiments in this direction with which he was familiar, mentioning the gasoline car equipped with bevel transmission gears used in Germany, the Prouty-Pierce gasoline car used at Sioux City, Tabor cars with

[illegible] the Hicks car recently built for the St. Joseph Valley Traction Co.

Mr. Clarke described some of the section cars and inspection cars built by his firm. The firm's 6-h. p. inspection car has two speeds in forward and one in reverse motion and has in service drawn seven hand cars with a load of 86 men at a speed in excess of five miles per hour. Its inspection car which has seats for nine persons is capable of a speed of 30 miles per hour. The firm is now building a new car to seat 20 persons; this is to be equipped with a 4-cylinder 25-h. p. engine.

Mr. Hippee expressed the belief that the gasoline motors must receive the serious attention of the railway companies but that these cars must be used as locomotives only, thus keeping the gasoline out of the passenger cars. The most serious problem in developing this class of motors he considers to be the transmission gear.

At 1:30 p. m. the convention adjourned to the Dubuque Club where the delegates were the guests of the Union Electric Co. at luncheon, at the conclusion of which the final business of the association was transacted.

The officers of the association were all re-elected for the ensuing year: President, George B. Hippee, Des Moines; vice-president, James F. Lardner, Davenport; secretary and treasurer, L. D. Mathes, Dubuque.

It was decided to hold the next meeting in Des Moines during the week of the meeting of the Iowa Electrical Association.

After a vote of thanks to the secretary and to the United Electric Co. the convention adjourned sine die.

The delegates of members in attendance were: J. W. Garner, Ottumwa; F. L. Diserens, Cedar Rapids; F. W. Laas, Cedar Rapids; J. F. Lardner, Davenport; J. G. Huntoon, Davenport; G. B. Hippee, Des Moines; H. H. Polk, Des Moines; J. D. Walters, Toledo; A. J. Lever, Toledo; C. H. Walsh, Burlington; J. W. Walsh, Davenport; W. L. Bowers, Davenport; R. A. Leussler, Council Bluffs; H. B. Noyes, Council Bluffs; F. J. Hanlon, Mason City; R. M. Howard, Clinton; C. C. Ewing, Clinton; L. D. Mathes, Dubuque; J. R. Lindsay, Dubuque; G. E. Miller, Dubuque; J. C. Donovan, Dubuque; E. L. Kirk, Sioux City; Frank McDonald, Waterloo; W. W. Hovey, Marshalltown; W. J. Greene, Cedar Rapids.

There was a large attendance of supply men at the convention, a number of houses making extensive exhibits. Among the street railway manufacturers and supply houses were:

H. W. Johns-Manville Co., represented by Frank E. Johnson; "Noark" fuses and railway line material.

National Carbon Co., represented by C. W. Wilkins.

Simplex Electrical Co., represented by W. F. Hruby.

Electric Storage Battery Co., represented by John A. White.

American District Steam Co., Lockport, N. Y., represented by its western manager, H. C. Eddy.

Porter & Berg, Inc., Chicago, represented by E. R. Mason, with an especially complete line of goods on exhibit, including Ohio Brass Co. overhead material and rail bonds; Crouse-Hinds Co. headlights; Falk Co. gears and pinions; "Miller" anchors; Speer Carbon Co. carbon brushes; Locke Insulator & Manufacturing Co. porcelain insulators; International Register Co. fare registers; Hunter illuminated car signs, National Brake Co. "Peacock" brakes, and a general line of supplies and tools.

National Electric Co., represented by A. P. Peck, H. M. Klingenfeld and J. Frank Perry, exhibiting samples of electrical apparatus and photograph and also a good assortment of descriptive literature. Thursday evening the company entertained, providing an orchestra concert at the hotel; the program announced "National Airs; 90 per cent Christensen."

Westinghouse Traction Brake Co., represented by C. J. Olmstead.

Sterling-Meaker Co., represented by F. D. Willis.

Gould Storage Battery Co., represented by P. B. Yates.

Duncan Electric Manufacturing Co., represented by W. H. Sinks, had an interesting exhibit showing its meters.

W. R. Garton Co., represented by W. R. Garton and E. D. Hill, exhibiting a large number of the specialties and supplies handled by it in one of the reception rooms on the main floor.

General Electric Co., represented by R. H. Hayward, W. J. Ferris, G. A. Seabury, F. W. Taylor and W. H. Coleman.

Westinghouse Electric & Manufacturing Co., represented by H. A. Coughlin, A. M. Miller, W. R. Pinckard and C. A. Ross, exhibited an extensive line of central station and railway apparatus.

Rural Railways.*

BY F. MCDONALD, ASSISTANT TO PRESIDENT AND GENERAL MANAGER, WATERLOO, CEDAR FALLS & NORTHERN RY., WATERLOO, IA.

In writing on the subject, "Rural Railways," I wish first of all to explain that when I say "rural railways" I do not mean interurban railways between two or more cities, whose population is sufficient to support a railway for the passenger business alone, or where the population outside the city proper is made up of wage earners whose employment depends to a great extent on the city. The railways to which I refer are the ones that have a fairly large city for a terminal and for the rest must depend on towns of from 200 to 1,500 population and the farmers living adjacent to the line for passenger and freight business enough to keep at least one jump ahead of the sheriff. It is to such railways that I have applied, for want of a better name, that of "rural railways," and it is to this class that the majority of so-called interurban railways in Iowa must belong for some time to come, at least until we have greatly increased our population in both the cities and the rural districts.

In looking over the proposed interurban lines for Iowa I find that nearly all the promoters are depending on the freight business from the country districts to furnish a large part of the revenue. We have at Waterloo about 45 miles of this class of railway, the rest of our line (about 35 miles) being in the cities of Waterloo and Cedar Falls, and between the two cities.

We handle freight in carloads on all parts of our line, and have portions which are operated exclusively by electricity, other parts operated entirely by steam locomotives, and some on which both steam and electric motive power are used.

I have been connected with this road (The Waterloo, Cedar Falls & Northern) for the past nine years, in which time we converted the Waterloo street railway from a horse car line into an electric street railway, and built the interurban line between Waterloo and Cedar Falls. The contents of this paper will necessarily be largely a history of that line. The statements made herein will probably conflict with opinions of many of those present today, and are simply opinions which have been formed from actual experience during the five years in which we have been engaged in the construction and operation of the rural end of our line. In the first place, I wish to say that so far as I know we were the first to attempt to build such a line, at least we were unable to find another road operating under the same conditions. Our president, Mr. Cass, and myself made several trips to different points where electric railways were said to be doing a freight and passenger business, only to find that their freight business consisted of a package or express business. In only one instance did we find a road handling freight in carloads in standard steam railways cars on joint through tariffs with trunk line railways. This was the Mason City & Clear Lake Ry., operated by Mr. Hanlon and his associates, and they had "Clear Lake," a summer resort, which drew large crowds of people during a greater part of the year to help them out on the passenger end of the business. We had nothing of this sort in the territory which we expected to enter, but only the market towns populated by business men, retired farmers and a few laborers and mechanics, and the farmers living along the line, each of whom had a stable full of horses. We did, however, have a fairly large territory not tapped by any other railway, in one of the richest and best parts of Iowa; also one or two inland towns which only lacked railway facilities to make them flourishing market points for the adjacent farming community. In addition to these we had a number of creameries whose coal and butter had to be hauled by team from five to twelve miles. For a start we built 15 miles from Waterloo to Denver, a small inland town of perhaps 150 people.

Location.

In locating a line of this kind it is necessary that a territory be selected in which the competition will not be direct with steam railways already established, the idea being to work as far as possible with the steam roads as a feeder and not against them; for the farming community alone will never support a railway unless there is a reasonable chance to secure the freight and passenger business in and out of its market towns.

Financing.

In financing a road of this class one of the great difficulties is to

*Read before the Iowa Street and Interurban Railway Association, Dubuque, Apr. 21, 1905.

convince the investor of the amount of business you can [illegible] on, and the universal question is "What is the population per mile?" Now, you gentlemen, who are acquainted with Iowa, know that the population per mile of an Iowa farming district, where each farmer owns a quarter section and some of them two or three times that amount of land, does not show up very well in a broker's office. The only way to convince them is to get them on the ground. [illegible] them the territory and the need of railway facilities. I wish to say here that you can do more to convince your man in one day's drive through Iowa during June or July than you can in a week in his office with a pencil and paper.

You must also be able to show that after you get your freight you have a way to get rid of it by connection with one or more trunk lines, the more the better, on a traffic arrangement whereby your shippers can secure the same rates for an equal distance that the shippers and merchants in neighboring towns, located on trunk lines get. This, in some cases, is very difficult, from the fact that since the time that electric roads entered the field of modern transportation they have been opposed by trunk line officials. Fortunately some of them are broad minded enough to take the position that they do not care how the business comes to them, by electricity, by team, or on foot, so they get it.

Construction.

In constructing such a line there is a tendency to lessen the cost of construction by not getting the maximum grades low enough, the idea being that with light trains one can mount a 3 or 4 per cent grade without much difficulty, and the cost of construction is lessened materially. Do not do it; for if you do, every time you pull a train over that grade you will regret it, and in time you will be compelled to cut it down, which will cost two or three times as much after the road is in operation. On the Waterloo line our maximum grade is one per cent, to obtain which, we had to make some deep cuts and some very heavy fills. In locating a line of this kind we have found it a great advantage to follow the half section lines wherever it is possible, in preference to running on or near the section lines or public highway, for several reasons. Among these are, that it is much easier to secure rights of way where in the majority of cases there is only taken a strip of land off one side of a man's farm, and easier also to avoid the farm yards and buildings, which, as a rule, are located near the section lines. There is also a decided advantage in securing passenger business through the country from the fact that there are two main roads to draw from, each only half mile from the line; in case the section line is followed there would be but that one road, the others being a mile distant in either direction.

Right of way should not be less than 100 ft. in width, in order to get room for barrow pits for obtaining material for heavy fills and avoid long over-hauls; also to get width for cuts and a chance to build snow fences far enough from the track to give the proper protection. We made the mistake of building our first 15 miles on a 50-ft. right of way, and have never ceased to regret it, for we soon found that it was much easier to get land for right of way before a line is built than to secure additional ground after a line is in operation, and during the past winter this 15 miles on narrow right of way has given us more trouble with snow than the other 30 miles on the same division.

In track and bridge construction we followed, as nearly as possible, standard steam railway construction, and in cases of washouts, wrecks, etc., on the large lines, we have often been called on to detour their trains over our line, and notwithstanding the fact that these trains are hauled by the heaviest of locomotives we have never had any trouble or any damage. The bridges I consider the important point, for a comparatively light rail (ours are for the most part 60-lb.) will carry a very heavy train if run at a reasonably slow speed. We limit the heavy engines of the steam roads to 30 miles per hour when running over our line, and always send a pilot who is perfectly familiar with all parts of the road.

Motive Power.

This is one of the hardest questions to decide for a road of this class, and while I realize that this is a convention of electric railways, I wish to say to any gentleman here who is contemplating the building of a railway through a farming district, consider well the location, prospective volume of business, and the frequency of the train service which you wish to give before installing expensive electrical machinery and overhead equipment to operate a line of [illegible] of Waterloo [illegible] Great Western Ry., equipped with electricity. We use for this line 20,000-volt alternating current stepped down through transformers and the rotary [illegible] mention that [illegible] house, Mr. Dryer, who was then with the Westinghouse Electric & Manufacturing Co., [illegible] running it as a generator, taking direct current off one end to supply our city lines, and alternating current off the other end for the longer lines. This was done by removing the starting motor from the end of the armature shaft and substituting a pulley, so that it might be driven by an engine. The plan has worked successfully for the four years we have had it in operation. I do not know of any other place where this scheme is in use, and I mention it thinking it might be of service to some of you. I do not know much about lighting plants, but it seems to me that where the street railway and lighting plants are consolidated it might successfully be adopted, using the alternating current end of the generator for lighting and the direct current end for street railway. It is a great saving in power house floor space over putting in two generators and a line shaft, or separate engine for each generator.

For the first six months we operated our line to Denver by steam, both freight and passenger trains; then having completed the installing of electric machinery and overhead work, we operated it entirely by electricity. This we continued to do for about eight months, using in the freight service an electric locomotive of 120 h. p. This locomotive would handle five loads over our heaviest grades, but we found, in operating a freight line, as many of you have found in the passenger business, that we could not take part and let the rest wait until we went back after it; it all must go about the same time. Our business is mainly a through business, and depends on connections with the trunk lines at junction points. For example, stock, butter and other time freight must connect with the time freight trains on the connecting lines, and at the same time shippers object to loading any earlier in the day than gives just time to make the run, and as a rule there are one or two days in the week when all stock men wish to ship in order to reach the market on a certain day. We soon found that in order to take care of the business it would be necessary to put into service a much larger locomotive, which meant increasing the capacity of our power station and overhead lines. This added investment would be used only one or at most two days in the week. We studied the matter carefully, making the comparison of operating electric and steam locomotives, both for labor and fuel, and returned to the use of the steam locomotive for the freight business, except for switching at points where the use of a steam locomotive was not practicable.

The amount of coal burned on our steam locomotives averages about 1.4 tons per 10,000 ton-miles, while for electrical service it is between 8 and 9 tons per 10,000 ton-miles. It is true that this is hardly a fair comparison, as the coal used in locomotives is Illinois lump, while that used at the power house is the cheapest Iowa steam, and also for the reason that the steam locomotives have longer runs without stopping, thereby giving them the advantage of the momentum, while the electric cars are operated largely on city lines, where they have to start and stop every few hundred feet.

About two years ago we acquired control of 28 miles of steam railway track between Denver Junction and Sumner. This we have never equipped for electricity, but have operated entirely by steam, running two passenger and one freight train each way per day. The passenger trains are operated the same as the electrical service, stopping to receive and discharge passengers at all highway crossings. We do not find this any more difficult to do with a light train, consisting of one combination baggage and smoker and one straight day coach, equipped with air brakes, than with an electrical train of the same size. This number of trains takes care of all regular passenger business without difficulty, and for special occasions we run excursion trains of whatever size is necessary to care for the business. The freight trains make the round trip from Sumner to Waterloo each day, a distance of 45 miles, or 90 miles for the round trip, with one engine and crew.

[illegible] the rural railway I have found the advantage of electric motive power over steam is largely a matter of convenience to the public, there being no question but that it is pleasanter to ride in an electric train with no smoke and no smell. On the other hand, the steam train has the advantage that each train has its own motive power. On the electric line, if anything happens to the power house or overhead lines, every train on that section of the road is at a standstill until the damage is repaired, and if it is line trouble and far out, considerable time is lost in reaching the location of the trouble, especially if you have no steam locomotive or other means of reaching the scene of trouble. In snow, I think with locomotives of the same weight and the power behind them the electric will do as good work as the steam, but when it comes to lightning and sleet, the steam locomotives have a decided advantage, and on one of these cross-country lines, over Iowa prairies, the bad sleet storms are as much to be dreaded on an electric line as the snow storm. If any one here has discovered a successful way to fight sleet on an interurban trolley wire, I should like to know it.

Our morning train out of Waterloo must make connection at Denver Junction with the Chicago Great Western train for Ft. Dodge, Omaha and all points west to the coast. In winter, when we were troubled with the snow, we could count on the other road being delayed by the storm to about the same extent we were; but during the early part of March we had a few sleet storms that (while not as bad as I have seen) were sufficient to delay our electric train for an hour or more, while the steam roads never knew there was a storm so far as their running time was concerned. No sooner does the weather become warm enough to do away with the trouble of snow and sleet than the trouble of lightning begins. We are protected by tank arresters, pole arresters and car arresters, but still we lose more or less armatures, to say nothing of the loss of controllers, light circuits, etc. We have fortunately never lost any generators at our power station.

For switching purposes it is often possible to use an electric locomotive in places where it would be impossible to use steam. For example, on our line at Cedar Falls we switch all the coal for the Iowa State Normal School from the steam railways, a distance of about a mile. We do this over our regular city line on the streets of Cedar Falls. During the fall and winter months they use about 300 tons per week, and it would be impossible to perform this service with a steam locomotive on account of the objecting of the city to running it on the streets. As it is, some property owners claim that the value of their property is decreased because a car or two of coal is hauled past their residence each day in a coal car, instead of in wagons, which would have to be done if we did not switch it.

In making rates, both freight and passenger, we have adopted the regular steam railway practice along our rural lines—viz., Iowa Distance Tariff and Classification for freight and 3 cents per mile for passengers.

I speak now of local business. On interstate and all through business we have through tariffc with our connecting lines and their connections, of which we draw our proportion, according to our traffic agreement with them.

Some people seem to think the electric or small steam railway should be able to handle passengers or freight for about 50 per cent of what the trunk lines charge. I cannot see it in that way, nor do I see any reason for any one supposing that it can be done; and I wish to say that you will find it much harder to raise the rate if you start too low than to drop it if you find it too high. We have had some experience along that line.

The patrons of a rural railway are not of a class that turn out en masse every day or do a great amount of pleasure riding, and for all special occasions, where there is a chance to draw large crowds by reduction of rate, you can put in an excursion rate that will in no way interfere with the regular business. We are members of the American Railway Association and the Western Passenger Association, and conform to their rules, selling interchangeable mileage, etc. We have a general passenger department and a general freight department, each of which looks after the business of its own department. In establishing freight terminals in Waterloo, we found we could lease terminal rights from the railways already established near the business center of the city much cheaper than we could secure and maintain our own in anywhere near as good a location. We do, however, maintain a city ticket office in connection with our city line waiting room, where we sell tickets to all parts of the world, and often only haul the passenger from his home to the depot on our city cars. Did space permit, I would like to touch on many points in connection with the operation of the rural railway, such as the system of dispatching trains, handling of business at the smaller towns, making of schedules, etc., all of which are very necessary to economic and successful operation of the rural railway, but I have already overstepped the time limit and am running on the time of other members on this morning's program.

I thank you for your attention, and would be pleased to have you come to Waterloo at any time, where we will be pleased to give you any information in our power, not perhaps so much by showing you what we have done as by pointing out the things we would not do if we could begin over again.

Semi-Convertible Cars for Newport News & Old Point.

The Newport News (Va.) & Old Point Railway & Electric Co. has lately received from the J. G. Brill Co. nine semi-convertible cars which will be operated in Newport News and on the suburban line connecting Newport News and Old Point. Newport News is a flourishing seaport, with a population of about 20,000, and Old Point is one of the most popular resorts on the eastern coast. The railway company now operates 75 cars and about 30 miles of track traversing a most pleasing section of country.

The cars measure 33 ft. 4 in. over the end panels and are 8 ft. ½ in. wide over the sills. They have seats for 44 passengers, with a smoking compartment 8 ft. 9 in. long at one end. The cane-covered seats are 24 in. high of the double-roll back type and have grab handles attached. The interiors are handsomely finished in

BRILL CAR FOR NEWPORT NEWS.

cherry, with ceilings of decorated birch. The semi-convertible window system adapts the cars to mild climates quite as well as the more severe climates of northern latitudes, as the sashes may be changed at will and held at any height, or raised entirely into pockets in the side roofs, thus admitting any amount of air desired. The advantages claimed for the roof pockets are that there is a gain of several inches in the interior width of the car, and that there is no danger of fingers being pinched, nor glass broken, as is so often the case where wall pockets are used.

The builders' specialties used include angle-iron bumpers, radial drawbars, "Dedenda" gongs, "Retriever" bells, vestibule door controlling devices and sand boxes. The general dimensions of the cars are: Length over crown pieces and vestibules, 43 ft. 4 in.; width over posts at belt, 8 ft. 4 in.; sweep of the posts, 1¾ in.; center to center of posts, 2 ft. 8 in ; side sills, 4 in. x 7¾ in., plated with ⅜ in. x 12 in. steel; end sills 5¼ in. x 6⅞ in.; thickness of corner posts, 3¾ in., and of the side posts, 3¼ in. The No. 27-G trucks on which the cars are mounted have a wheel base of 4 ft., and 33-in. wheels.

Technical Publicity Association.

The advertising representatives of a large number of concerns engaged in the manufacturing of machinery and allied industries have formed an organization to be known as the Technical Publicity Association. The first annual meeting, dinner and election of officers was held in the rooms of the Hardware Club in the Postal Telegraph Building, New York City, on the evening of April 27th, when an address was delivered by Mr. E. P. Harris, well known as a broker of trade and technical journals.

Wages of gatemen and guards on the subway and elevated line of the Interborough Rapid Transit Co. have been increased.

The Electric Railway Freight Service.*

BY H. H. POLK, PRESIDENT AND GENERAL MANAGER, INTERURBAN RAILWAY CO., DES MOINES, IA.

It is only within the last three or four years that electric railway men have awakened to the fact that there might be some money made at the freight business. Even today the majority of them will not consider the idea at all. They are content with the passenger business alone. The one great reason for this is the fact that electric railways when first built were nothing more nor less than street railways extended into the country, the track being laid upon the public highway and constructed of light rails and ties and operated by street railway men who had had no experience in steam railway service and who did not realize the possibility of freight as a source of earnings for the electric railway. Within the last few years, however, the modern electric railway is being built on steam railway standards. This means low grades, minimum curvature, heavy rails and bridges, and the private right of way. The private right of way enables the electric railway to run its cars at any rate of speed it desires, to haul any kind of freight, and eliminates the great majority of accidents caused by collisions with teams and vehicles.

In every territory occupied by an electric railway there will be found freight to be shipped in and out. These roads will either have steam railway competition or they will not. Even if they have, they certainly should get practically all of the local or less than carload shipments, owing to the frequent and rapid service which they can give. This service can be made equal or superior to the express service of steam railways, and if the electric railway is fortunate enough to have traffic arrangements with connecting steam railways it should secure a greater portion of the through carload and foreign shipments to competitive points. It seems to me that steam railways, with few exceptions, are very short sighted in refusing to recognize electric railways in the interchange of freight. They cannot by this policy stop the building of electric railways. The latter are here to stay, and each year sees more of them in operation. They make good feeders for the steam railways, bringing to them much freight. The steam railways that publish joint rates with electric railways, and are willing to grant a division of the rate, will get all of the foreign shipments which originate on the line of the electric road, and there are many instances where the electric railway taps a new territory, one to which the steam railroad has heretofore never had access. The electric railway should have a traffic arrangement with some connecting steam railway in order to do a successful carload business, for if it does not have this the rate from a point on its line to a point on the steam railway would be the sum of the two locals, and therefore prohibitive.

Mr. A. B. Stickney, president of the Chicago Great Western Railway Co., says that he does not care how freight is brought to his road, whether in a wheelbarrow, stage-coach, horse car or by an electric car; he will take it and be willing to pay a little something to get it. This is the broad-minded view to be taken of this question. It is generally conceded that the electric road is more popular with the farmer. It is more profitable to him to ship over the electric railway than over steam railway, as the electric railway gives him more rapid, frequent and fully as reliable service, enabling him to receive and ship freight, mail and express at almost any hour of the day. The farm takes on a new aspect and becomes capable of being used in many ways otherwise impossible, part of the benefit of which will, of course, accrue to the railroad. On the farm not adjacent to an electric road it is not profitable to raise garden truck for the market. The farmer cannot afford to take his team away from the field in order to haul this garden produce to the market, so he feeds to the hogs or allows to go to waste enough to pay his taxes each year. With an electric road doing a general railroad business, such as the hauling of passengers and freight, mail and express, running through the farms or near them, it becomes a simple matter to market the products of the farm every morning. This is also true of the poultry, fruit and dairy business. The products of the farm can be marketed regardless of the condition of the roads, at any time of the year. If there is coal under the land, it at once becomes available. If a farm machine is broken, repair parts can be got easily and quickly, and work can be resumed without losing a day or so.

[illegible] lowest rate and the shortest route. After deciding upon what road he desires to ship he has merely to notify the electric railway and he will be supplied with a car from that road. He can also ship in tile, coal, machinery, feed, etc., and have these cars set upon his siding, eliminating the long haul from the railroad station. Is it not true that these advantages to the farmer will give to the electric railway the majority of the business it can handle. Much the same thing is true of the small cities and towns through which these interurban lines run. The merchant can easily order by telephone from the wholesale houses and within an hour or two the goods so ordered are in his store. He is not required to have so great an investment in his stock, and is able to cut down his insurance, so that he, too, is glad to make use of the electric freight service.

Some comparison of statistics of the freight traffic on steam and electric railways may be interesting here. On steam railways the income from passenger service is about 30 per cent of the total earnings, while the receipts from the freight service amount to about 70 per cent.

During the year ending June 30, 1901, the steam railways in the United States reported a freight traffic of 1,089,226,440 tons. Of course this is a greater tonnage than shippers actually turned over to the railways, because of the handling of the same freight by more than one road, duplications resulting from taking the total of all traffic on all roads. However, after making the deductions necessary to eliminate the duplications, it is found that traffic received from the shippers amounted to 583,692,427 tons. To handle that vast tonnage required 29,400 freight and switching locomotives and 1,600,000 freight cars. The mines from which coal, iron ore and other minerals are taken furnish more than one-half the tonnage handled by the railroads, but as this traffic is carried at a low rate per ton the receipts from this amounts to much less than one-half of the total freight revenue. Manufacturing industries supply nearly one-seventh of the tonnage; the products of the forest nearly one-eighth; the products of agriculture one-ninth; the remainder, which is less than one-seventh of the total, consists of live stock, general merchandise and unclassified commodities. The articles referred to include many thousand kinds of commodities.

The reports on street and electric railways compiled by the Department of Commerce and Labor, Bureau of the Census for the year ending June 30, 1902, of all street and electric railways in operation during that time, give in Tables 42 and 43 the items of income with per cent that each item is of the total, which is as follows:

		Per cent.
Number of companies	[illegible]	
Operating earnings	[illegible]	[illegible]
From passengers	233,821,549	94.4
From chartered cars	303,608	0.1
From freight	1,038,097	0.4
From mail	432,080	0.2
From express	401,672	0.2
From sale of electric current for light and power	[illegible]	[illegible]
From miscellaneous	3,853,420	1.6

While Tables 46 and 47, classified according to population and separating the interurban from urban railways, show the items of income with per cent that each is of the total, as follows:

	Fast, long.	Other.
Number of companies	[illegible]	[illegible]
Operating earnings	[illegible]	[illegible]
From passengers	6,968,044	24,932,033
From chartered cars	34,044	78,311
From freight, mail and express	426,987	470,675
From sale of electric current for light and power	[illegible]	[illegible]
From miscellaneous sources	[illegible]	[illegible]

	Fast, long.	Other.
Operating earnings, per centage	100.0	100.0
From passengers	[illegible]	[illegible]
From chartered cars	0.4	0.3

*Read before the Iowa Street and Interurban Railway Association, Dubuque, Ia., Apr. 20, 1905.

[illegible]	[illegible]	[illegible]
From sale of electric current for light and power	0.2	1.2
[illegible]		[illegible]

From these figures we see that there is much room for the development of this department of electric railways.

Concerning Rates.

Until 1887 nearly every large railroad had a classification of its own, but now most business is handled by one of three classifications. These are the Official, which is used in the east; the Southern, and the Western. In several states—Illinois, Iowa, Georgia and some others—there are classifications prescribed by the state board of railroad commissioners applying to freight carried entirely within the state. The electric railways should use the classification which is used by the steam roads in their territory. In this state the roads should govern business within the state according to the Iowa Classification. On interstate business the Western Classification should apply. It is my opinion that the electric railways in this state should adopt a rate which is possibly 5 per cent lower than the Iowa Classification. The rapidity and frequency of the service does a great deal towards getting business for the electric road, but if we can say to a shipper that our rates are less than the Iowa Classification it is just that much more attractive to him.

A well organized freight department is, of course, of primary importance, and I will attempt to outline the methods used by our company in this department.

We have a general freight agent and two clerks in the general office. We also have a local agent at our freight house in Des Moines, and an agent at each of our stations on the line. The great volume of freight business done by steam railways is conducted by the use of a few business papers, and the records kept are complete and very simple. In the electric railway freight business still fewer papers are required. We use the regular shipping ticket that is used by all steam railroads. This is filled out by the shipper in duplicate, the agent receipting the original and retaining the duplicate, from which he makes up his way bills. The way bills show the station from the destination, the date, car number, car initials, consignor and consignee, number and description of articles, weight, rate and charges. They are sent to the freight auditor each day by the agent, and he enters them in his "Freight Forwarded Book." The agent also makes out an expense bill in duplicate for each consignment on the way bills for all freight billed from his station. The expense bill gives the names of the consignor and consignee, station from destination, car number, car initials, number and description of articles, weight, rate and charges. The conductor takes the expense bill instead of the way bill, as is customary on steam railways, and delivers it to the agent at destination, who in turn checks the freight delivered from them. The expense bills are then entered in a book called the "Freight Delivery Book," in which the consignee receipts for the shipment delivered to him. When the charges are paid, the agent signs the orginal and gives it to the consignee for his receipt, and the consignee signs the duplicate which is retained by the agent. The agent is required to remit to the treasurer daily all money, together with all duplicate expense bills, whether deadhead, prepaid or with charges, for freight which has been delivered A duplicate of these remittance sheets is retained by the agent. The original remittance sheet with all original expense bills and money are placed in a heavy manila envelope, which is sealed with wax and sent by "Railway Mail" to the treasurer, so as to reach the general office before 5 p. m. In this manner we can tell at the end of each day how each agent stands in his accounts. This system was adopted for two reasons; first, we wanted all accounts kept in the general office; and second, we could handle the freight and accounts at each station much cheaper than we could by any other system, and we have found this to be very satisfactory.

The greatest difficulty we experienced in developing our freight department was in convincing the public that we could handle any kind of freight, from a small package to a carload of live stock, grain, lumber or any other commodity. However, this did not take very long, and today they know that we can handle anything a steam railway can.

In order to do a successful freight business it is necessary to get out after the business or some one else will get it. Solicit your business, not only from the farms through which your road runs, but also from as far away as it is possible to draw it. The amount of business obtained by a good solicitor five or six miles away will astonish you. Do not be content to work up business in the country alone. Do so in your cities and towns. See that your freight solicitor makes regular calls upon the merchants of the smaller towns, the dairy concerns and wholesale houses in the cities. Find a market for the products of the farm, such as dairy products, poultry, fruit and vegetables. Encourage all of these lines and the freight business will rapidly grow.

A report of the Department of Commerce and Labor for the year 1902, in a general discussion of the characteristics and significance of interurban service, says: "It is difficult to avoid entrance into the domain of prophecy. Some of the electric railways have already made such progress in methods that certain prophets look forward to the complete superseding of steam traction by electric traction. However this may be, it is evident that even if the electric railways confine themselves to the methods already widely prevalent, they are bound to become a social and economic factor of enormous importance. Remarkable benefits have already been realized from the existing interurban lines, and the extension of such railways to a large proportion of our more prosperous communities seems but a matter of a short time."

Tennessee Jim Crow Law.

An act to promote the comfort of public travel by providing for and securing the separation of white and colored passengers on street cars. Approved Apr. 4, 1905. In effect, June 30, 1905.

Section 1. That all persons, companies or corporations operating any street car line or lines in the state of Tennessee be and the same are hereby required, where white and colored passengers are carried or transported in the same car or cars, to set apart and designate in each car or coach so operated, for both, a portion thereof, or certain seats therein, to be occupied by white passengers, and a portion thereof, or certain seats therein to be occupied by colored passengers: Provided, that nothing in this act shall be construed to apply to nurses attending children or other helpless persons of the other race: Provided, that large printed or painted signs shall be kept in a conspicuous place in the car or cars, or the parts thereof set apart or designated for the different races, on which shall be printed or painted, if set apart or designated for the white people, and it being a car so designated or set apart: "This car for white people." If a part of a car is so designated, then this sign, "This part of the car for white people." If set apart or designated for the colored race, this sign to be displayed in a conspicuous place, as follows: "This car for the colored race." If any part of a car is set apart or designated for said race, then this sign, as follows: "This part of the car for the colored race."

Sec. 2. That the conductor or other person in charge of any car or coach so operated upon any street car line shall have the right at any time when in his judgment it may be necessary or proper for the comfort or convenience of passengers so to do, to change the said designation so as to increase or decrease the amount of space or seats set apart for either race; or he may require any passenger to change his seat when or so often as the change in the passengers may make such change necessary.

Sec. 3. That all passengers on any street car line shall be required to take the seats assigned to them, and any person refusing so to do shall leave the car, or, remaining upon the car, shall be guilty of a misdemeanor, and upon conviction shall be fined any sum not to exceed $25: Provided, no conductor shall assign any person or passenger to a seat except those designated or set apart for the race to which said passenger belongs.

Sec. 4. That any person, company or corporation failing to set apart or designate separate portions of the cars operated for the separate accommodation of the white and colored passengers, as provided by this act, shall be guilty of a misdemeanor, and upon conviction shall be fined in any sum not to exceed $25.

Sec. 5. That nothing in this act shall be construed to prevent the running of extra or special cars for the exclusive accommodation of either white or colored passengers if the regular cars are operated as required by this act.

Sec. 6. That this act shall take effect ninety days from and after its passage, the public welfare requiring it.

The Aurora, Elgin & Chicago Railway Co. has reduced the price of commuters' tickets from $10 to $9 between Chicago and Aurora, which appears to be the beginning of a rate war between this line and the Burlington.

Pittsburg Luna Park.

Greater Pittsburg's Luna Park, which is being erected by Mr. Frederick Ingersoll, is of such magnitude that all who have been on the grounds were astonished not only with its extent but with the marvelous rapidity with which building after building has been completed. Commenting editorially on the work being done on the park, the Pittsburg Bulletin said in a recent issue:

"As if by the rubbing of a lamp, or the scraping of a ring on the sands of a seashore and a command to a summoned Genii, not one but a score of palaces have sprung into existence in the very heart of Pittsburg and many that pass them daily are wondering if after all there might not be some magic about it. There is much magic about it; the magic that brain and energy backed by half a million dollars can work. The palaces are at Luna Park, Pittsburg's new resort that is being built at Grant Boulevard and Craig St., by Mr. Frederick Ingersoll and his associates. On the morning of February 15th, while the alcohol in the thermometer was hovering near the zero point, the ground covered with eight inches of snow and frozen to a depth of nearly two feet, a carload of lumber was placed on the siding of the Pennsylvania R. R., at Shadyside. Teams appeared and carted it to the Aspinwall grounds, where it was stacked in huge piles. That was the beginning of Luna Park.

"It was not until ten days after the arrival of the first car load of timber on the ground that actual work was commenced. In fact, millions of feet of lumber, ranging from a common scantling to great timbers cut from the hearts of forest giants, each of which would cut up into enough dressed lumber to finish an ordinary dwelling, were hauled from railroad cars and piled in the park and in the streets surrounding the place before a carpenter or any other mechanic appeared on the scene. Then, to put the story in the words of a commuter on the Pennsylvania who passes the park twice every day: 'One day a fence appeared that excited comment, for it encompassed enough ground on which to build a town. Nobody on the train knew what was going on and everyone was curious to know because among us there were many supply men who are constantly on the lookout for building operations. It seemed that in a day the park began to grow, building after building reared

View of Casino Building.

View of Luna Park from Pennsylvania R. R.

its bleak form high in the air, in another day it would be inclosed, in another day the painters would be at work and we could see from the train, through the scaffolding that surrounded the buildings that they were highly ornamental and realized that the park would be beautiful. So full of surprises has been the growth of the park that when trains near the site all eyes are glued to the car windows. Sometimes, when the train would turn the curve and reveal the park, someone in the car would call out, "There is another one" and, looking to where he indicated, we would see the starting of another building. [illegible] and pleasure park in the country.'"

It is entirely true that Mr. Ingersoll did astonish the natives. Even in the city of Pittsburg [illegible] to that of any two other American cities, and where the people are accustomed to the rush and hurry and the noise of big productions, such results as were produced in a few weeks were never approached before. Though unheard of speed was attained it was not at the sacrifice of stability. The buildings are there to stay. They are on concrete foundations and are as thoroughly fireproofed as is possible. It is a fact that this feature is so complete as to elicit from the building inspectors and fire insurance underwriters letters of congratulation and a consequent lowering of the rates of insurance.

Pittsburg Luna Park has an admirable location for a summer amusement park. It is in the geographical center of the city. Ten lines of cars pass the entrance and at the rate of eight cars a minute in each direction. All other car lines between the residence and the business districts of the city pass within three short city blocks. The running time from either end of the car lines to the entrance of the park is 17 minutes. It, like Israel's capital, is a city built upon a hill and cannot be hid. Its golden and rainbow colored towers are seen flashing in the sunlight from residence districts having a population of three hundred thousand, and at night the reflection of its magnificent illumination is visible over a territory in-

habited by a million pleasure seekers, who are already impatient for [illegible] May [illegible]

The attractions include everything that can be found in other parks that are clean and wholesome, and many others that are controlled by Mr. Ingersoll exclusively. One feature that should be specially mentioned is the coaster, it being of an entirely new type. Instead of being in tiers it is elongated and contains locks but 80 ft. less than a mile in length. It makes a wide circuit through hills and vales and at one place the cars will attain a speed of 90 miles an hour. Another novelty is an aquarium exhibiting both fresh and salt water fishes. For this attraction salt water was transported from the seashore in tank cars and is kept fresh by circulating pumps and filters. There is in connection with the aquarium a complete fish hatchery where trout and other fishes will be hatched from spawn. The casino is the largest and handsomest building of the kind in the country. There will be scenic railways, old mill, every one of the scenic theater attractions, cafes, Japanese village, cave of the winds, the old shoe, novel slides for children, nurseries, concert bands, orchestras, in fact everything in color, life and motion, and that which pleases the ear, eye and the heart has been provided for by Mr. Ingersoll.

FREDERICK INGERSOLL

Mr. Ingersoll has built and equipped 44 other parks and has attractions in more than a hundred cities in all parts of the world.

Westinghouse New York Changes.

Westinghouse interests after May 1st will occupy all but a small part of the 19th and 20th floors of the new Trinity Building, at 111 Broadway, New York. The executive offices of the Westinghouse Electric & Manufacturing Co., which have for nearly twenty years been in the Equitable Life Building, at 120 Broadway, will be on the 19th floor of the new building, and the eastern sales offices of the Westinghouse Air Brake Co. and the Westinghouse Traction Brake Co. will occupy a large part of the 20th floor. The law offices of Hunt, Hill & Betts, which have been for several years in the Equitable Life Building, will be on the 20th floor of the new building, and the remaining part of the floor has been sublet to an engineering company. The United States Electric Light Co., which was absorbed by the Westinghouse Electric Co. shortly after the organization of the latter company, opened offices in the Equitable Life Building in 1878, and the old building has been more or less a Westinghouse headquarters in New York for the last generation, and the New York office of Mr. George Westinghouse. The new offices in the Trinity Building will be more commodious, to provide for the growth of the working staff in the treasury and other departments.

The New York sales offices of the Westinghouse Electric company will remain in the Hanover Bank Building, at Pine and Nassau Sts., without changes, and the New York office of the Westinghouse Companies' Publishing Department, formerly at 10 Bridge St., will be connected with them. The export offices of the Electric company will continue at the same address, under the management of Mr. Maurice Coster, recently appointed to succeed Mr. F. B. H. Paine, and the office of Mr. Charles S. Powell, the new general agent of the Electric company, will be connected with the sales and export offices. Mr. Coster and Mr. Powell have arrived from Paris and from London to take up their new duties, after long terms of successful Westinghouse service abroad.

Mr. Coster, who has acted as sales manager of the Societe Anonyme Westinghouse since the spring of 1899, has had a broad experience in domestic and foreign markets. His Westinghouse connection began in 1888, in Pittsburg, and later he acted as manager of the Chicago office of the Electric company. His work for the French Westinghouse company, which manufactures nearly all forms of Westinghouse products—railway appliances, prime movers, and electrical apparatus—involved several branches of engineering, and he will act as export manager in New York for the Westinghouse Machine Co. as well as for the Electric company. Mr. Coster has for many years been a full member of both the Electrical Engineers' and the Mechanical Engineers' societies.

Mr. Powell has returned from Europe after two years and a half as assistant manager of the British Westinghouse Electric & Manufacturing Co., Limited, in which his duties brought him into close touch with all the plans for the electrification of England's traction systems and railroad terminals. His Westinghouse connection began in 1893, and prior to his departure for London in December, 1902, he had acted as manager of the Cleveland office of the Electric company.

Mr. Coster included among his duties, while in Paris, the general management, or "exploitation", as the French say, of the central station at Moulineaux, which has for its largest clients the Paris Metropolitan Underground System and the Western Railway of France; also the management of a 55-car storage battery street railway service in Paris, with a charging station in the suburb of Puteaux.

Opening of Manila Street Railway.

The first important railway work in the Philippine Archipelago to be completed since the beginning of American occupation is the Manila Street Electric Ry., which was formally opened Monday, April 10th. J. G. White & Co. have, for the last two years, been engaged in the work of reconstructing the tramways of Manila. Peculiar difficulties have been met and overcome and, where formerly was a horse car line, with eight miles of track, laid with 40-lb. rails, there is now an electric system as complete as that of any city of similar size in the United States.

The entire street railway system of Manila is controlled by the same syndicate, it having purchased, in addition to the horse car line, a steam line running to the suburbs. Forty miles of track have been laid, the rails of which are 70-lb. in the city and 94-lb. in the suburbs. Municipal lighting privileges are also controlled by the company. The power will be supplied from a new power house just completed.

The track is all laid in concrete and owing to climatic conditions all rails were painted with asphaltum paint.

The destructive "white ant" exists in such large numbers that it was necessary to use teak for ties and sleepers, except where California redwood, or Australian, or Philippine native soft wood were obtainable. The latter served for the purpose only when treated with preservative.

The rolling stock at the present consists of 100 cars, especially designed to meet the prevailing conditions. They are of the standard. single truck, cross bench, open type, for city service, the streets being too narrow to permit of the use of double-truck cars. In the suburbs, double truck open and combination cars are in use. During the rainy season, there are sudden driving showers, and the company has provided convertible and semi-convertible cars, which were built by the Electric Railway & Tramway Carriage Works, of Preston, England, and by the J. G. Brill Co., of Philadelphia.

Portable screen partitions are used to separate first and second class passengers. The Canadian system of fare collection, by means of fare boxes, has been adopted.

Protection against the ravages of the white ant is afforded by the use of teak for all woodwork in cars.

The power plant is located on an island in the center of the Pasig River, and has a generating capacity sufficient to supply 508 arc lights, 30,000 incandescents, and current necessary for operating 100 cars over 40 miles of track. It is interesting to note that, Manila being so far from the base of supplies, J. G. White & Co. experienced considerable delay at various times. In making shipments of material for construction, it was necessary to put in the requisite number of everything, as when the work began it was not only impossible to buy bolts, etc., in Manila, but there was not even a machine shop in which repair work could be conducted.

The company operates its own printing plant, which is located in the car barn, and is used in printing time-tables, circulars and tickets.

Electric railways entering Muncie, Ind., have under consideration the erection of an interurban terminal station.

Car Shop Methods.*

BY JOHN D. FISH, MASTER MECHANIC TRI-CITY RAILWAY CO., DAVENPORT, IA.

The reasons for going into the building of cars have been, first, to cheapen the cost of cars, second, to build a car suited to the different needs of lines operated; and last, to standardize all of the parts so that the cost of repairs may be reduced as low as possible. Where a variety of cars are used, much hand work must be done in the repairing, if all the cars are built on the same lines much if not all this is done away with. These lines have been followed as much as possible, at the same time the mechanics employed are made familiar with all of these parts and do better and quicker repairing, and this is worth some consideration.

A number of all parts going into the cars are kept in stock at all times, ready to repair with at once. Sash and doors are oiled and varnished, and the small amount of fitting can be done very quickly, siding is painted all but the last coats to go into broken sides or ends of the cars.

The type of car being built is a semi-convertible 31-ft. body seating 44 persons, with a maximum standing load of about 150. This

CLOSED CAR—TRI-CITY RY. CO.

type was chosen to do away with the expense of changing in the spring and fall. The windows come out entirely and are not used in the summer.

In building these cars only the best of lumber was used, but we find that lumber cut locally will work in and save about one-third the cost of the lumber. It will be used in greater amount in the cars we build in the future.

The bottom framing of these cars is of long leaf yellow pine, except the end sills and bolsters, which are of hard white oak, to give better support to the bolts used in them. If yellow pine is used the heads draw down and leave the platform loose; and it is hard to find any remedy for this trouble.

The intermediate sills are mortised into the cross sills, to give a continuous sill for tying the side sills. No tie rods are used, but angle plates are bolted to the ends of the cross sills a little back from the end, to draw shoulder of the tenon tight to the side sill. These bolts may be tightened from time to time and keep the tenon from starting. The corners of side and end sills are treated in the same way, with the addition of a tie plate bent edgewise at right angles, and bolted to the under side of sills.

Body bolsters are built up of two steel tees with white oak fillers. This is not as strong as the standard bolster, but the car has to be kept as low as possible on account of low headroom of bridges and viaducts.

The floor is double; lower, yellow pine; upper, red gum, with a filling of building paper to keep the dust and noise out. The floors are laid diagonally, which gives great strength to the lower frame, and prevents distortion in collisions. It is not as easy to repair, but this is not very important, as the wear is taken up by maple strips in the aisle space.

The upper frame work is of the best heavy white ash only, all light and brash wood is used for other work. All rails and plates are strap bolted to corner post to prevent tenons from loosening. To keep the posts from loosening at the bottom, by the pitching of the car body, [illegible] the arm rail, and to the sill.

The upper [illegible] thickness of the wood carline smaller than the outer part, gives a bearing for the [illegible] is gained for the post, and rebated to set under top plate.

All tenons in the cars are pinned with white oak pins, after clamping up. Draw pinning is not used as it breaks the tenons out.

In getting out the rails long ash was used, but we found it too expensive and used short ash making a long scarf, gluing and screwing them together. No trouble has been found with these joints as yet.

Steel carlines are let in between the wooden ones at each post. A stiff springy steel is used for this purpose.

A single thickness of beaded siding is used and scrim well glued stands as well as two, with much saving of weight.

The upper and lower trusses have each two turnbuckles to take up the slack. In this way about the same strain can be put on each end of the truss.

The vestibules open only on one side. The doors were made narrow to keep passengers from falling, in getting off; it is inconvenient in the rush hours, but seems to prevent accidents. The platform knees are of white oak, trussed by two rods running each side of both outside knees, from lower corner to center of support, and down to lower corner at the other end of the knee. This gives a strong truss and the whole platform can be lifted back to place, when sprung down. A truss is also used on the side which is closed, running from the platform end sill up to corner post to car body, and down on inside to sill. This is to help support the heater which is on this side in the winter. Hard maple flooring is used in the vestibules, as yellow pine cuts out too quickly.

In the interior of the car we have used cherry and mahogany, with maple head linings, but now are using quartered white oak and it is giving better results as to wear and looks than the mahogany, and only costs about one-half as much.

The sash are held in place by metal strips edged with rubber to keep the weather out.

In painting we are using the lead system, the several coats applied being as follows:

1. Lead and oil.
2. Lead and oil with tint.
3. Clear lead with tint.
4. Ground color of car.
5. Color varnish.

6 and 7. Finishing varnish.

No rubbing varnish is used except in the color varnish.

Inside, the oak is finished dark with one coat of rubbing and two coats of inside finishing varnish. The mahogany and cherry are not stained, and are finished the same. The window sash and all exposed parts where no paint is used are soaked in hot oil before varnishing, and this is wearing as well as the painted work.

Several different makes of primers and fillers have been used to hasten the painting of the cars, but have all failed to wear but one, and that one takes as long as the lead and therefore no time is saved, but as the makers claim a longer life than lead, it may pay to use it.

In connection with painting, I will mention that all matched work and tenons are filled with white lead before jointing. All the under frame work is painted with red lead and oil before any of the framing is put on.

No figures have been used in this paper, as it is intended to be a description of the work only, as done at the shop of the Tri-City Railway Co.

*Read before the Iowa Street and Interurban Railway Association, Dubuque, Apr. 21, 1905.

At its last session the Tennessee Legislature passed a law known as the "Raine Bill," whereby the city of Memphis was authorized to issue $1,000,000 in bonds for the purpose of erecting a municipal electric lighting plant. The bill provided, however, that the bonds in question should not be sold for less than par. Since these bonds are a special and not a general liability, it is thought that it will be an utter impossibility for the bonds to be sold at the price stated, and the measure is practically inoperative. Mayor Williams, of Memphis, who is in favor of building the plant, has, it is said, acknowledged that it will be a difficult matter to surmount this difficulty.

Accounting as an Aid to the Operating Department.*

[illegible] OMAHA & COUNCIL BLUFFS [illegible] WAY CO., OMAHA, NEB.

The [illegible] of accounting has many applications, but [illegible] this paper is addressed not to a body of accountants, interested in all the various phases of the subject, but rather to a body of operating men, interested in accounting only in so far as it can be of assistance to them in operating their properties, I shall endeavor to confine myself to such parts of it as are indeed an aid to the operating department.

First of all, then, what does the operating man want to know from the accounting department?

As the success of every railroad enterprise depends necessarily upon the relation between the earnings on the one hand and the expenses and fixed charges on the other, every operating man is naturally interested in increasing the former and keeping at their minimum the latter, and therefore what he principally desires from the accounting department is detail information concerning earnings and expenses. Just how much of this detail information he wants or needs depends upon the size and individual characteristics of the property, and also upon the personal views and methods of the operating man—principally, however, upon the size of the property. If the system is so small that the operating man can easily keep in close personal touch with every part of it, he can dispense with a great deal of the detail accounting, without which the operating man of a larger property would be absolutely lost. In fact, a very small system would not be justified, from the standpoint of economy, in going too much into detail in its accounting.

Beginning now with the passenger earnings, it is important that the accounting should determine accurately, first, the actual or true earnings of each separate line each day; and second, the number of car-miles and the number of car-hours made on each line. In order to arrive at the actual or true earnings, only the fares (or tickets) actually earned or collected by conductors (as distinguished from ticket sales) should be treated as earnings. When ticket sales are treated as earnings, the showing is incorrect to begin with, and of no value whatever for purposes of comparison, especially if ticket sales are large and fluctuate greatly.

A record should also be kept showing the weather conditions, unusual attractions, and any other causes or conditions which affect passenger earnings, either beneficially or detrimentally. With this information at hand, a daily comparative statement of passenger earnings should be prepared showing the earnings, car-miles, car-days and earnings per car-mile and per car-day of each line, together with a comparison of the same data for the corresponding day of the previous year, and this statement should also show the increase or decrease in the earnings of each line, the percentage of such increase or decrease in the earnings of each line, and the weather conditions, unusual attractions, etc., for both days compared. By "corresponding day of the previous year" is meant not the same day of the month, but the same day of the week which corresponds most nearly with the day of the month. A like statement of passenger earnings should be prepared weekly, monthly and annually.

From a careful study of these statements the operating man should be enabled to draw certain deductions of great value to him in running his road. For instance, the "Increase" and "Per Cent of Increase" columns gage accurately for him the growth of traffic on the different lines, and the "Earnings per Car-Mile" and "Earnings per Car-Day" indicate the relation between the traffic and the service. This information puts him in a position to judge intelligently the needs of the different lines in the matter of service, particularly if these statements are supplemented by a further statement showing graphically the number of passengers carried on individual cars of each line during the rush hours. By observing the increase above the normal on days of special attractions, such as conventions, excursions, parades, etc., he can get a tolerably correct idea of the value of such attractions and can know how much effort or financial encouragement he is warranted in giving towards securing such attractions.

Of assistance to him also in checking the returns of conductors is a "Conductor's Percentage Sheet," showing the ratio of each conductor's collections to the earnings of the line on which the conductor is employed, and the ratio between his transfers and cash collections. If this is faithfully followed up it points out all irregularities in collections and leads to investigation of the causes thereof.

Passing now to the "Operating Expense Accounts," we enter a very broad field, in which there is no limit to the amount of detail accounting that can be indulged in. The standard classification of operating expense accounts, as formulated by the Street Railway Accountant's Association of America, embodies 39 accounts; but these can be subdivided to one's heart's content. One company with which the writer was connected for some years has in use a classification embodying something like 150 accounts, and another road of which he has knowledge uses a classification containing something over 200 accounts. The number of subdivisions of operating accounts must be decided with reference to the size and needs of the road; but as the greatest benefits to be derived come from comparing notes with other roads, the advantage of conforming to the standard system should not be overlooked. However, whatever classification be used, a monthly statement should be prepared showing a comparison with the same month of the previous year, the increase or decrease in the different accounts, the per cent of such increase or decrease, the amount of each account per car-mile and per car-day and the ratio each classified expense bears to the receipts.

In addition to this the monthly statement should also contain some data concerning the power station, as the cost of power is a very important item of expense and one which is very susceptible to economies under proper handling. Assuming, of course, that the power station is equipped with a wattmeter, the monthly statement should show the number of kilowatt-hours produced, the cost per kw. h., the number of pounds of coal consumed per kw. h., and also the number of kw. h. consumed per car mile traveled. With such a statement before him, the operating man is enabled to make an analytical study of the various items of operating expense and to measure the efficiency of his various departments, with a view to strengthening the weak places and attaining a higher degree of economy in operating.

There are many other things which come under the head of accounting, although they are not usually performed by the accounting department, which may be made helpful to the operating department; but as I promised the secretary of the association in accepting his invitation to read a paper before this convention that I would make it a short one, I will have to leave them for some future discussion.

In conclusion I wish to say that while occasionally detail accounting is overdone, my observation has been that, as a rule, operating departments do not avail themselves, as fully as they might, of the benefits and aids to be derived from a careful and intelligent system of accounting.

*Read before the Iowa Street and Interurban Railway Association, Dubuque, Apr. 21, 1905.

Chicago & Southern Traction Co.

The Chicago & Southern Traction Co. has been organized for the purpose of constructing a high speed electric railway to run from Kankakee to Chicago. The distance between Kankakee and the business district of Chicago is 56 miles. Plans are now under way for the construction of 40 miles of this road between Kankakee and West Pullman, Ill. From West Pullman, Ill., to the terminus of the South Side Elevated Railroad Co. the cars of the new line will operate over the tracks of the Calumet Electric Street Railway Co., with which company a traffic arrangement has been made. It is hoped that at a later date, when the South Side Elevated Railroad Co. has completed the express track now in process of construction, that arrangements may be made for operating limited cars from Kankakee to the Union Loop in the business district of Chicago.

The right of way affairs are now well in hand. A route has been laid out over a private right of way from the center of the business district of Kankakee, parallel with and adjacent to the west side of the Illinois Central Railroad Co's. right of way from Kankakee to Riverdale. At Riverdale the right of way leaves the Illinois Central and parallels the west side of the Pennsylvania R. R. line to West Pullman.

This route as laid out is an excellent location for the construction of a high standard roadbed over which limited service cars can be run in competition with the neighboring steam lines. Standard trolley construction will be used.

It is stated that the distance between Kankakee and Chicago will be covered by the limited service in 1 hour and 30 minutes, and by the local service in 2 hours, with hourly cars in each direction.

A power house, the architects' plans for which are about completed, will be built on a site now under consideration where the right of way crosses one of the branches of the Calumet River. The exterior dimensions of the building will be 115 x 185 ft. Its construction will be fireproof throughout, using brick and stone with terra cotta trimmings for the walls and a tile roof supported on steel trusses. The floor system and all foundations will be of concrete. A partition wall, extending throughout the length of the building, will divide it into a boiler room and an engine room.

The plans include the installation of machinery suitable for generating current for the railway, and also to sell to the manufacturing plants and the municipalities through which the road will run. The first installation will be three units of 1,000 kw. capacity each, with the necessary boilers and auxiliary apparatus. A complete coal and ash handling conveyor system will be used. All the electrical apparatus, such as switchboards, transformers, etc., will be placed on the engine room floor, and the entire equipment will be of the latest design and all auxiliary apparatus will, as far as possible, be automatic in its operation. This 3,000-kw. installation will occupy but one-half the space of the present building, thus making provision for future additions to the generating capacity.

Near the power house a car barn 76 x 220 ft., and a repair shop 70 x 80 ft., will be built. These buildings will be of a fireproof type of construction, using brick and steel with slate roofs.

When this line has been built there will remain but about 65 miles to be built between Kankakee, Ill., and La Fayette, Ind., to complete a standard roadbed over which electric cars can then be run between Chicago and Indianapolis. The designs of the power house are now nearly complete and it is expected that roadway construction will start in June. The officers of the Chicago & Southern Traction Co., which has headquarters in the Hartford Building, Chicago, are: William S. Reed, president; Charles F. Davis, vice-president; John B. Reed, secretary; Robert P. Wood, treasurer.

Freight Tariffs in Birmingham, Ala.

In the "Review" for April were given some facts concerning the freight traffic of the Birmingham Railway, Light & Power Co. Herewith are the freight tariffs made effective Jan. 15, 1905:

Tariff No. 1, applying between Birmingham, Bessemer, Ensley, Pratt City and Intermediate Stations (14 miles):

Article.	Cents per 100 lb.
Bar Fixtures	15
Billiard Tables	15
Bananas, loose bunches (5 cents per bunch)	
Beer—¼ kegs (7½ cents each)	
Beer—½ kegs (15 cents each)	
Beer—bottled—in casks	10
Buggies, crated	15
Bellows	15
Boots and Shoes	10
Canned Goods	10
Coffins (25 cents each)	
Cotton Seed Meal and Hulls	3
Crockery	10
Corpses (50 cents each)	
Carpets	10
Cider and Vinegar, in kegs or barrels	10
Clothing	10
Dry Goods, Notions, etc.	10
Empties returned (exc. beer kegs), no minimum (5 cents each)	
Eggs, in cases (10 cents per case)	
Fish, Fresh Meat, etc.	10
Flour, in sacks or barrels	5
Fruits, in cases	10
Furniture	15
Glassware	10
Grain and Feed Stuff	3
Hats	10
Hardware	[illegible]
Hay, in bales [illegible]	[illegible]
Household Goods [illegible]	[illegible]
[illegible]	[illegible]
Iron and Iron Pipe	[illegible]
Iron Safes	[illegible]
Jugs, [illegible]	[illegible]
Jugs, etc. [illegible]	
Loaded Shells	[illegible]
Lumber, Lath, Doors and Sash, etc.	[illegible]
Lime, Cement and Plaster	[illegible]
Mattresses	[illegible]
Meat, in bulk or boxes	[illegible]
Meal, in sacks or barrels	5
Marble, crated or boxed	10
Nails, in kegs (5 cents per keg)	
Organs, crated or boxed	10
Organs, not crated or boxed (50 cents each)	
Oils, in barrels or cans	10
Poultry, all kinds—single coop	25
Poultry, all kinds—double coop	[illegible]
Produce, Fruit, etc.	10
Pianos, boxed	10
Sewing Machines, crated (15 cents each)	
Sewing Machines, not crated (25 cents each)	
Stoves and Stoveware	10
Split Baskets	25
Tinware	10
Trunks (25 cents each)	
Terra Cotta Pipe	10
Wagons	10
Whiskey, Wines, etc., in barrels or kegs	10
Whiskey, Wines, etc., in glass, boxed	10

Tariff No. 2, applying between Birmingham, East Lake, Gate City, Woodlawn, North Birmingham and Intermediate Stations (9 miles):

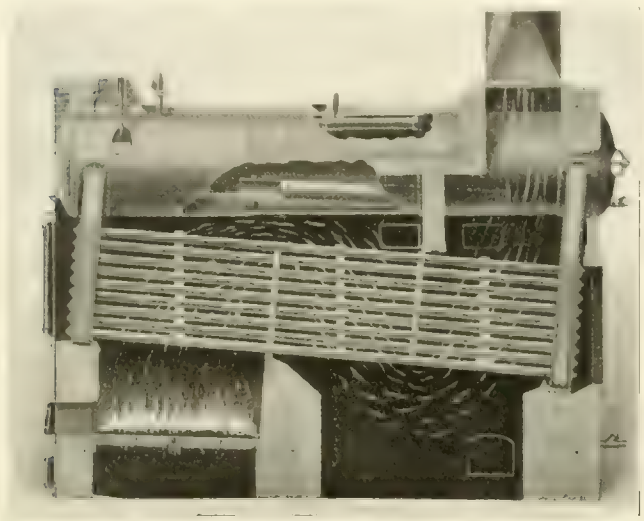
Article.	Cents per 100 lb.
Bananas, in bunches (5 cents per bunch)	
Buggies, crated	15
Boots and Shoes	8
Canned Goods, packed	8
Crockery and Queensware, packed	8
Cotton Seed Meal	3
Carpets	8
Clothing	8
Dry Goods and Notions	8
Eggs, in cases (10 cents per case)	
Fish, Fresh Meat, etc.	8
Fruits and Vegetables, packed	8
Furniture	12
Grain and Feed and Meal	3
Groceries, in packages	8
Hats and Caps	8
Hardware	8
Hay, in bales	4
Household Goods	15
Iron and Iron Pipe	5
Lumber, Sash, Doors, Blinds, etc.	8
Lime, Cement and Plaster	5
Mattresses	[illegible]
Meat, fresh, in bulk or boxes	8
Meal, in sacks or barrels	3
Marble, crated or boxed	8
Nails, in kegs (5 cents per keg)	
Produce, Fruit, etc., packed	8
Stoves and Tinware	8
Trunks (25 cents each)	
Wines and Liquors	8

On each Tariff the following minimum charges apply: Shipments under 50 lb., 10 cents; shipments over 50 lb., 15 cents.

Freight for prepaid stations (where there is no agent), will be unloaded at owner's risk.

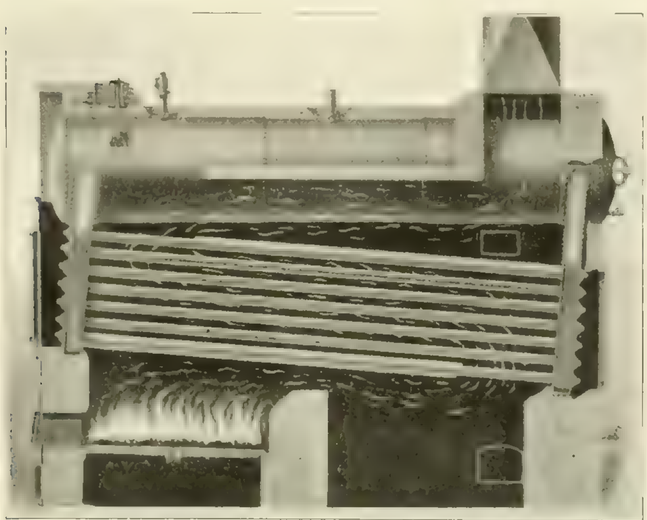
E. Keeler Co. Water-Tube Boilers.

Simplicity and durability of construction, together with absolute safety and the highest attainable economy, are features which the designer of a boiler must strive to secure. These requisites have been successfully incorporated in the design of the Keeler water tube boilers. The accompanying illustrations are sectional views of the standard water-tube Keeler boiler, showing the two general arrangements of baffle plates. When anthracite or similar fuels are used, vertical baffle walls made of a high grade fire brick backed



KEELER WATER TUBE BOILER WITH VERTICAL BAFFLE.

with cast iron, are provided to govern the flow of the gases of combustion. The path of these gases is such that they must pass between the staggered boiler tubes three times, and then pass the steam drum before reaching the stack. By thus being forced to pass first up, then down, then up again between the tubes, the gases are given much time in which to lose their heat to the water tubes before passing out through the stack to the air. It will be noticed that the hottest gases come in contact with the tubes at the highest portion near the steam drum, and the next hottest passage is through the middle of the tubes and the last passage through the section nearest the



KEELER BOILER WITH HORIZONTAL BAFFLE

back header. This is essential for a perfect current of water through the boiler and to insure a minimum amount of contraction and expansion when cold water is fed to the boiler. With this arrangement cold water enters a sheet steel mud drum in the upper shell. From here it passes down the back header and into the lower end of the tubes between which the gases are making their last pass before going to the stack. On becoming heated the water rises in the tubes and as it rises it passes to a portion of the tubes which is heated by hotter gases, until just before reaching the front header the water passes directly over the grates and up through the header to the steam drum. Thus all the water in the boiler is continually kept in motion, flowing upward through the tubes heated by the gases, then through the front header to the steam drum, then toward the back of the boiler and down through the back header to the tubes again, and so on. This steady circulation furnishes an even temperature practically fixed at any one point in the boiler and so does away with expansion and contraction troubles, as well as furnishing a rapid steaming capacity.

For bituminous and similar fuels, horizontal baffles are used as shown in one of the illustrations. With this arrangement a somewhat stronger draft is allowed but the general scheme of circulation as described is not interfered with.

The headers, front and rear, of this type of boiler, are built entirely of flange steel plates and so designed that the strains are well equalized at the connection with the steam drum. The drums are made of flange steel with straight seams, butt-strapped and triple riveted. No bent tubes are used in any part of the boiler and the hand holes are so arranged that all parts of the boiler can be reached for inspection, cleaning or repairs. The hand hole plates are all pressed steel.

The feed water is introduced through the top or front of the shell into a submerged steel mud drum. It is raised to a high temperature in its passage through the surrounding water, discharged from the feed pipe at the rear end of the mud drum, and before it leaves this drum at the front end is of practically the same temperature as the rest of the water in the boiler. This high temperature causes the precipitation of most of the impurities in the lower end of the drum to be blown out through the outlet in the rear header provided for that purpose. The internal mud drum also serves to prevent the feed from coming in contact with the hot places, with consequent contraction and leakage at the seams. Any impurities carried into the general circulation are deposited in the bottom of the rear header and discharged through the main blow-off openings.

These boilers are built in units from 50 to 600 h. p., and also in special sizes to suit space conditions. The standard boilers are built for a working pressure of 150 lb., but if desired can be built for any pressure up to 250 lb. The grate surface is carefully proportioned and air space regulated by the class of fuel to be burned.

The factory and main office of the E. Keeler Co. are at Williamsport, Pa., and the company has branch offices at Boston, New York, Philadelphia, Pittsburg and Chicago.

New South Wales Tramways.

The railway commissioners of New South Wales have submitted a report for the quarter ending Dec. 31, 1904, which gives some interesting details of the traffic on the railways and tramways under their jurisdiction. The report states that the present condition of lines is good and that during the period, satisfactory progress was made in reconstruction of permanent way and the improving of grades. An interesting part of the report is a complete list showing the appointments and the removals of employes during the quarter reported. This list includes the name, position, rate of pay and reasons for the hiring or removal of each employe in the government railway and tramway service.

There were in New South Wales at the close of the quarter reported 125.75 miles of tramway track open for traffic. The revenue derived from the operation of this mileage was £209,926, with an expenditure of £190,113. During the quarter, the total number of the car miles run was 4,186,044, with earnings of 1s. od per car mile. The expenditure per car mile was 11d., which is a ratio of expenditure to earnings of .9166. During this quarter there were carried over the entire mileage of these tramways 36,119,113 passengers, which was an increase of 509,908 passengers over the similar quarter for the previous year. The earnings show an increase of £2,259, and the expenditure, owing largely to the more extensive relaying of the lines, etc., shows an increase of £10,471. The commissioners for the period reported were Charles Oliver, David Kirkcaldie and W. M. Fehon.

Arrangements are being made to open a union ticket office in the Traction & Terminal Building, Indianapolis, where tickets on all of the electric railways entering Indianapolis may be purchased.

Some European Notes.

BY T. J. NICOLL

It is quite important to note the difference between the care taken in Europe and the seeming carelessness of those having charge in America of the return electric current. Not only does the law regulate how it shall be taken care of in the first case, but employes are ever watchful to prevent even the ordinary "sparking." In America it is not unusual for the bonding of joints in return current to be deficient or wanting entirely, and "sparking" is looked upon of no importance. The consequence is, when a trolley pole or wheel comes off the wire, we see a series of the grandest pyrotechnics and the same is the case when the dirt is allowed to accumulate on the rail or in the grooves, causing the wheels to jump and break circuits, often brilliantly lighting the streets through which they pass. Every street railway manager knows or ought to know what an expensive luxury this all is, and that it can be avoided. Certainly the current can be returned to the point of generation with but a trfle of loss and "sparking" can be reduced to a minimum with very little care and watchfulness. Trolley poles and wheels can be so constructed and are so made in Europe that they rarely leave the wire, the wheels being changed before they become too much worn, and the springs, pivots and fastenings of the trolley base kept in order. The poles are generally well wound and covered with insulating tape, so that when the pole does leave the wire one seldom or never sees anything but the "spark" of the first circuit break.

The rails and their slots (the latter are never so wide as in America) are kept clean and free from dirt either by hand or by brooms attached to the car truck.

But it is the return current that receives the most attention. The law provides generally for this, and the laws with regard to it, as well as on all other subjects, are strictly enforced, and until we in America learn how to keep and enforce our laws better, there is not much hope of saving expense by loss of current.

The rules enforced in England by the Board of Trade are perhaps a very good example of the general requirements all over Europe, and will serve to show what may be expected in America. The Board of Trade is a bureau created for the purpose, amongst other things, of regulating traffic and rates with the care of the public and property always in view, it is an institution with even greater powers than our Inter-State Commerce Commission and the various railroad commissions of the states combined, and its power is so well applied that it results in the general good. In the particular case under consideration it provides:

1. That dynamos used as generators must conform to its requirements and be capable of producing a continuous current without pulsation.

2. That one of the two conductors transmitting energy to the motors must be insulated from the earth and from the other in such part or parts as may be required.

3. That where any rails on which cars run or any conductors laid between or within 3 ft. of such rails form any part of a return circuit, such part may be uninsulated, but all other parts of returns must be insulated unless of such sectional area as will reduce the difference of potential between the ends of the uninsulated portion of the return to less than 7 volts.

4. That when any uninsulated conductor laid between or within 3 ft. of the rails forms any part of a return current, it must be electrically connected to the rails at distances not exceeding 100 ft. apart by means of copper having a sectional area of at least 1-16 of a sq. in.

5. That any part of an uninsulated return must be connected with the negative pole of the generator and in such case the said pole shall also be directly connected through the current indicator to two separate earth connections, which shall not be placed less than 60 ft. apart.

6. Earth connections must be constructed, laid and maintained so as to secure electrical contact with the general mass of earth, and so that an electric motive force, not exceeding 4 volts, shall suffice to produce a current of at least 2 amperes from one earth connection to the other through the earth, and a test must be made of this at least once in each month— but in place of two such earth connections, one may be made to a water main of not less than 3 in. diameter, with the consent of the owner of said main, and when it can be demonstrated beyond a doubt that both earth connections [illegible] placed with [illegible] 3 in. diameter internally, which is metallically connected to the earth.

7. When the generator is at a considerable distance from the railway the uninsulated return [illegible] of the generator by means of one or more insulated return conductors and the generator shall have no other connection with the earth; and in such case the end of each insulated return connected with the uninsulated return must also be connected through a current indicator to two separate earth connections. If the current indicator cannot conveniently be placed at the connection of the uninsulated return with the insulated return, this instrument may consist of an indicator at the generating station, connected by insulated wires to the terminals of a resistance interposed between the return and the earth connections, said resistance must be such that the maximum current of 5 per cent of the total output of the station, shall produce a difference of potential not exceeding 1 volt between the terminals. The indicator must be so constructed as to indicate correctly the current passing through the resistance, when connected to the terminals by the insulated wire.

8. When the return is partly or entirely uninsulated, arrangements must be made in construction and maintenance of the railway to separate the uninsulated return from the general mass of earth and from any pipe in the vicinity, to connect the several lengths of rails, to adopt such means for reducing the difference produced by the current between the potential of the uninsulated return at any one point and the potential of the uninsulated return at any other point, and to maintain the efficiency of the earth connections so that:

A. The current passing from the earth connections through the indicator to the generator, or through the resistance to the insulated return shall not at any time exceed two amperes per mile of single track or 5 per cent of the total current output of the station;

B. If at any time or place a test be made by connecting a galvanometer or other current indicator to the uninsulated return and to any pipe in the vicinity, it shall be possible to reverse the direction of any current indicated by interposing a battery of three Leclanche cells connected in series if the direction of the current is from the return to the pipe, or by interposing one Leclanche cell, if the direction is from the pipe to the return. For the purpose of providing a continual indication of (A) an indicator properly connected, and correctly marked, must be kept connected always in a conspicuous place during the whole time the line is charged. In (B) the owner of any pipe such as is named, must be permitted, at reasonable times and intervals, to ascertain by test that the conditions are complied with as regards his pipe.

9. When the return is partly or entirely uninsulated, the operating company is required to keep a continuous record of the difference of working potential between points on the uninsulated return and if at any time such difference exceeds 7 volts, the said company must reduce it below that limit immediately.

10. The current density in the rails shall never exceed 9 amperes per sq. in.

11. Every electrical connection with any pipe must be so arranged as to admit of easy examination and must be tested at least every three months.

12. Every line and every insulated return or part thereof, except feeders, shall be constructed in sections not exceeding one-half mile in length, and means provided for isolating each such section for testing.

13. All insulation of wires must be so maintained that the leakage current shall never exceed 1-100 of an ampere per mile of railway. The leakage current must be ascertained daily when the line is not in operation, and if found to exceed one-half of an ampere per mile of railway, it must be localized and removed as soon as practicable and cars stopped if the leakage is not localized and removed within 24 hours.

14. The insulation resistance of all continuously insulated cables used and laid below the surface of the earth, shall not be permitted to fall below the equivalent of 10 megohms for a length of 1 mile, a test is required once per month.

15. When any part of the line is erected overhead and the return is laid on or under the ground, and when any wires have been erected or laid before the construction of the railway in the same or nearly the same direction the construction company may be required by the owners of such wires to permit such owners to insert

[illegible]

16. Any insulated return shall be placed parallel to and at a distance not exceeding 3 ft. from the line when the line and return are both erected overhead or 18 in. when both are laid underground.

17. All reasonable precautions must be taken to avoid injurious interference with any existing wires.

18. System must be constructed and maintained so as to secure good contact between motors and feeders and the return respectively.

19. The best means available must be adopted to prevent undue sparking at the rubbing or rolling contacts in any place and in the construction and use of motors and generators.

20. Companies are required to keep records, which must be sent to the Board of Trade as follows:

Number of cars running. Daily.

Number of miles of single track line. Daily

Maximum working current. Daily.

Maximum working pressure. Daily.

Maximum current from earth plate or water pipe connections. Daily.

Leakage current. Daily.

Fall of potential in return. Daily.

Condition of earth connections. Monthly.

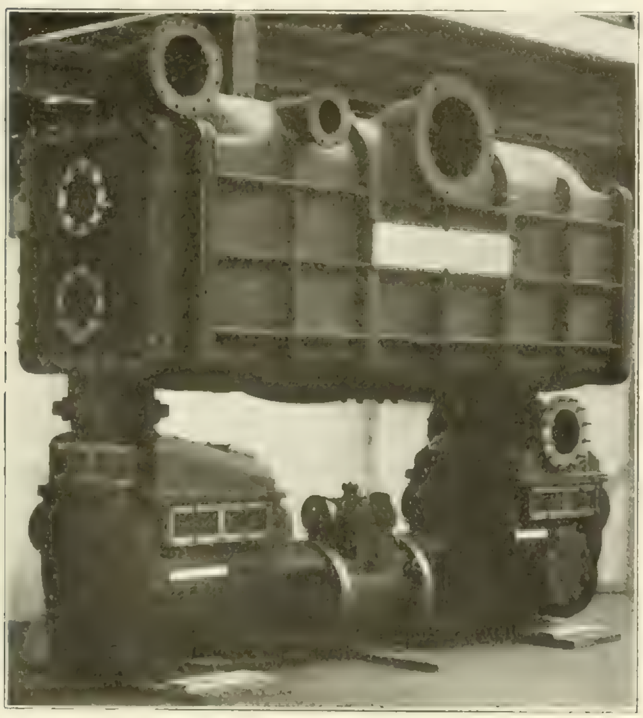
Minimum insulation resistance of cables in megohms, per mile Monthly.

Conductance of joints to pipes. Quarterly.

Specimens of tests at any time.

The W. H. Blake Condenser.

The advent of the independent air pump and condenser has had much to do with the practical development of the compound engine in medium and small sizes, for with this combination there are now obtainable economic results which not long since were expected only from the large compound engine with direct connected air pump. It is seldom that a non condensing plant can be found where



W. H. BLAKE SURFACE CONDENSER.

an increase of 20 to 30 per cent in the output cannot be obtained coincidently with a reduction of 15 to 25 per cent in the steam consumed per horse power. The convenience of application and operation of the separate condenser are appreciated by every engineer. That the jet and the surface type have their respective fields is clearly recognized. Both designs in a full line of sizes are now being manufactured by the W. H. Blake Steam Pump Co., of Hyde Park, Mass. They range in capacity from 600 to 40,000 lb. of steam condensed per hour with injection water at 70° F. One type is illustrated herewith.

This is of the surface condenser type, designed along the lines of marine practice and capable of withstanding the hardest usage. The tubes are of Muntz metal, so held in the tube sheets as to allow for free expansion. The steam passes in at the top and thence across the water tubes, and finally escapes below as water of condensation. Rapid condensation is secured by the introduction of baffle plates, which force the steam into close contact with the exterior of all the pipes through which the water flows. The condenser shell, rectangular in cross section, is supported by the combined air and circulating pump, which is of exceptionally substantial construction. Certainty of action is insured by having the valve mechanism actuated solely by direct boiler pressure, and not dependent upon an adjustable arrangement of levers and rods connected to the piston. With the latter arrangement, which is not employed upon the pumps, there are certain points in the stroke where the valves are not directly controlled, but momentum is relied upon to reverse the valve gear. These pumps are composition fitted throughout, both the water and air cylinders are lined, and a Tobin bronze piston rod is used.

Glendale Park, Nashville.

Every year the Nashville Railway & Light Co. is giving more attention to beautifying Glendale Park and adding to its attractions. The company has established a small, but very attractive Zoo, and has in operation the following amusements and attractions: Casino summer theater, the roller coaster or figure eight, laughing gallery, Ferris wheel, merry-go-round, cave of the winds, house of trouble, shooting gallery, cane racks, baby racks, glass blowers, dancing pavilion, circle swing and miniature railway. During the spring the company has greatly improved the theater, the size of the stage being almost doubled, the proscenium arch widened from 24 to 30 ft. and the front of the stage extended 4½ ft. and 10 ft. room made in the wings.

Elaborate arrangements have been made for cooling the auditorium. The old ceiling fans were removed and in their stead numerous buzzers are placed around the walls. The company does not attempt to operate any of the amusements or attractions, but leases all of them to responsible parties. The park season opens May 1st and closes September 30th. During the month of May the manager of the Casino Theater will put on high class vaudeville and opera, and in June minstrels will be offered. Each week will be entirely different. The manager having charge of a circuit of summer play-houses is thereby enabled to provide good wholesome attractions each week at popular prices. The company has not so far made money from the operation of the park, and really closes each season with a small loss, but considers that the increase in car fares abundantly makes up for a great deal more than the loss. With increased attractions and attendance, it is hoped this season will show no loss on the park proper.

The third annual "Easter Egg Hunt" given on April 22nd, was a decided success, one of the largest crowds ever seen at the park being present. The statements showed that about 2,500 more people were participants in the hunt this year than last year.

The Indiana Electric Railway Guide.

The first edition of Richey's Indiana Electric Railway Guide was issued for the month of April. This is the only publication containing the official time tables of Indiana electric railways and also includes a directory of the hotels of Indiana. In addition to the time tables are included several short stories and poems and jokes of lighter vein, it being the object of the publishers only to furnish information regarding the electric railways of Indiana, a little reading matter to enable its readers to pass a few moments pleasantly, and as an advertising medium, to acquaint them with the industries of Indiana, the patronage of which will support the publication. In addition to these a few short interurban items and a map of the electric railways of Indiana and Ohio complete the guide, which includes 32 pages and is 6¾ x 8¾ in. in size. Mr. Paul Richey, of Muncie, Ind., is the editor and manager of the publication, and it is to his efforts that the publication of this guide is due.

New Publications.

LIGHT AND POWER. A monthly journal devoted to electric progress in the world in general and New Jersey in particular; [illegible] pages with illustrations, the Public Service Corporation of New Jersey, publishers. This publication is devoted to the interests of this company and is descriptive of the latest electrical devices and their installation for commercial purposes, such as the new tube light, electric coal conveyors, electric signs and electric household utensils.

THE ART OF GENERATING GEAR TEETH, by Howard A. Coombs; 120 pages; 30 diagrams, price, 50 cents. Published by D. Van Nostrand Co., New York. It is interesting to read the history of gears and gear cutting machines as reviewed by the author of this book, and to follow him in his description of the improvements which have taken place in the methods for forming gear-teeth since the direct application of geometry to the problem of the action of gear-teeth was shown in the 17th century. The first chapters of this book treat of the theory of tooth curves and state briefly what the problems in gear cutting are. The machines described are those which are based upon the principle of generating or forming teeth by virtue of the operation of the machine, rather than to form a copy of a previously made templet or cutter. Three chapters of the book are devoted to the description of the principles of operation of American and foreign tooth generating machines. The last chapter of the book includes the description of several classes of machines for generating other forms of teeth, such as spiral gears, bevel gears to mesh with pin-wheels, etc. This publication is reproduced by permission from the American Machinist. It is written in a clear style without the use of extended mathematical formulae, and will be found to be of interest to those who desire to obtain a comprehensive view of the art of generating gear-teeth.

EXPERIMENTAL RESEARCHES ON THE FLOW OF STEAM THROUGH NOZZLES AND ORIFICES, to which has been added a note of THE FLOW OF HOT WATER, by A. Rateu; authorized translation by H. Boyd Brydon; published by D. Van Nostrand Co., New York; price $1.50 net. Book of 76 pages with 4 double page plates and 16 full page tables. This book is a record of the results of researches made by the author in his study of the phenomena of the flow of steam. The first few pages are devoted to the derivation of the formulae needed, and a statement of the fundamental theory. Then follows a description of the methods used and an estimate of the precision of the measurements. Next is a description of the results of the tests which were made with three convergent nozzles and with an orifice in a thin plate. Following this comparison is the log of these 152 tests performed by the author. The closing section of the book is devoted to an analysis of the phenomenon of the flow of hot water through a convergent nozzle and an explanation of the results obtained by Sauvage and Pulin in experiments made by them in 1892.

The rapid advance in steam turbine construction has necessitated a more careful study and a reconsideration of steam from a kinetic rather than a potential standpoint, and the taking into account of the friction of rapidly moving bodies in vapor, rather than on lubricated surfaces. This publication furnishes to the turbine student a reliable fund of useful information along these lines. The translator, Mr. Brydon, is engaged in active consulting engineering practice in Chicago.

GAS ENGINE DESIGN, by Charles Edward Lucke, Ph. D. Published by D. Van Nostrand Co., New York; price $3.00 net. Book 254 pages, subject index, 322 formulae, 145 illustrative figures and numerous full page tables. The book is divided into three parts, the first part treating the subjects, Power, Efficiency and Economy. Under "Power" are described the standard measurement of capacity of gas engines and the measurement of losses. The method of treatment in this first part is by establishing a standard reference indicator card, and, by comparison with tests, finding a diagram factor by which the probable mean effective pressure for any fuel and compression can be predicted. It is shown that this same diagram factor applied to the efficiency of the standard card will give the probable efficiency of the engine, as well as the economy when applied to the standard economy. The second part of the book treats of the forces due to gas pressure and inertia. Methods are given for plotting the forces and type cards for different classes of service. The balancing of the parts is treated mathematically [illegible] ... design the parts and calculate the performance for gas engines.

GENERAL LAWS RELATIVE TO FRANCHISES FOR PUBLIC SERVICE CORPORATIONS, compiled by J. [illegible] Cummins; published by H. M. Byllesby & Co., engineers, New York Life Building, Chicago, for gratuitous distribution; 268 pages; 6 x 9 in. This manual of general statutes relative to the use of streets and highways by street railways, gas, water and electric light companies was compiled by Mr. Cummins, general counsel for H. M. Byllesby & Co., to meet a want which had risen in his own practice, he having found that there was no ready reference book covering this subject that had been brought to recent date. Very frequently it is found that the preliminary expenditures in connection with the development of a property are almost entirely wasted because of ignorance as to the fundamental laws regarding franchises in the state or territory in question, while in nearly every instance a preliminary reference [illegible] the [illegible] of proceeding further. The book is divided alphabetically by states, and under each state are given extracts, under proper subheads, of those sections of the constitution and general laws which affect public service corporations. In most states these subheads are comparatively few in number, usually only the constitution and the city and town acts. In states which contain the larger cities, however, a greater number of laws have to be consulted; thus, in Illinois, the subheads are constitution; city, village and town; elevated ways and conveyors; gas and electric light companies; street railroads. This work will be found extremely convenient and valuable for reference by the legal departments of all concerns having interests in more than one of the states.

THE STEAM ENGINE AND OTHER STEAM MOTORS, two volumes, by Robert C. H. Heck, M. E., Volume I. The Thermodynamics and the Mechanism of the Engine. Volume II. Form, Construction and Working of the Engine: the Steam Turbine. D. Van Nostrand Co., New York, publisher. The second volume of this work is yet in press. The first volume contains 391 pages, 190 figures, 10 tables, 292 formulae, complete subject index and appendix. Price $3.50 net. With the aim of making this publication suitable for use as a text book for engineering colleges and a treatise and reference book for engineers, the author has clearly set forth the fundamental principles of the steam engine, meanwhile giving a broad description of constructive practice, explaining fully the working of the machine in its several departments and showing how to find its efficiency in performance. The first part of the book is a general view of the subject of steam power plants and their essential parts. Next is a discussion of the behavior of gases under pressure, and the definition of the ideal heat-engine. This is followed by an application of the properties of steam for doing work and the behavior of different kinds of steam under various conditions. The mathematics of condensation is exhaustively treated as are also the determinations of the flow of steam through orifices and the kinematics and working forces in the engine. Fly-wheel effects and the principles of counterbalancing are treated in the final chapter of this volume. The appendix comprises numerous tables of constants, tables of the properties of saturated steam and records and notes of experiments with superheated steam. The subject of this work is such a large one that the treating of every detail of it would make a volume too cumbersome for handy use, but this work so lays down the foundations and makes plain the general laws that any problem which may occur in the study of the subject treated will have a basis for its solution in this book.

THE STEAM TURBINE, by Dr. A. Stodola; translated from the German by Dr. Louis C. Lowenstein. Published by D. Van Nostrand Co., New York. Second edition; book of 423 pages with 241 cuts and 3 lithograph tables; 7 full page tables. Price $4.50 net.

The second edition of this work on steam turbines with an appendix on gas turbines and the future of heat-engines contains the subject matter of the first edition and new matter which brings the book up to date and renders it of more use to those in practical life by exhibiting the results of many elaborate experiments. The book is divided into five parts and [illegible]

explains the fundamental laws of the adiabatic change of condition of steam and a discussion of the principles of axial turbines, including the discussion of the different number of pressure stages. The second part treats of the theory of the steam turbine, thermodynamically considered, including a discussion of laws and experiments relative to the flow of steam and the laws of energy in steam turbines, both axial and radial. The third part is a treatment of the machine design of the most important turbine parts giving the principles and formulae for use in the calculation of the details and also including some graphical methods. Twenty-three pages of this part of the book are devoted to the study of the critical angular velocity of multiple loaded shafts and a discussion of the regulation of steam turbines. The fourth part consists of descriptions of the standard steam turbine types, a historical review and a discussion of the latest suggestions for turbine improvements. The fifth part consists of 13 special problems of steam turbine theory and construction, such as pressure distributions, stress study, equilibrium and limiting velocities. In the appendix are discussed the first and second types of perpetual motion, the Carnot cycle, entropy and its application to the work done by steam, the economy of the heat-engine, some late suggestions and a description of the ideal gas turbine. Three large scale entropy diagrams for steam, two in French units and one in English units, are included in a cover pocket.

ELECTRIC RAILWAYS, by Sidney W. Ashe, B. S., and J. D. Keiley; published by D. Van Nostrand Co., New York. Book of 285 pages with subject index, 172 illustrations. Price $2.50 net. This book, which is a theoretical and practical treatment of electric railway equipment, is divided into 11 chapters, each describing some particular part of the main subject. First are defined the fundamental units, instruments and methods used for plotting performance curves. Next follows an exhaustive analysis illustrating and carefully describing the curves for graphically representing the many different quantities measured and included in a study of motor and car operation. A short chapter is devoted to the description of recording instruments used in testing. Then follow two chapters, one on the theory and design of the direct current motor and one on the same functions of alternating current single-phase motors, which subjects are treated in a practical manner with a pleasing absence of complex formulae. The next subject treated is the motor control apparatus and its operation; here are described the function of a controller, the standard method of hand control for small cars and the many details of the General Electric and Westinghouse companies' standard types of automatic—acceleration, multiple-unit control. Double page plates showing the wiring of these systems are included in this chapter, also a wiring diagram for a single-phase alternating current equipment and a description of its connections. Car bodies and their general design and fittings comprise the next chapter. Chapter VIII is devoted to trucks of the several different classes and Chapter IX to an analysis of the mechanical laws of braking, methods for brake testing and a general description of the standard types of brakes and their accessories. A following chapter briefly describes several standard types of electric locomotives and the closing chapter of the book consists of a selected number of tests which are especially applicable to traction purposes.

The magnitude of the traction field of the present day and the lack of special courses in electric railway study in the representative universities, make a demand for just such a book as this, one which treats its part of the general subject in a clear concise manner, omitting higher mathematics wherever possible and being written in a practical way. This work should be appreciated as a text book which will familiarize technical students with the practical part of the electric traction field.

Connecticut Valley Railway Co.

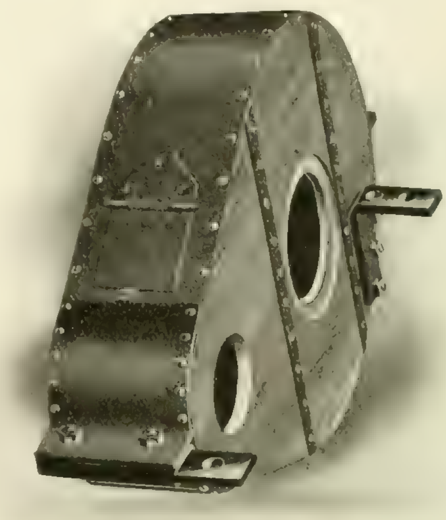
The Northampton & Amherst Street Railway Co., Greenfield, Mass., with which were consolidated the Greenfield & Turners Falls Street Railway Co. and the Greenfield, Deerfield & Northampton Street Railway Co. on May 1st, changed its name to the Connecticut Valley Street Railway Co.

The subway loop under Battery Park, New York City, around which Manhattan and Bronx trains are to swing for their return trip northward, is nearly completed, the work of laying the steel rails being well under way.

Combination Gear Cases.

The accompanying illustration shows a new combination steel and wood gear case which has been designed by the E. W. Bliss Co., of Brooklyn, N. Y., and is recommended as a very satisfactory substitute for malleable iron cases, its use avoiding the exasperating delays many roads have experienced in getting malleable cases, as well as the troubles due to iron cases breaking in service.

For this style of gear case there are claimed many advantages over those heretofore placed on the market. The supporting lugs on the malleable iron case are very easily broken, thereby making



BLISS COMBINATION GEAR CASE.

the case useless; in the combination case this difficulty is overcome, as the lugs are of wrought steel. Experience has shown that when the combination gear case comes in contact with a serious obstacle the sides, being made of wood, give way on the lower half without delaying the car, instead of becoming wedged under the car, as frequently happens with malleable iron cases, often necessitating the jacking up of the car before the case can be removed and the car allowed to proceed. The nature of this case is such that it is least liable to damage or break the gear or pinion. Its weight is only about one-third as much as a malleable iron case and it is considerably cheaper.

Westinghouse Electrical Apparatus.

The introduction of steam-turbine generating units operating at speeds of about 750 r. p. m. allows a great saving in the weight of the electrical apparatus, compared with machines built for operating at speeds suitable for large reciprocating engines. Turbine type generators with a rated output of 50,000 kw., such as are used to furnish current for the New York subway cars, weigh 234,000 lb. and run at a speed of 750 r. p. m. Generators of the same ouput driven by reciprocating engines at a speed of 75 r. p. m., weigh 980,000 lb. This is a saving of 746,000 lb. in the weight of the generator alone.

The Westinghouse Electric & Manufacturing Co. advises that recent orders are for eight turbine generators; one 2,000 kw., one 2,500 kw., the others of 400 and 500 kw. capacity. It has received orders for a motor generator set, consisting of a 1,400-h. p. induction motor and a 1,000-kw. revolving field alternating current generator, also 104 induction motors, aggregating 2,200-h. p. capacity, 204 Westinghouse No. 101-B railway motors, for the Transit Development Co., of Brooklyn, and several scattering orders for smaller numbers of No. 101-B and No. 93-A railway motors. The Pittsburg Reduction Co. will install two Westinghouse direct current generators, each rated at 2,200 kw. at 500 volts, with a speed of 140 r. p. m.

The Knoxville (Tenn.) Traction Co. has let contract for the construction of a car barn and repair shops.

Closed Cars for Springfield Consolidated Ry.

The Springfield (Ill.) Consolidated Railway Co. has [illegible] placed in service vestibuled cars of the type illustrated [illegible] built by the American Car Co. The railway company now operates [illegible] 65 cars on its 24 miles of track. The new cars measure [illegible] over the end panels and 7 ft. 5½ in. over the posts at belt. As the car body is somewhat longer than is usual when mounted on [illegible] the bottom framing is made extra strong and outside sills are included. The platforms are 5 ft. instead of 4 ft., the usual size, and the timbers are re-enforced with angle irons. At the entrances to the platforms are high folding gates of Brill manufacture and the folding doors have the Brill patented controlling device. This device consists of a roller mounted vertically on the upper corner of

CLOSED CAR FOR SPRINGFIELD CONSOLIDATED RY.

the outer leaf of the folding door, and which moves between a guide-rail, attached to the lintel of the door, and a guide-rail parallel to it. A spring catch at the top of the door near the center locks it in its closed position, and when released, the spring hinges open the door part way, so that a light push with one hand is only necessary to fold it back, where it is held by a clasp. The lower clasp has a spring buffer, and the upper one utilizes the same spring lock which fastens the door when closed. To close the door, the spring lock at the top is released and the lower catch pressed down at the same time by a small toe-piece.

The car seats are of spring rattan and are placed longitudinally. The interior of the car is handsomely finished in cherry with the trimmings of bronze and the ceilings are of decorated birch. The windows are arranged to be dropped into pockets in the side walls. Among the furnishings are Brill angle iron bumpers, "Dedenda" gongs, and radial drawbars, and American Car Co. sand boxes.

The general dimensions are: Length over crown pieces, 32 ft.; width over sills, including panels, 6 ft. 3 in.; sweep of posts, 7¾ in.; center to center of posts, 32 9-32 in.; side sill size, 3¾ x 7 in.; end sill size, 3¾ x 6 in.; sill plates, ½ x 7 in.; thickness of corner posts, 3¾ in.; and of side posts, 1¾ in.; height of steps, 15 [illegible] in.; height of risers, 12 in.

The cars are mounted on Brill No. 21-E trucks with an 8 ft. wheel base and 33-in. wheels. This type of truck is remarkable for its steadiness and its smoothness which enable it to carry long and heavy car bodies at speeds of from 15 to 20 miles an hour without bouncing motion.

Electricity for Heavy Freight Service

Tuesday evening, April 18th, Mr. J. H. Hallberg delivered an illustrated lecture on the "Application of Electricity to Heavy Freight and Trunk Line Railways," before the Electrical Engineering Society of Columbia, at the Columbia University.

The lecturer described in detail all electric systems which have been proposed and tried for trunk line service, and a number of lantern slides, illustrating the 15,000-volt single-phase railway developments carried on by the Oerlikon Electric Co., of Zurich, Switzerland, under the direction of Mr. Emil Huber, were the subject of an interesting description and discussion.

The electrical equipment for the New York Central Railroad was also illustrated by lantern slides, and an enthusiastic discussion followed the description of this system.

[illegible]

has recently been invented by Mr. Hallberg. The important advantage claimed for this system is that it is possible to build very powerful locomotives, which can be operated with only one contact wire, delivering high voltage single phase current to the locomotive, on which the current is then converted by means of a motor-generator set into polyphase currents suitable for the polyphase induction motors, which are mounted on the driving axles. As all generating and transforming apparatus are of the alternating current type, no commutators will be [illegible] locomotive eliminates altogether the use of commutators for any of the main generating or driving machines for this system, and which was considered an important feature.

Considerable attention was also given to the various forms of construction for overhead contact wires for high speed trunk line railway service, and the inverted catenary construction developed by Mr. [illegible] commented upon, and the general opinion was that it would be preferable to make contact on the top of the contact wire, as suggested by Mr. Huber, instead of using the ordinary catenary suspension, which makes it necessary to collect current from the under side of the contact wire.

The speakers also agreed with Mr. C. O. Mailloux and Mr. Damon in that nothing less than 15,000 volts should be used for heavy trunk line traction, and it was also thought that the use of more than one wire for each track would be prohibitive. In other words, the straight three phase system, requiring either two or three trolley wires for each track, would not be considered as a general proposition.

Mr. Hallberg also commented favorably upon Mr. Mailloux's suggestion to generate current at about 15,000 volts, which could be distributed directly to the contact wire wherever necessary, instead of generating current at a low voltage and then stepping up to a very high voltage for the transmission lines, and again reducing the pressure at sub-stations for the contact wire. Where large amounts of power are generated, as for a large trunk line railway system, it would perhaps be more economical to generate and distribute directly to the contact wire without the use of high potential transmission lines and sub-stations.

Prof. Fitzhugh Townsend took active part in the discussion, and several interesting references were made by him to the bipolar motors designed by the General Electric Co. for the New York Central locomotive, and he explained very clearly why these motors operate under greatly varying loads and other unfavorable conditions without sparking. He also pointed out several advantages of Mr. Hallberg's single phase to polyphase railway system.

Mr. Karl Wersall, an electrical engineer until recently in the employ of the Oerlikon company at Zurich, also participated in the discussion, and he pointed out several of the advantages of the Huber inverted catenary contact wire support, and he also referred to the successful operation of the Oerlikon 15,000-volt single phase locomotive, which is equipped with the Ward Leonard system of control, and which has been in daily successful operation during the past few months on a section of the State Railway in Switzerland.

The trustees of the Everett-Moore property have been discharged and the business is now in the hands of the syndicate to be handled by it. It is understood that Col. F. S. Dickson, one of the trustees, will be made president of the various Everett & Moore telephone companies.

At a voting contest of the most popular conductors and motormen [illegible] gold, the second prize a sewing machine, the third prize a suit of clothes, the fourth prize $10 in gold and the fifth, sixth and seventh prizes checks for $5. The total vote for all candidates was 227,137. [illegible]

Personal.

SENATOR F. D. SHERWOOD has been chosen president of the Hornellsville (N. Y.) Electric Ry. and the Hornellsville & Canisteo Ry., succeeding the late De Merville Page.

MR. W. S. McGOWAN, JR., has been appointed eastern sales manager for the American Brake Shoe & Foundry Co., with headquarters at 170 Broadway, New York City.

MR. JOHN T. DARLING, for 14 years connected with the Montgomery Street Railway Co., has resigned his position as secretary and will be succeeded by Mr. J. B. Giovanni.

MR. JOHN L. MATSON, superintendent of motive power of the Indiana Union Traction Co., has resigned to accept a similar position with the Chicago & Milwaukee Electric Railroad Co.

MR. E. A. CROSBY, assistant treasurer of the Twin City Rapid Co., has been promoted to the position of treasurer, and Mr. Edward S. Pattee, auditor of the company, has been made secretary.

MR. LEONARD EISENMENGER, formerly with the Springfield, Troy & Piqua Railway Co., has been appointed general passenger agent of the Appleyard lines, with headquarters at Springfield, O.

MR. JOHN I. BEGGS, president of the Milwaukee Electric Railway & Light Co. and of the United Railways Co. of St. Louis, was on April 27th elected president of the National Electric Co., of Milwaukee, to succeed Mr. S. W. Watkins.

MR. E. A. RICHARDS has been appointed superintendent of the Providence & Taunton line of the Massachusetts Electric Cos., having resigned as assistant superintendent of the Boston & Worcester Street Railway Co. to accept this position.

MR. A. H. METZELAAR, representing the National Electric Co., of Milwaukee, has been transferred from the Chicago office to the San Francisco office of the company, and he will be in charge of the Christensen air brake sales on the Pacific coast.

MR. J. M. BRAMLETTE, general superintendent of the East St. Louis & Suburban Railway Co., has resigned to become general manager of the Philadelphia & Western Interurban Ry., which is now under construction between Philadelphia and Lancaster, Pa.

MR. HARRY S. NEW has been elected president of the Indianapolis & Martinsville Rapid Transit Co., to succeed Mr. Charles F. Smith, whose business interests in the Southwest demand considerable attention and necessitate his being in that territory most of the time.

MR. S. P. BAIRD, who was for several years general manager of the Portsmouth Street Railroad & Light Co., of Portsmouth, O., is now engaged in practice as consulting engineer; his headquarters are in Portsmouth. Mr. Baird is an associate member of the American Society of Civil Engineers.

MR. JOSEPH W. TAYLOR, secretary of the Master Car Builders' Association, the American Railway Master Mechanics' Association and the Western Railway Club, has removed his office to No. 390 Old Colony Building, Chicago, which will hereafter be the headquarters of these organizations.

MR. H. F. PEARCE, general superintendent and purchasing agent of the Marquette County Gas, Light & Traction Co., has resigned to become superintendent of the board of public works of Negaukee, Mich., and will be succeeded by Mr. F. W. Judson, formerly superintendent of the Madison Light & Railway Co., Madison, Ind.

MR. T. T. LYMAN, who has been connected with the H. W. John-Manville Co., 100 William St., New York City, for many years, has been appointed general sales manager of the company. The position will call for the installation of various comprehensive systems in connection with the work of the branch offices of the company in the larger cities throughout the United States.

MR. R. F. KELKER, JR., has assumed his duties as engineer for the Goldschmidt Thermit Co., and will superintend the street railway department. Mr. Kelker was lately with the Brooklyn Heights Railroad Co. as assistant engineer. He succeeds Mr. William Howard Cole, who has resigned and leaves for Europe in order to pursue professional work in connection with the electrical tramways.

MR. A. C. EMMERICK, whose appointment as auditor of the International Railway Co., Buffalo, was noted in the "Review" for April, was born in Syracuse, N. Y., in 1869, graduating from the grammar and high schools of that city. Mr. Emmerick went to Buffalo in 1892, entering the service of the Buffalo Traction Co. four years later in charge of its consent corps, being appointed auditor of the company in 1897. At the time of the absorption of this company by the International Traction Co., he was retained as chief clerk in the auditing department of the new company, being appointed assistant auditor in 1901, which position he held until his recent appointment as auditor.

THE ENGAGEMENT of Mr. Charles Foster Bancroft, of Boston, to Miss Cornelia Herriman Dow, second daughter of Mr. Abbot Low Dow, of Brooklyn, N. Y., has been announced. Mr. Bancroft is prominently identified with electrical railway and lighting interests in Massachusetts, being electrical engineer of the Massachusetts Electrical Companies, and the Hyde Park Electric Light Co. He is also superintendent of motive power and machinery of the Boston & Northern Street Railway Co., and the Old Colony Street Railway Co., which are controlled by the Massachusetts Electric Companies. The wedding is to take place at 92 Remsen St., Brooklyn, on June 7th.

MR. ARCHER RICHARDS, recently chief draftsman for the Wason Car Co., of Springfield, Mass., has resigned that position to accept a similar one with the Roberts & Abbott Co., of Cleveland O. Mr. Richards has had an extended experience in the design of cars for steam and electric operation and has made a study of the artistic as well as the technical features of car designing. He has been connected with the Wason Manufacturing Co. for 6 years, with the Jackson & Sharp plant of the American Car & Foundry Co. 14 years, and also with the Chicago, Milwaukee & St. Paul Ry., Enterprise Hydraulic Works of Philadelphia, and Edgemoor Iron Works, Wilmington, Del., and has perfected himself in the practice of decorative art by two years of study in Europe.

MR. C. D. EMMONS has been appointed general manager of the Ft. Wayne & Wabash Valley Traction Co., of Ft. Wayne, Ind., in charge of all the company's property in northern Indiana. The system embraces the following properties: Ft. Wayne city railway lines, Fort Wayne electric lighting plant, Fort Wayne & Southwestern Traction property from Fort Wayne to Wabash, Wabash River Traction Co. and Wabash-Logansport Traction Co., operating from Wabash to Logansport; the Logansport Street Railway Co. and the Logansport, Rochester & Northern Traction Co. in Logansport, and the Lafayette Street Railway Co. in Lafayette. The other interurban lines to be built out of Fort Wayne north and south will also be under his management. Mr. Emmons was born in Lafayette, Ind., in 1871, but his family soon afterwards removed to Pittsburg, where he lived for 18 years. Mr. Emmons was educated at the Western University of Pennsylvania, graduating in civil engineering. He then entered the service of the Pennsylvania R. R., advancing to the position of supervisor of signals for the territory around Philadelphia. In 1900 he was appointed superintendent of the Lafayette city railway system. In July, 1903, he went to Ft. Wayne as general superintendent of the lines enumerated, also acting as superintendent of construction of the Ohio & Indiana Construction Co., which is building the Ft. Wayne, Van Wert & Lima Ry.

Interstate Electric Railway Association.

During the past month an association has been formed consisting of those roads now operating in the south part of Wisconsin and the northern part of Illinois. The object of this association is to formulate plans for an interchange of traffic. Mr. Edwin C. Faber, general manager of the Aurora, Elgin & Chicago Railway Co., was elected president, and several business committees were appointed, and a constitution and by-laws were adopted. The association is the result of agitation on the part of the officers of several companies for an interchange of traffic between the intersecting roads now operating and in process of construction. The plan is that each line be divided into 5-cent fare sections and that mileage books be sold and honored on the cars of those lines belonging to the association. The cancelled coupons will be audited by the secretary-treasurer of the association, who will make the settlements with the proper companies.

The mileage book used will consist of 600 5-cent coupons and these books will be sold at $25 each. A similar book but with a less number of coupons, will also be sold, but at a slightly increased rate. The lines which were represented at the first meeting of the association are as follows: Aurora, Elgin & Chicago Railway Co.; Rockford, Beloit & Janesville Railroad Co.; Rockford & Inter-

urban Railway Co.; Joliet, Plainfield & Aurora Railroad Co.; Elgin, Aurora & Southern Traction Co.; Chicago & Milwaukee Electric Railroad Co.; Chicago & Joliet Electric Railway Co.; Milwaukee Electric Railway & Light Co.; Waukegan, Fox Lake & Western Railway Co., and DeKalb-Sycamore Electric Co.

New Construction Work in 1905.

Montgomery Traction Co., Montgomery, Ala. This property has recently been taken over by the same interests controlling the Lynchburg (Va.) Traction Co., and the new owners have ordered four 38 ft. convertible double truck cars from the J. G. Brill Co., each equipped with four G. E. 67 motors and Christensen air brakes. The company is now building five miles of double track extension, 7-lb. American standard rail and is drawing plans for the construction of a new car barn and shops. R. D. Apperson, president.

Delaware Interurban Railway Co., Wilmington, Del. Will build about 15 miles of new track during the coming season and desire catalogs of high tension line material, cars and trucks and power house equipment. All specifications for this new road will be ready by May 15th. H. R. Fathergill, chief engineer.

The Detroit, Monroe & Toledo Short Line Railway Co. Will double track its line between Wyandott and Monroe, a distance of 22 miles, and 80-lb. rail will be used in this work. When this is completed the company will have a total of 32 miles of double track, it being the intention to double track the entire line. The company will also make several improvements at its resort on Lake Erie near Monroe, known as Monroe Pier; a new casino will be built, the grounds and hotel enlarged, and several amusement devices installed. W. B. Tarkington, manager and purchasing agent, Monroe, Mich.

Springfield Traction Co., Springfield, Mo. Will reconstruct eight miles of old track during the present year and will purchase three new cars, four new motor equipments, a new 500-h. p. engine and a new 350-kw. generator. J. Fenton, superintendent.

The New Jersey & Hudson River Railway & Ferry Co., Edgewater, N. J. Will build 9 miles of new track during 1905 and will purchase 8 new motor equipments. F. W. Bacon, general manager.

Syracuse & South Bay Railway Co., Syracuse, N. Y. Will build 24 miles of new track, a sub-station 35 x 64 ft., a new car barn 71 x 360 ft., and will purchase 22 new cars and 12 new motor equipments. W. R. Kimball, general manager.

Bloomsburg & Millville Street Railway Co., Bloomsburg, Pa. Will build 10 miles of new track, a new car barn and a new power house and will purchase 4 cars and two 250-h. p. engines and two 150-kw. generators. C. W. Miller, president.

Knoxville Traction Co. and Knoxville Electric Light & Power Co., Knoxville, Tenn. Will build about 6 miles of new track and reconstruct 20 miles of old track during the coming season, is reconstructing and making additions to its present power house and is building a new car house and repair shops at a cost of about $90,000. The company will also purchase 24 new cars and motors equipments from the St. Louis Car Co. and a 2,000-h. p. engine and 2,800-kw. generator. H. T. Bunn, treasurer and auditor.

Fred. E. Sander, Incorporated, Seattle, Wash. Will build 25 miles of new track, a new car barn, and will purchase 15 new cars. George W. Albin, secretary.

Anderson Traction Co., Anderson, S. C. Will build two miles of new track and purchase a new engine and generator. George E. Coughlin, general manager.

Tacoma Railway & Power Co., Tacoma, Wash. The company will build one mile of new track and purchase eight new cars and three new motor equipments, all of which have been contracted for. W. S. Dimmock, manager.

St. John Railway Co., St. John, N. B. Will build two miles of new track and a new car barn and has recently purchased six new cars and their motor equipments and will purchase engines of 900-h.p. capacity and generators of 600-kw. capacity. W. Z. Earle, general manager and purchasing agent.

Arrangements have been made by the Columbia (S. C.) Electric Street Railway, Light & Power Co. for the attractions at its parks during the summer season. Mr. Morris Boom, of New York, has the contract for furnishing these amusements, and will open the season May 29th, closing August 19th.

Steel Tired Wheels in Liverpool.

[illegible]

[illegible] the engineers and general manager stated:

[illegible] can cars, which followed, were chilled cast iron.

"The steel tires 'spread' in running, became loose and out of [illegible] which was giving much better results on the American cars.

[illegible] steel tires for tram cars about 1900, when their experimental use in competition with chilled wheels began.

"These experiments were carefully watched, and in May, 1902, a number of selected tires were placed in service in Liverpool, and later it was considered desirable to try tires of all the representative makers. Fifty-two of the cars are now fitted with steel tired wheels, none of which have yet worn out, and therefore final figures cannot be quoted. Very divergent results have, however, been obtained, the mileage per unit of wear varying to the extent of 50 per cent, indicating the importance of selecting tires of suitable composition.

"As a result of the experiments carried out for the last two years, a steel tired wheel is now being assembled and finished at Lambeth Road Works, which will cost 50 per cent less than the price at which such wheels can at present be bought, and which, it is believed, will afford a life considerably in advance of the average of these wheels, which may be estimated at 60,000 miles, the average mileage of chilled wheels in Liverpool being 35,000.

"It is hoped that on trial this new wheel will be found suitable for general adoption."

Since the date of this report over 100 cars have been fitted with new wheels, which are giving satisfactory results, and the work of general equipment is proceeding.

Schuykill Railway Co.

A reorganization of the Schuykill Traction Co., and the lines controlled by it, being the Mahanoy City, Shenandoah, Girardville & Ashland Street Railroad Co., the Ashland, Locust Dale & Centralia Street Railroad Co., the Lakeside Street Railroad Co. and the Shenandoah & Pottsville Street Railroad Co., has been effected, the new company taking the name of the Schuykill Railway Co. A mortgage for $1,450,000 to the Fidelity Trust Co., of Philadelphia, has been filed by the new company, and officers have been elected as follows: President, George H. Gerber, Pottsville; secretary, MacHenry Wilheim, Ashland; treasurer, D. J. Langton, Shenandoah. The board of directors includes: J. C. Biddle, Fountain Springs; J. W. Smith, Girardville; MacHenry Wilheim and William S. Leib, Ashland; Alexander Scott and C. O. Bleiler, Frankville; J. S. Housenick, John Mildazas and D. J. Langton, Shenandoah. Mr. J. W. Smith has been retained as general manager of the company.

The Wet Transfer Again.

A conductor writes that he has profited by the physician's warning against wetting the thumb with saliva in dealing out transfers. He has this to say, however:

"Many fares during the day are taken from the mouths of passengers and many Chinamen carry their nickels in their ears."

He adds:

"The practice of holding the fare in the mouth is common among ladies."

"Just imagine," says he, "the conductor collecting one fare from the mouth of one passenger and the next from the ear of a Chinaman."

We don't want to imagine any such condition of affairs. Thoughts of it are not agreeable, but as our worthy conductor says:

"Scarcely a day goes by but that the foregoing happens. Maybe if this is seen by the public it will do some good."

The lady who holds her carfare in her mouth is not only taking desperate chances, but is guilty of a careless indifference to dirt that is not pleasant to contemplate.—From "Transit Tidings," published by the United Railroads of San Francisco.

Amusement Machines for Street Railway Parks.

venture is plainly illustrated by the great increase in the number of such machines to be seen in all localities. The success of these devices depends upon the observance of four factors: proper location, the use of novel and up-to-date machines, attractive display cards and proper maintenance so that the devices are always in good working order. These machines pay well in all locations where crowds congregate, and they enjoy good patronage at street railway and other recreation parks.

The popularity of the coin in the slot machine may be realized when it is stated that the Mills Novelty Co., No. 11 South Jefferson

ILLUSTRATED SONG MACHINE [illegible]

St., Chicago, manufactures and sells over 200 different types of these devices. This company occupies a large five-story building as its manufacturing plant, and has been making coin-operated machinery for 15 years. In this factory all the individual parts of these many types of machines are manufactured from the raw materials and in each process the work is carefully executed and inspected.

In general, coin-operated machines may be divided into three classes: those that pay prizes, amusement machines, and so-called trade stimulators. The prize machines are built to represent roulette wheels and other gaming devices, in which the operator deposits his coin and takes a chance of losing it or gaining many times its amount. These devices are built in heavy substantial cabinets of well chosen woods, decorated with heavy bronze or nickel-plated trimmings.

The strictly amusement machines are made in a great number of styles, among which are the automatic piano, which can be operated either by a nickel in the slot or may be played in the ordinary way and thus serve a double purpose in a park pavilion or similar location; the stereoscope, which shows a series of illuminated views; the mutoscope, which is a moving picture machine; a fortune-telling machine, which sells printed horoscopes; Cupid's postoffice, which automatically delivers a love letter, and many styles of vending, weighing and muscle-testing machines. The two latest designs of amusement machines, the first of which is illustrated herewith, are the illustrated song machine, which plays songs on a phonograph and illustrates them during the playing by moving pictures; and the automatic violin, which will soon be placed on the market. This is a violin of the usual type mounted in a tasty cabinet and arranged to play all classes of music from standard records. The bowing and manipulating of the strings are accurately done by an ingenious arrangement of electro-magnets and a small motor.

The trade stimulators are those machines in which the player may win prizes of a greater or less amount payable in cigars or other articles of trade. The most common design of these machines is that using playing cards, different combinations of which win for the player certain amounts of credit in trade.

In many cities and successful parks there have been established so called "penny arcades" fitted up with a number of types of these machines and all operated by one management. It is said that wherever this arcade plan has been used the venture has been successful. There are several now in use at street railway parks.

The Mills Novelty Co. makes many types of machines for sale outright and also endeavors to furnish plans for equipping arcades with these machines. A large stock for quickly filling orders is carried at the Chicago factory.

Annual Report of the General Electric Co.

The 13th annual report of the General Electric Co. for the fiscal year ending Jan. 31, 1905, contains some figures which are interesting because they are indicative of the growth of the electric trade in general.

The profits of the company for the past year, after deducting all general and miscellaneous expenses and allowances for depreciation and losses, etc., were $5,959,892, from which were paid during the year dividends amounting to $3,684,384, leaving a surplus for the year of $2,275,508, which added to the existing surplus makes the total surplus, Jan. 31, 1905, $9,569,196. The total sales during the year amounted to $39,231,328, which is about $2,500,000 less than the business done in 1904. During the year there were received about 187,350 separate orders, not including contracts, an average of 624 per day; this is an increase of 54 orders a day over the previous year.

Some of the important contracts which are now being filled are for the electrical equipment and 40,000 kw. of turbine generating apparatus for the New York Central & Hudson River R. R., steam turbine generators, rotary converters and auxiliary apparatus for the Public Service Corporation of New Jersey, contracts for 154 steam turbines, contracts for 10 different water power developments and contracts for additional motors and control equipments for many large railway systems throughout the country. During the past year 402 cars have been equipped with Sprague-General Electric control. In the past 5 years the floor space used for manufacturing has increased from 2,300,000 to 4,100,000 sq. ft., and the number of employes from 12,000 to 18,000. The lands of the plants at Schenectady, Lynn and Harrison now comprise a total of 425 acres and this land with the buildings on it is valued at $4,593,812 or about $1.12 per sq. ft. of manufacturing floor space.

At the close of the year reported the balance sheet showed that the total assets of the company were $61,634,345, which was made up of: cash $6,529,116, stocks and bonds, real estate, notes and accounts receivable, work in progress and merchandise inventories $45,605,229, and factory plants, patents, franchises and good-will $9,500,000. The liabilities were as follows: 3½ per cent and 5 per cent gold coupon debentures, accrued interest, accounts payable and unclaimed dividends $3,475,206, deferred liabilities on account of purchase of Curtis turbine patents, payable on or before Feb. 1, 1906, $342,000, capital stock $48,247,943 and the surplus $9,569,196.

The report states that while the total business for 1904 was less in money value than that of 1903, the number of contracts and orders was greater and thus more work was required of the same organization.

Monarch Engine Stop.

A serious flywheel accident is reported from Belleville, N. J. According to the press reports, the plant of the Hardman Rubber Co., which employs some 200 men, was obliged to close for several weeks. Accidents of this nature are so frequent as to demonstrate the impossibility of preventing them by any care in the design of the plant and machinery, and reliance must be placed upon mechanical safety devices actuated positively and automatically by the engine in case its speed should exceed the normal from any cause. The Consolidated Engine Stop Co., of 100 Broadway, New York, in this connection directs attention to its "Monarch" engine stop and speed limit system. This company has installed the "Monarch" system in the power plants of many important railway and lighting companies and reports among its orders for the last month 19 installations for the Lorain, O., plant of the National Tube Co.

Annual Report of the Philadelphia Co.

The 21st annual report of the directors of the Philadelphia Co., which covers the year ended Mar. 31, 1905, has just been published. This company operates the Pittsburgh Railways Co. The following statement made by the president, James D. Callery, concerning the Railways company will be of interest:

During the year the following lines have been aded to the system: The Mt. Washington Street railway and Mt. Washington Tunnel were completed and put in operation on Dec. 1, 1904. The wisdom of the acquisition of this property and the construction of the line has been fully demonstrated by the increased receipts from the Mt. Washington district. The completion of the tunnel has afforded the Charleroi line a terminal in the city of Pittsburg. Through cars are now operated from Pittsburg to Allenport without change. Owing to the difficulty in securing a private right of way for the connection of the Hill Top lines, the full benefit has not as yet been derived from the tunnel. All of the rights of way have been secured and construction is now under way, and it is hoped that this connection will be in operation by May 1, 1905. The Shady Ave. line was constructed from Forbes St. to Fifth Ave., affording a cross town connection between Homestead and the Forbes St. district to East Liberty, thereby accommodating a large population. The reconstruction and completion of the 10th St. bridge crossing the Monongahela River has afforded another and shorter line to the South Side district, and has to an extent relieved the congestion on Smithfield St. and the Smithfield St. bridge. On Jan. 1, 1905, the property of the Seventeenth Street Incline Plane Co. was acquired, which incline connects the Penn Ave. district with Bedford Ave. The three months' operation of this incline plane shows a small profit after deducting interest charges, without making any charge for this company's heavy feeder lines and the gas lines of the Philadelphia Co.

The company during the year has constructed 18.73 miles of new track, and the total track now operated by the company is 464.29 miles.

The company has practically completed the Brunot Island power plant. This plant was put in service on Oct. 18, 1904. The operation of this plant has enabled the management to close down the West End and Birmingham power stations, and the Coraopolis and Carnegie sub-stations, and the Suburban power station during the light hours of travel, also the closing down of all power houses between the hours of 1 and 5 a. m., the night cars being operated from one of the smaller plants. The Brunot Island power plant is also furnishing a large supply of alternating current for the Allegheny County Light Co.

The company has maintained its power plants, tracks, cars, buildings and equipment in thorough repair. The account of Maintenance of Way and Structures shows a marked increase, owing to the extraordinary outlay for repaving streets to meet the requirements of city ordinances, also to the repairs to bridges, buildings and structures on various parts of the system. A considerable portion of these expenditures were in the nature of permanent betterments. The gross receipts from the operations of the company show a decrease caused by the general depression in business during the year 1904. Since Jan. 1, 1905, the receipts show an increase, and it is anticipated that with a better feeling in the business community and the general employment of labor, the receipts for the year 1905 will be more satisfactory.

[illegible] economically and satisfactorily handle its business on certain lines.

[illegible] and Wilmerding.

[illegible]

Gross earnings	[illegible]
Operating expenses	[illegible]
Bridge tolls and taxes	466,391.71
Net earnings	[illegible]
Total income	[illegible]
Net income after deductions	1,301,281.87
Fixed charges	[illegible]
Deficit for year	[illegible]

The number of passengers carried was 172,562,625; the number of car-miles, 32,655,426; earnings per car-mile, $0.2624.

Liverpool Corporation Tramways Report.

The tramways of Liverpool are owned and operated by the city, being in direct charge of a general manager who is responsible to a tramway committee consisting of the mayor and 18 aldermen and councillors. The annual report for the year 1904 has just been issued in the form of a bound book of 80 pages and an appendix. The report sets forth the additions and alterations in routes, stages and fares, which have taken place during the year. An official hand book and guide is published by the Corporation and during the past year 71,948 copies were sold at 1 d. each. Experiments have been carried on with various kinds of wheels and tires and steel tired wheels have now been fitted to more than 150 cars. The ratio of fatalities to passengers carried on the railways was 1 in 19,440,444 and although during the year 123 people fell in front of the cars all were thrown clear of the wheels by the Liverpool plow guard, only three cases of fractures occurring.

A section of the report is devoted to a description and remarks about the condition of the different depots, shops and offices used by the company. During the year the total number of emergency calls for repair to the overhead equipment was 558, exclusive of 65 calls for the breakdown wagon dealing with vehicles of various descriptions having broken down while crossing the tramway tracks. The cost of maintenance for overhead equipment during the year was £4,809.

The total amount of power used during the year 1904 for hauling and lighting cars was 20,045,629 kw. h., for which the Tramways Committee paid to the Electric Power and Lighting Committee of the city £94,937. The rolling stock owned consists of 494 single and double deck American, German and English motor and trail cars, and during the year reported the average weekly maximum number of cars in service was 398. During this period there were carried 116,642,663 passengers paying fares to the amount of £540,850. The number of car-miles was 12,166,419.

The report includes an analysis of the total traffic showing the receipts and milages of the different portions of the system for the different weeks in the year, also statements of the rain fall and barometer readings for each day in the year, a list of the property found on the cars during the year and compared with the three preceding years. The total number of employes including all departments was 2,409. The social, athletic and beneficial societies are reported as being in good condition. A detailed analysis of the cost of operation for the year 1904 compared with the three preceding years showing the total costs and the cost per mile for each distribution item and a summary of the principal figures applicable to the Liverpool tramways for the last three years forms an interesting part of the report.

There were in all 103 miles of track divided into penny stages approximately 2½ miles long. The earnings were 10.67 d. per car-mile and the average fare per passenger 1.112 d. The total cost of the property is placed at £1,916,258 and during the year the total revenue was £557,889, and the operating cost was £367,845 or 65.9 per cent of the total revenue. The gross profits were £190,044 or 9.9 per cent on the capital expenditure. From the gross profits £108,717 were set aside as interest and sinking fund and the balance

of the gross profits was divided as reserve, renewal and depreciation £54,217, transferred to general rate account £27,109.

The total operating costs per car mile were 7.256 d., and the interest and sinking fund per car mile 2.144 d., making the total charges per car mile 9.4 d.

The appendix to this report consist of tables showing the routes, stages, fares and services; the tramway accounts and balance sheet for the year reported; typical cards of the number of passengers carried over a typical route to and from the city, showing the licensed capacity and the passengers actually carried; diagrams showing the interval between cars and the loads on a typical route with the loading during the rush hours both to and from the city; a diagram showing the passengers carried per month during the years 1897 to 1904 inclusive; and a colored map of the routes of the Liverpool Corporation Tramways at the beginning of the year 1905.

The general manager of the tramways is Mr. C. R. Bellamy.

Steel-Tired Wheels.

The Railway Steel Spring Co., 71 Broadway, New York, has devoted a great deal of attention to the requirements of interurban railways in the matter of wheels, and has determined upon a num-

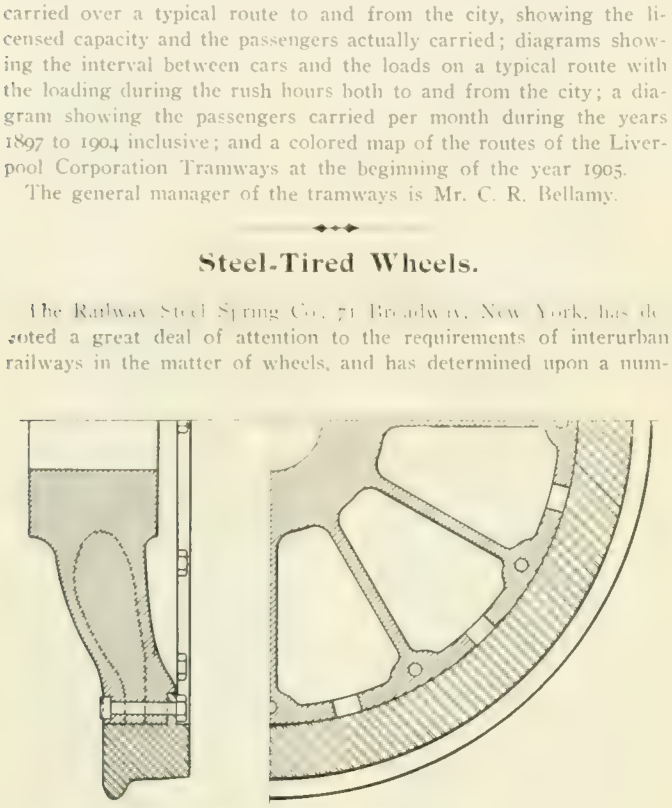


Fig. 1. Plate Center Wheel.

ber of types of steel-tired wheels which it recommends for this service. The success which the company has achieved it attributes to using the highest grade of tires especially manufactured of a composition best adapted to meet the requirements.

The drawings herewith show a double-plate wheel and a spoke wheel for electric service. Fig. 1 shows the wheel with double-

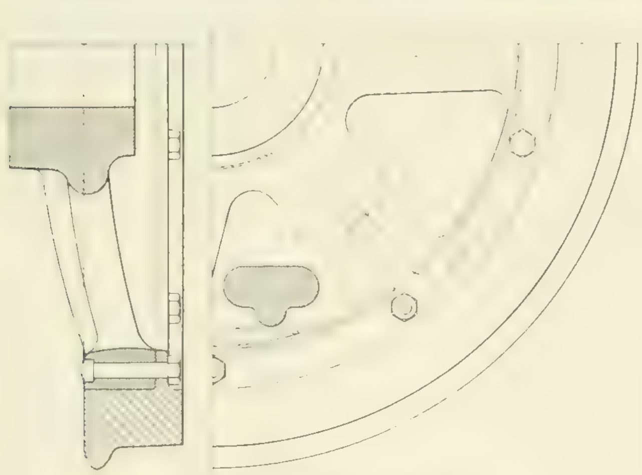


Fig. 2. Spoke Center Wheel.

plate center cast from Salisbury charcoal iron and having the tires shrunk on and secured by bolts through the center and an internal web on the tire. Fig. 2 shows the wheel with spoke center. Particular attention is called to the fact that, with this construction, the wheel may have a new tire fitted without removing the center from the axle, as the tires are bored and the centers are turned to standard gages and all for a nominal size are made interchangeable.

Dundee Broughty Ferry & District Tramways Co., Ltd.

The Dundee Broughty Ferry & District Tramways Co., of Scotland, which was authorized under private legislature procedure, act of 1899, and received royal assent in August, 1904, has let the contract for the complete construction and equipment of its line to J. G. White & Co., College Hill, Cannon St., E. C. This includes the construction of permanent way, overhead lines, power house, car shed, cables and cars, the contract price being £88,250. The route is 5⅓ miles long, part of which will be double tracked, making it equivalent to 9 2-3 miles of single track. The gage will be standard and the rails British standard No. 1, in 45-ft. lengths, fitted with "Continuous" rail joints and intermediate anchors. One mile of the road will run through private estate, which portion of the track will be laid with the usual 6-in. bed of concrete and paved with tar macadam and granite edging. The overhead construction will consist mostly of bracket arms with No. 00 double trolley wire. The power house will be a brick building, in which will be installed two 200-kw. railway generators with high speed engine, three Lancashire boilers, superheaters and the usual condensing plant. The car shed will be a brick building, 176 x 45 ft., with tracks of T-rails laid on ties. The rolling stock will consist of 12 single truck double decked cars, fitted with two 37-h. p. motors each.

An Aluminum Excursion.

The Chicago office of the Pittsburg Reduction Co., of which Mr. E. H. Noyes is manager, entertained a number of prominent engineers and railway managers, Tuesday, April 25th, with a trip over the lines of the Aurora, Elgin & Chicago Railway Co., the Joliet, Plainfield & Aurora Railroad Co. and the Chicago & Joliet Electric Railway Co. The handsome new buffet car of the Aurora, Elgin & Chicago company was provided for the occasion, by courtesy of the management of that company, and the party left the Fifth Ave. terminal of the Metropolitan elevated at 12 o'clock, running to Batavia, where it was met by General Manager Faber and inspected the plant of the company. The party then proceeded to Aurora, where it took the new private car "Louisiana," which was recently purchased by the Joliet, Plainfield & Aurora, and made the run over this company's line to Joliet and returned to Chicago via the Joliet & Chicago Electric railway to Archer Road and 52nd Ave., where it was met by a special car of the Chicago City Railway Co. An elaborate luncheon was served enroute from Chicago to Batavia.

While the object of this trip was purely for pleasure and entertainment, it gave those present an opportunity of inspecting the aluminum railway feeders and high tension transmission lines which have been installed on these lines, and which were furnished by the Pittsburg Reduction Co. To three of the Aurora, Elgin & Chicago sub-stations there are two high tension feeder lines of aluminum cables equivalent to No. 00 copper wire; and to three, single high tension feeder lines of aluminum equivalent to No. 2 copper. The feed wires of the Joliet, Plainfield & Aurora railway are aluminum cables, with weather-proof covering, equivalent to 400,000 cm. of copper. One of these feeders runs the full length of the line, and a second feeder supplements it for four miles at each end. Aluminum high tension transmission lines and aluminum cables are installed on the Chicago & Joliet line.

The party included R. N. Baylies, president Rockford & Interurban Railway Co.; W. A. Blanck, electrical engineer Chicago & Milwaukee Electric Railway Co.; E. B. Ellicott, city electrician; E. C. Faber, general manager, Charles Jones, chief engineer, Joseph O'Hara, superintendent transportation, Aurora, Elgin & Chicago; John T. Huntington, general manager, F. E. Fisher, president, and F. E. Stoddard, secretary, Joliet, Plainfield & Aurora Electric Ry.; J. R. Blackhall, general manager Chicago & Joliet; J. C. McMynn, chief engineer Robert W. Hunt & Co.; George W. Knox, president Knox Construction Co.; P. J. Mitten, superintendent construction Milwaukee Electric Railway & Light Co.; W. G. Carlton and Peter Junkersfeld, engineers, Chicago Edison Co.; C. H. Wilmerding, consulting engineer; H. M. Sloan, general manager Calumet Electric Street Railway Co.; W. D. Ball, consulting engineer; J. W. Brett, Westinghouse Electric & Manufacturing Co.; F. A. Poor, Weber Rail Joint Co. The representatives of the Pittsburg Reduction Co were E. H. Noyes, F. N. Baylies, J. H. Finney, William Hoopes and Aaron K. Lawrie.

Equipment for the Alton, Granite & St. Louis Traction Co.

The Alton, Granite & St. Louis Traction Co. has just received 10 new cars similar to the one illustrated. These cars were built by the St. Louis Car Co., and have a seating capacity for 56 persons, 40 in the passenger compartment and 16 in the smoking room. The seats are placed longitudinally. The length of these cars is [illegible] ft. 8 in. over all and 41 ft. over corner posts, with a width over all of

INTERURBAN CAR FOR ALTON, GRANITE & ST. LOUIS.

9 ft. and a height from rail to trolley board of 12 ft. 11⅝ in. The distance between truck centers is 28 ft. The side sills are made up of two yellow pine pieces, one 5 x 8 in. and one 2 x 6 in., with a 6-in., 10½-lb. channel iron between extending the full length of the car and turned up at the ends. The intermediate sills are 4½ x 6 in. and the center sills are 6 in., 12½-lb. I-beams with wooden fillers. The cross timbers are 3½ x 6 in. yellow pine, and the entire frame is tied together with ¾-in rods. The four platform knees are faced with 1 x 6 in. irons extending 29 in. back of the bolster centers. A layer of heavy building felt is placed between the two

INTERIOR OF CAR.

sections of the double floor. A single sliding door separates the two compartments of the car, and the interior is furnished throughout with mahogany, trimmed with straight lines of marquetry. Opalescent glass is used in the ventilators, and the ceilings are in semi-empire style with a monitor deck pattern roof and steam coach hood. Each end of the cars is fitted with a radial drawbar and pilot, and the vestibules are of the closed type with a cab for the motorman and having a center door to permit entrance from car to car when trains are operated. These cars are also equipped with St. Louis Car Co.'s arc headlights and illuminated destination signs.

Owl cars are being considered in London, Ont.

Two Products of the W. R. Garton Co.

The W. R. Garton Co. [illegible] ture and sell the original American indestructible packing. This is [illegible] of journals or boxes with oil wells and is claimed to show considerable saving in oil and packing and consequently a saving of [illegible] for export as well as for domestic purposes for [illegible] railway journals or bearings.

This company has also produced and is beginning to manufacture and sell the new "Hivol" pin for high tension work. These pins are made in five or six different forms, but of one general principal. It is provided with a metal top for cementing it in the insulator, or with wooden top so that it can be screwed into the insulator. It is made so that it will fit over the arm, or rest on top of the arm either with the bolt passing through side of the arm or through the arm perpendicularly. It is practically a universal pin adaptable to all conditions and made to fit all kinds of high tension insulators. Patents have been applied for and the company is receiving very strong claims covering the salient features. It is also prepared to furnish the Eiffel pin. These will be manufactured in Chicago and it is proposed, in so far as possible, to carry a reasonable stock of standard sizes. The company is as well prepared to supply all kinds of high tension locust pins and the Hivol and Eiffel, when requested, with special insulated bases.

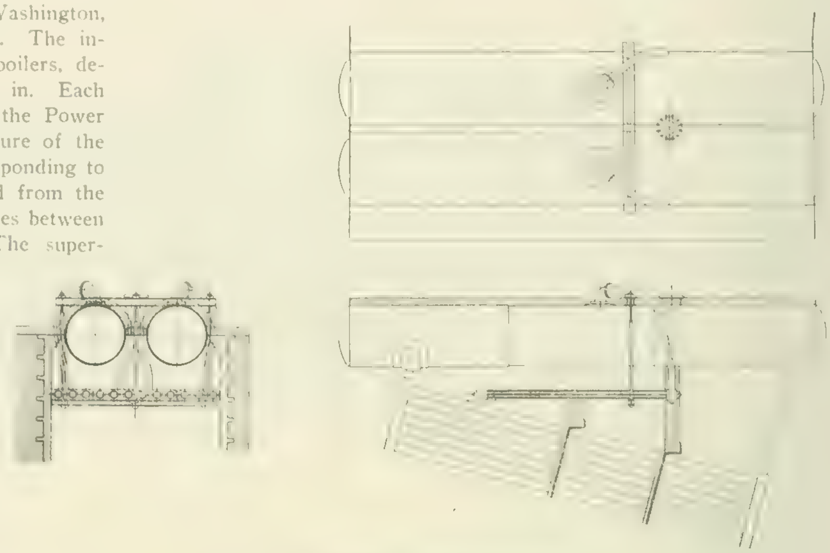
The Mullins Special Livery Boat.

One of the many types of steel boats manufactured by the W. H. Mullins Co., Salem, O., the general design and construction of which were described in the "Review" for April, is the company's "Special Livery" boat. This boat was designed to supply the demand for a small two-passenger boat, such as is most used by boat liveries, a boat of this size being found a source of greater revenue for this service than larger boats. The dimensions are as follows: Length, 12 ft.; beam, 44 in.; height at bow, 22 in.; at stern, 21½ in.; amidship, 13½ in.; weight, 150 lb. This boat is painted aluminum outside, light blue inside and has natural wood trimmings.

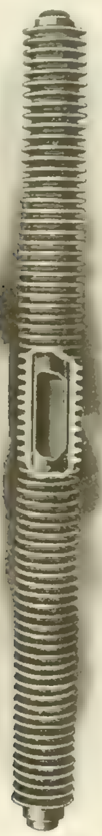
The fact that these boats are light, roomy, easy running and perfectly safe, not only appeals to the patron but to the boat liveryman. The careful handling and housing of boats is in the hands of the liveryman and there is no doubt but that better results are going to be obtained from the man who has a light and graceful craft to handle than the man who has placed in his care boats that are awkward, clumsy or heavy. The great buoyancy which is added to the boat with the air chambers is an essentially superior feature of these steel boats, making them easier running as well as rendering them perfectly safe. In short, the many qualities of the Mullins steel boats appeal to the liverymen as well as the patron and the many parks using these boats have found them satisfactory to maintain and operate and very popular with their patrons.

Foster Superheaters in Washington Navy Yard.

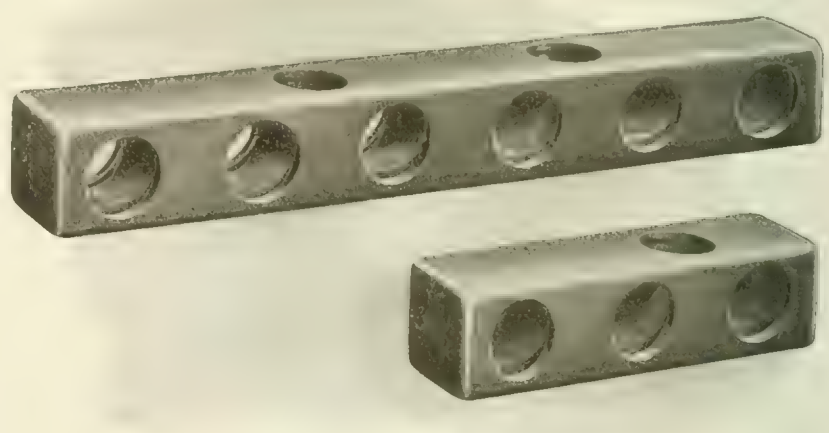
It is noteworthy that the number of manufacturers of steam superheaters has notably increased. Several large boiler manufacturers have recently issued new catalogs in which they have made superheaters a prominent feature. There are also several concerns who manufacture superheaters but do not make boilers. These are independent of the boiler manufacturers who are prepared to adapt their superheater to any type of boiler. It is held by many that the superheater bears about the same relation to the boiler as does the stoker or the economizer. One of the most recent examples of modern superheater construction combined with water tube boilers may be seen at the United States Navy Yard in Washington, in Building No. 116, which constitutes the power plant. The installation consists of ten 300-h. p. Babcock & Wilcox boilers, designed to carry a working pressure of 200 lb. per sq. in. Each boiler is equipped with a Foster superheater, made by the Power Specialty Co., of New York, which raises the temperature of the steam at a pressure of 200 lb. per sq. in. to a point corresponding to a superheat of 120°. All the steam which is generated from the boiler passes through the superheaters; there are no valves between the boiler and superheater or by-pass connections. The superheater headers are constructed of hammered steel, being rectangular in cross-section and made hollow by boring out the center from the solid mass. A series of holes is also bored crosswise to form apertures for expanding in the superheater elements and for handholes. The handholes are placed opposite the ends of the elements to facilitate the expanding of the joints and the removal of inner tubes. The elements themselves consist of seamless cold drawn Shelby tubes horizontally suspended under the boiler drums and above the tubes, forming a row of parallels extending all the way across the setting. The important feature of the superheater consists in the external cast iron covering of the elements serving as a means of protection against the hot gases and adding strength, heating surface and volume of metal for equalizing temperatures. Inside of the elements of the superheater are placed centrally supported inner tubes for the purpose of forming a thin annular space for the passage of the steam, the inner tubes being closed at the ends. The external diameter of the inner tubes is 3¼ in. and the internal diameter of the elements being 3¾ in., the annular space through which the steam passes is [illegible] in. in width. The steam, which is liberated in the drums, is conducted by means of bent pipes attached to the upper side of the drums and leading down to short sections of headers near the wall of the settings. The steam is then passed forward through two sets of elements, where it is partially superheated and turned back by a long header, which spans the whole of the boiler furnace, into a set of elements, where the process of superheating is completed. These latter groups of elements are connected at the rear to the outlet headers, which are in line with the inlet headers. These outlet headers are each joined to a pair of 4-in. tubes, which conduct the superheated steam out between the drums and deliver it to the steam main. All the joints between the elements or tubes and the headers are expanded and are thoroughly protected from the action of the heated gases. The superheater is always in use when the boilers are under steam and no flooding devices are needed; in fact, water is never admitted to the interior of the superheater tubes, and consequently there is no danger of scale forming in them. Any accumulation of soot on the elements can be readily blown off by a steam jet from the side walls, but it has been found in practice at this station that there seems to be practically no tendency for soot to accumulate on the surface of the superheater.



ARRANGEMENT OF SUPERHEATER.



SUPERHEATING ELEMENT.



STEEL FORGED HEADER.

The Rochester, Syracuse & Eastern Railroad Co., has awarded the contract for the construction of the overhead work between Rochester and Lyons to J. G. White & Co., which already has the contract for the track work between the two points mentioned, and are at present engaged in grading the roadbed between Palmyra and Lyons.

Parks, Groves and Seashore Resorts.

"Parks, Groves and Seashore Resorts" is the title of an interesting pamphlet issued by the passenger department of the Boston & Northern and Old Colony Street Railway companies, and is descriptive of the parks, groves, seashore resorts and other places along the lines of these electric railways, especially adapted for picnic parties and outings. The purpose is to place before every organization full information pertaining to the resorts and places of interest reached by these systems and the completeness of this pamphlet will no doubt furnish the public with such information as it may demand on this subject. It also includes information regarding special cars and gives a list of the offices of the division superintendents where arrangements may be made for such. The company has also offered prizes for the best photographs of views of picturesque places along their lines.

Chicago Litigation.

On April 24th, Judge Grosscup decided that the ordinance of the city of Chicago, passed Feb. 6, 1905, requiring the Chicago City Railway Co. to accept transfers from other street railway companies, was void insofar as it related to the transportation of passengers on Clark St. between Washington St. and 22d St. and on State St. between Lake St. and 22d St., and the city was enjoined from attempting to enforce this ordinance until the expiration of the rights enjoyed by the Chicago City Railway Co. under the so-called 99-year act.

May 6th, Judge Grosscup entered the decree defining the 99-year right of the Chicago Union Traction Co. for the north division of the city. The 99-year act is held to cover the streets now occupied by cable lines from the down town loops for a distance of about three miles north.

It is reported that stockholders of the companies underlying the Chicago Union Traction Co. will file a bill asking for an accounting by the receivers, the stockholders of the North and West Chicago companies not being satisfied with the disposition made of the earnings of the lessee company.

May 5th, Mr. John C. Fetzer tendered his resignation as managing receiver of the Chicago Union Traction Co., which was accepted. The court has made no statement as to who will be appointed to succeed him, but it is generally believed that a representative of the Chicago City Ry. interests will be named.

May 8th Judge Grosscup decided the Chicago Passenger Ry. case in favor of the city, holding that the franchises for the Adams, Desplaines, Harrison and 12th St. line of the Union Traction Co. expired in 1904.

Recent Accidents.

Within the last month there have been two unfortunate accidents on suburban lines near Chicago. Early in the evening of April 21st, a car on the line of the Chicago & Milwaukee Electric Railroad Co., carrying about 100 passengers, struck the curve at Fourth and Greenleaf Sts., Wilmette, at such a high rate of speed that it was overturned and several people injured. This car was late and as there is a long tangent before reaching the curve the motorman tried to make up some of his lost time on this straight track, but it is stated that after having attained the high speed and when attempting to slow down before reaching the curve, the brakes failed to work. As the fast moving car began to take the curve the car body left the trucks, falling on its side in the ditch. The trucks, which carried motors, did not leave the track.

Sunday evening, May 7th, a collision occurred on the Elgin branch of the Aurora, Elgin & Chicago Ry., at the Wayne siding, where the electric road connects with the Omaha branch of the Illinois Central R. R. The electric freight locomotive left Elgin a little before 8 o'clock pulling a train of loaded stock cars which were to be transferred to the Illinois Central tracks at Wayne. At 8 o'clock a well loaded two-car train, consisting of a motor car pushing a trailer, left Elgin bound for Chicago. The freight train in the meantime had taken the siding and was awaiting the passage of the passenger train before completing its switching duties. The switch leading into the siding is a standard spring switch facing Elgin, having 15-ft. points and a 60-ft. lead. It is stated that the passenger train was running at a speed of 30 [illegible] reached. The cause has not been ascertained, but for some reason the passenger train took the side track, crashing into the freight train standing there. The heavy passenger car wrecked the locomotive and telescoped [illegible] of the passenger car [illegible] jumped in time to avoid injury. The passengers were badly shaken up but no one [illegible].

Illuminated Signs.

Railway companies operating [illegible] or other amusement resorts will be interested [illegible]

PARK SIGN

which is reproduced from a photograph taken at 9 o'clock at night with an exposure of four minutes. The sign shown was furnished by W. N. Matthews & Bro., of St. Louis, Mo.

Golden-Anderson Valve Specialty Co.

Mr. W. E. Golden, formerly general sales manager for the Best Manufacturing Co., and Mr. E. V. Anderson, inventor and mechanical superintendent, have formed a new company for the manufacture of Anderson cushioned non-return valves, Anderson pressure reducing valves, Golden high and low pressure tilting steam traps, Anderson roller lock cocks and Anderson automatic float valves. The headquarters of the Golden-Anderson Valve Specialty Co. will be at 105 Pike St., Pittsburg, Pa., where all inquiries and orders for these products should be addressed.

The J. G. Brill Co. has recently received an order from the Dunedin Corporation Tramways, New Zealand, for a lot of seven 10-bench open cars. This type of car, and other Brill types, are already in use at Dunedin. The cars will be mounted on the Brill No. 21-E single trucks. Among the foreign companies that have lately ordered this type of truck are the Kobe Railway Co., Japan; Compagnie Generale Electrique de Nancy, France; Manitoba & Northern Ry., Canada, and the tramways at Alexandria, Egypt, and at Naples, Italy.

Tariff and Mileage Tables.

The Indiana Union Traction Co. has prepared a number of charts on which are shown tariff and mileage data in a very convenient form for reference. For the system five tables are needed. The largest of these is that for the Indianapolis-Logansport Division, which is reproduced herewith. Smaller diagrams show the Muncie-Anderson, the Anderson-Marion, the Alexandria-Tipton and the Kokomo-Peru divisions, which are respectively 57, 34, 20 and 20 miles in length, the Indianapolis-Logansport division being 80 miles.

Indianapolis-Logansport Division

Between	Indianapolis	38th Street	Broad Ripple	Nora	Pleasant Grove	Carmel	Grays	Noblesville	Cicero	Arcadia	Atlanta	Tipton	Jackson	Sharpsville	Fairfield	Kokomo	Jewell	Galveston	Lincoln	Walton	Hill Top	Logansport
Indianapolis		10	20	25	35	45	55	65	80	90	1 00	1 15	1 25	1 35	1 40	1 60	1 75	1 80	1 85	1 95	2 05	2 25
38th Street	4		15	25	25	35	45	55	70	80	90	1 10	1 15	1 25	1 35	1 55	1 70	1 75	1 80	1 90	2 00	2 20
Broad Ripple	[illegible]	4		15	15	25	35	45	65	70	80	1 00	1 10	1 15	1 25	1 45	1 60	1 65	1 70	1 80	1 90	2 10
Nora	11	[illegible]	[illegible]		15	15	25	35	55	65	70	80	90	1 00	1 10	1 25	1 40	1 45	1 50	1 60	1 70	1 90
Pleasant Grove	13	[illegible]	[illegible]	2		15	25	35	55	65	70	80	90	1 00	1 10	1 25	1 40	1 45	1 50	1 60	1 70	1 90
Carmel	16	12	[illegible]	[illegible]	[illegible]		15	25	45	55	65	80	90	1 00	1 10	1 15	1 30	1 35	1 40	1 50	1 60	1 80
Grays	[illegible]	[illegible]	11	[illegible]	6	3		15	35	45	55	70	80	90	1 00	1 10	1 25	1 30	1 35	1 45	1 55	1 75
Noblesville	24	20	17	14	12	[illegible]	[illegible]		15	25	35	55	65	70	80	1 00	1 15	1 20	1 25	1 35	1 45	1 65
Cicero	30	26	[illegible]	[illegible]	18	15	12	[illegible]		15	15	35	45	55	65	80	95	1 00	1 05	1 15	1 25	1 45
Arcadia	33	29	26	23	21	18	15	[illegible]	[illegible]		15	25	35	55	65	70	85	90	95	1 05	1 15	1 35
Atlanta	36	32	29	26	24	21	18	[illegible]	[illegible]	[illegible]		15	35	45	55	65	80	85	90	1 00	1 10	1 30
Tipton	41	36	34	31	29	26	23	17	11	[illegible]	[illegible]		15	25	35	55	70	75	80	90	1 00	1 20
Jackson	45	41	37	34	32	30	27	21	15	12	9	4		15	25	35	50	55	60	70	80	1 00
Sharpsville	49	45	41	38	36	33	31	25	19	16	13	8	4		15	25	40	45	50	60	70	90
Fairfield	53	48	44	41	39	36	33	28	22	19	16	11	7	3		15	30	35	40	50	60	80
Kokomo	57	53	49	46	44	41	39	33	27	24	21	16	12	8	6		15	20	25	35	45	65
Jewell	60	56	53	50	48	45	42	37	31	28	25	20	16	12	9	4		15	20	25	35	55
Galveston	64	60	56	53	51	48	46	40	34	31	28	23	19	15	12	7	3		15	20	25	45
Lincoln	66	62	59	56	54	51	48	43	37	34	31	26	22	18	15	10	6	3		15	20	35
Walton	70	66	62	59	57	55	52	46	40	37	34	29	26	22	19	14	10	6	4		15	25
Hill Top	75	71	68	65	63	60	57	52	45	42	40	35	31	27	24	19	15	12	9	5		15
Logansport	80	76	72	69	67	64	62	56	50	47	44	39	35	31	29	23	19	16	13	10	4	

MILEAGE TABLE.

INDIANA UNION TRACTION MILEAGE DIAGRAM.

C. H. Wheeler Condenser & Pump Co.

The C. H. Wheeler Condenser & Pump Co., with general offices and works at Philadelphia, Pa., has recently been organized to succeed the Barr Pump Co., of Philadelphia. Mr. Clifton H. Wheeler, formerly president and general manager of the Wheeler Condenser & Engineering Co., of New York, is now identified solely with this company and will devote his entire time to the business of the company, which will manufacture condenser apparatus and pumps of all sizes and descriptions. Inquiries are solicited by the new company for surface, jet or barometric condensers; vacuum and circulating pumps, electric, geared or steam driven; water cooling towers; pumping engine and all auxiliaries. The officers of the company are: President, John Pitcairn, president Pittsburg Plate Glass Co.; vice-president, George Burnham, Jr., Baldwin Locomotive Works; secretary, C. H. Wheeler; treasurer, W. H. Rometsch, Fletcher Works, Philadelphia; works manager, Otto W. Schaum, Schaum & Uhlinger, Philadelphia. The main office of the company is at Lehigh Ave. and 18th st., Philadelphia, with branch office at 26 Cortlandt St., New York. Sales offices in Chicago and elsewhere will soon be established.

Extension of the London United Tramway System.

J. G. White & Co., 22 College Hill, Cannon St., London, E. C., have been awarded a contract by the London United Tramways for a substantial extension of its system. The contract comprises two distinct sections, the first covering Kingston, Surbiton, Malden and Wimbledon districts, and the second the lines in Hanwell and Brentford.

The total route length of the lines comprised in the first section is about 10¼ miles, and the length of single track is about 18¾ miles. The route length of the lines in the second section is about 2⅝ miles, and the length of single track 5⅛ miles.

The track construction will consist generally of No. 3 B. S. rails, with crossed girders spaced 9 ft. apart throughout. The joints are supported by anchors of H section, secured to the rails with bolts and clips.

The concrete underbed is 6 in. thick, finished with a layer of fine concrete 1 in. thick, and over this a floating coat of 1 in. of cement and sand to form bed for wood paving. The paving throughout is of Jarrah wood, finished, in the Kingston section, with an edging of granite sets, while in the Hanwell and Brentford section the margins are entirely of granite sets.

The overhead construction is span wire throughout, the poles being 33 ft. long and the ornamental character of the company's pole work will be preserved on the new sections. The trolley wire will be No. 00 B. & S. gage grooved copper wire, and will be supported by mechanical ears. The height of the trolley wire above rail level will be 23 ft., which is greater than usual, owing to special London conditions.

Improved Wurtz Lightning Arrester.

A successful lightning arrester should protect a line from lightning discharges without the need of continued inspection. Its operation should be certain with no danger that it will permanently ground or short circuit the lines. The fact that the Wurts non-arcing arrester has been in satisfactory service for a period of 12 years is evidence that it meets the requirements. This type of non-arcing arrester has lately been improved by its manufacturer, the Westinghouse Electric & Manufacturing Co.

The essential parts of the arrester are seven knurled cylinders of a special non-arcing metal which form the surfaces for the discharge between the line and ground. These seven cylinders are rigidly held in line and at a set distance from each other by two molded porcelain blocks which cap their ends. All the cylinders are securely fastened to one of the blocks by binding screws and the combination of cylinders and blocks is fitted to the interior of a cast iron box, provided with a cover held on by screws and made water tight by a rubber gasket. Two turns of rubber-covered wire surround the combination to lessen any jar. The middle one of the seven cylinders is connected to the ground and the end cylinders are each connected to one of the lines. In order to reach the ground the lightning must pass from one of the end cylinders across three air gaps to the grounded middle cylinder. When the numerous sharp points on one side of a cylinder have been dulled by long service it is an easy matter to revolve that cylinder in its socket and present a fresh portion of the path of the current.

The success of this type of arrester depends upon the fact that an alternating current arc cannot be maintained over a short air gap when the electrodes consist of certain metals and alloys thereof. In the new arrester all the best electrical operating characteristics of the old Type-C arrester are retained. The improvements consist of changes in the mechanical construction, consequently longer life and ease of inspection and repair are gained.

State Meetings.

The April meeting of the Ohio Interurban Railway Association was held at the Arcade Hotel, Springfield, O., April 27th. The subjects for discussion at the morning session were "Summer Resorts," "Special Attractions" and "How to Attract Summer Travel." For the afternoon session the program included a paper by Mr. C. E. Meade, of the Westinghouse Electric & Manufacturing Co., on the "Application of Single Phase Electric System to Electric Roads."

The May meeting of the Indiana Electric Railway Association was held at the Traction & Terminal Building, Indianapolis, May 11th. "Repairs of Car Equipments" was the principal subject assigned for discussion.

The Davenport & Suburban Electric Railway Co. has been granted by the secretary of war the permission for the cars of its proposed line to cross the Government bridge over the Mississippi River between Davenport and Rock Island. It is the plan of this company to build and operate a line from Rock Island to Monmouth and then to Galesburg, Ill. About eighty-five miles of track will be needed to connect these cities. It is stated that the construction materials have been arranged for and the money is in the hands of the incorporators.

Westinghouse Companies at the International Railway Exhibition, Washington.

The Westinghouse building at Washington is the largest structure on the grounds, apart from the headquarters building devoted to the grouped displays of the smaller exhibitors, and presents in an attractive and orderly arrangement the most remarkable combination of Westinghouse products ever brought together under a single roof. The brake and coupler appliances of the Westinghouse Air Brake Co. and its associated interests are shown under conditions approximating those of actual practice; the Union Switch & Signal Co. has installed full size safety apparatus of all standard types, the Westinghouse Electric & Manufacturing Co. exhibits for the first time complete operative equipments of its latest forms of multiple control systems for alternating current and direct current traction, with important auxiliary sub-station apparatus, and displays also an interesting collection of heavy railroad-shop tools driven with Westinghouse motors; the Westinghouse Machine Co. has set up, open for inspection, a 600-h. p. steam turbine identical in size and type with the Westinghouse turbine that ran continuously for 3,962 hours at the St. Louis Fair; and Nernst lamps and Cooper Hewitt lamps are used liberally throughout. The dome of the building is lighted with four big electric signs, flashing the name of Westinghouse, and large banners at the entrance carry the names of the twenty-six Westinghouse companies of the United States and Europe represented in the joint display. Mr. Frank S. Smith, one of the resident Westinghouse commissioners at the Louisiana Purchase Exposition, is the managing director, and Mr. C. W. Townsend is in immediate charge of the installations of the Air-Brake company.

The most important feature of the electric traction exhibit is a 50-ft. dummy car platform completely equipped with Westinghouse single-phase motor and "straight-air" brakes, and with the Westinghouse unit system of multiple control as designed for alternating current practice, with induction regulators by means of which a variable operating voltage is secured to provide a wide range of speed without resistance losses. The motors are of type No. 106, 100-h. p. capacity, two on each truck, and the master controller and brake operating valve are mounted at each end of the platform as in the motorman's cab, the entire car frame being so raised above the elevated tracks as to permit the revolution of the wheels under slight frictional pressure on greased rails to keep the motors under load. The tracks are raised several feet above the floor to permit thorough inspection of the underhanging parts, and a side platform reached by a stairway affords a close view of the motor mounts. The entire equipment is similar to that of the Westinghouse single-phase cars built for the Vallejo, Benicia & Napa Valley road in California, the Blairsville and Derry line near Pittsburg, and other alternating current suburban systems not requiring combination rheostatic control for direct current service over tracks within city limits previously equipped. The straight alternating current system is exhibited as more desirable than the combination equipment, as its advantages of a simpler and more efficient method of control are particularly important in the frequent starts and stops of city service. Alternating current for the operation of the motors is obtained from a 400-kw. rotary converter, running inverted, which receives direct current at 500 volts from outside the exhibition grounds.

The latest form of Westinghouse multiple control for direct current practice is demonstrated in the complete car equipment for the operation of a truck driven by two No. 113 motors, each of 200-h. p. capacity, a type embodying slight modifications of motor No. 86 for heavy train service on the Long Island railroad. The unit switch group is enclosed in a rectangular casing, more substantial than the turret box, every switch is a circuit breaker, and provision is made for changing from series to multiple operation of the motors without opening circuits, by a bridging system.

The Illinois Traction Co. has sent checks for five per cent of the amount of salaries drawn during the past year by employes as a compliment from the company.

At the annual meeting of the Rockford & Interurban Railway Co. the board of directors and officers of the company were re-elected for the ensuing year.

Electrically Operated Drawbridges.

The Pyrmont and Glebe Island drawbridges both at Sydney, N. S. W. and both connecting important centers of population, have been completely electrically equipped by the Australian General Electric Co., and are to-day among the finest examples of electrically operated drawbridges. Both are almost identical in construction and electrical equipment.

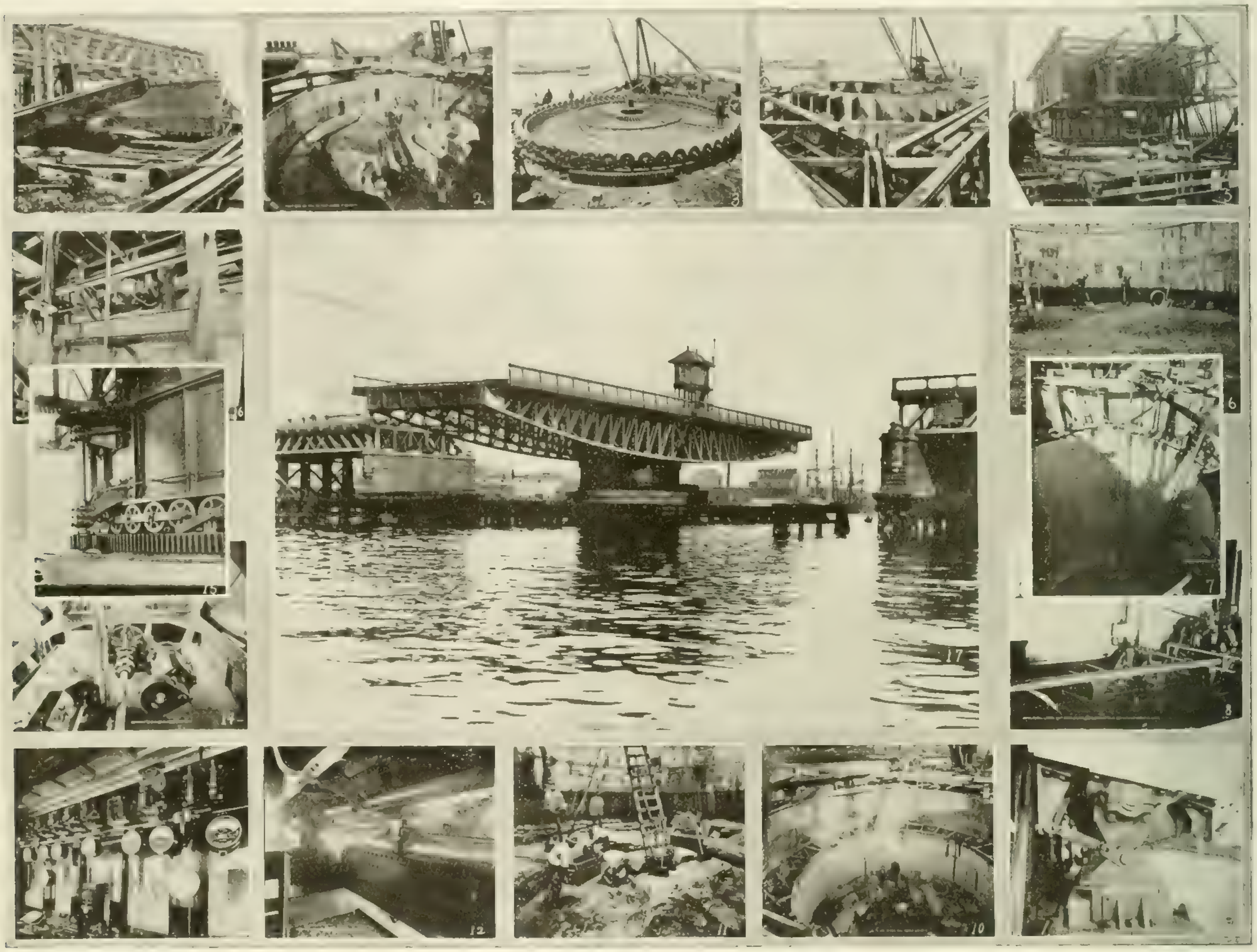
From an electrical point of view the most interesting part of the bridge is the equipment to operate the swing span, the end lifts and the gates. The length of the swing span is 223 ft. and its weight is about 900 tons, and although there may be larger electrically operated swing spans, this is believed to be the first instance where all of the operations in connection with a draw bridge are performed by electric motors, controlled by one man from one point.

The power to operate the bridge is supplied from the large power stations of the Sidney Tramways at 500 volts direct current.

For slewing the bridge, two GE-57 motors are provided and the bridge can be opened in 30 seconds if desired. Such quick work has been found unnecessary, however, and the average time taken is 50 seconds. It is interesting to note, that to open the bridge in 60 seconds requires a maximum of 15 h. p. and to open it in 30 seconds requires a maximum of 89 h. p. It has been found possible to open and close the bridge with one motor, but for the sake of economy two are used, which are never taken beyond the series position of the controller. These motors are carried on a platform inside the drum and operate two vertical shafts through a train of cut gears; on the lower ends of the vertical shafts are cast steel pinions meshing with a cast steel rack secured to the top of the pivot pier.

An ingenious latch is used to stop the swing span in its proper position upon the abutment piers. The latch is provided with heavy coiled springs so that should the moving mass be traveling at too high a rate of speed it will jump the latch without jar and may then be returned to its true position. The design of this latch to stop a mass of 900 tons, sometimes moving at a considerable speed, required much care, and the operation of the device has been thoroughly satisfactory in practice.

The ends of the swing span when free of supports have a deflection of 3½ in., but when closed, and to prevent chattering under heavy loads, the ends are raised 1¼ in. by means of a GE-1000 motor, which is geared to a longitudinal shaft running the entire length of the span and working two horizontal shafts carrying cams under each main girder. This operation takes 15 seconds. An automatic device is provided for opening the circuit, and for stopping the end lifts when they have reached the correct position by means of a solenoid brake on the motor armature shaft.



ELECTRICALLY OPERATED DRAWBRIDGE AND DETAILED VIEWS.

Each of the four gates on the abutment piers is operated by a General Electric type CE 5-h. p. motor completely enclosed and connected by beveled gears to a screw shaft. A nut threaded upon the screw shaft communicates the motion through a slotted crank to the gate axis. Contacts are also supplied for automatically stopping the gates in their proper position, and automatic latches for locking them.

All of the operations connected with the moving of the swing span, the raising and lowering of the end lifts and the opening and closing of the gates as well as the control of the 25 G. E. arc lamps on the bridge and protecting platforms are performed from the controller house, situated above the footpath at the center of the swing span. This house is completely equipped with apparatus

furnished by the Australian General Electric Co. The controller house contains a type K controller for every operation, with the necessary resistances located in the roof. Switches, circuit breakers, and ammeters for showing the amount of current taken for each operation, are also provided, together with a Thomson recording wattmeter for recording the total consumption of current, and dial indicators showing the operator the position of the swing span and the end lifts. All of the operation [illegible].

The six arc lamps on the protecting platforms are provided with ruby globes as a guard to vessels passing through the draw at night.

In the two years ending June 28, 1904, the swing span has been opened 12,317 times for the passage of 21,758 vessels involving 98,536 individual gate movements. The cost of the current for operating the swing pan, the end lifts, and the gates for the two years has been but $235, at 2 cents per unit. This is a little less than 2 cents for each complete operation of opening and closing the bridge with the attendant operations of moving the end lifts and opening and closing the gates. Notwithstanding the mechanical and semi-automatic operation of the gates no accident has occurred, although the average daily traffic over the bridge totals 11,825 pedestrians, 5,288 vehicles, and 7,645 head of live stock.

The design of the swing span, bridge and approaches and the work of construction were under the immediate supervision of Mr. Percy Allen, to whom is due all credit for the eminently successful results which have followed its opening over two years ago. The installation of all of the electrical machinery was carried out by the Australian General Electric Co.

Some of the most interesting features of the bridge are shown in the accompanying group of views. No. 1 shows one of the uncompleted approaches. No. 4 is the first section of the caison. No. 11 is the caison bottom in position 60 ft. below low-water level. No. 7 is the caison empty. Nos. 2, 6 and 10 illustrate the refilling operation. No. 3 shows the rollers on the center pier. No. 9 illustrates the end lifts, No. 16 the motors operating them, and No. 12 the latch for stopping the bridge in the proper position. No. 14 shows the turning motors and No. 15 the gearing. No. 8 is the gate operating mechanism and No. 13 the interior of the controller house.

Summer School for Artisans.

The fifth [illegible] under the direction of the [illegible] of Wisconsin [illegible] weeks.

Courses of study are offered in the following subjects:

1. Engines and Boilers—Lectures and laboratory courses covering the theory, construction, management and testing, of steam engines, boilers, gas engines, refrigerating machines, etc.

2. Applied Electricity—Lectures and laboratory courses covering the theory of direct and alternating current dynamos and motors, the operation and method of testing electrical machinery, batteries, transformers and other apparatus, photometry and calibration of instruments.

3. Mechanical Drawing and Machine Design—Elements of applied mathematics, courses in mechanical drawing and machine design adapted to the preparation of the students.

4. Materials of Construction, Fuels and Lubricants—Lectures on the properties of materials accompanied by laboratory tests; lectures on fuels and lubricants with laboratory tests on the heating value of coals and efficiency of lubricants.

5. Shop Work—Practice with hand tools, wood and metal working machinery, and in blacksmithing and pattern making.

The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work, so that the student may take advantage of all the preparation he has obtained.

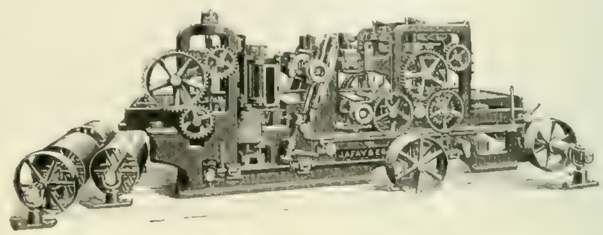
This school offers to those unable to take a regular four years' course, an opportunity of obtaining a working knowledge of the methods of testing and the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit.

A bulletin describing the work of the School for Artisans in detail will be sent on application to Frederick E. Turneaure, Dean, College of Engineering, Madison, Wis.

A New Timber Dresser.

Heavier machine tools are needed for working the timbers of increased size which are now used in the construction and repairing of street and interurban railway rolling stock. The accompanying illustration shows a very powerful tool designed for this class of work and adapted for ready adjustment so that many different sizes of stock can be dressed as needed.

The tool is constructed after a generous design which insures solidity, thus lessening vibration and enabling it to stand the wear and tear of the hardest work. It will plane two or four sides of a timber 30 in. by 20 in. or two sides and one edge of two timbers each 13 in. by 20 in. The upper cylinder is so supported that it may quickly be raised or lowered by hand or power and readily locked in its new position. The lower cylinder is double belted and cuts first; it has an independent adjustment, can be drawn out when the knives are to be sharpened, and has a pressure of four rolls, each raised independently.



FAY & EGAN TIMBER DRESSER.

The upper cylinder and feed-out rolls can be disconnected and the separate parts raised by hand, or, if desired, the horizontal mechanism is so arranged that all parts can be operated together. It is stated by the maker of this timber dresser, J. A. Fay & Egan Co., Cincinnati, O., that the feed of this machine is especially well designed and effective in operation. The six rolls are so geared that four feed in and two feed out, the feed-in rolls being center geared exert a powerful driving force. These rolls are divided so that they will allow two timbers of uneven thickness to be planed at the same time. Their vertical adjustment may be rapidly changed to suit timbers of different dimensions. For dividing an extra heavy cut between upper and lower cylinders, the lower feed-in rolls are lowered one inch below the bed of the machine. The feed-out rolls are geared on both ends and all the upper rolls are driven down. A patent weighing device permits changing the position of the rolls without raising the weights, and the feed of the machine is controlled from the operator's end, or at the side heads. The design of this timber dresser is such that the machine is successful in operation upon both odd and regular size timbers, and the parts are so arranged that inspection and repairs may easily be made.

A timber dresser having the same general design but being adapted for handling somewhat smaller material is also one of the products of the same manufacturer.

The Kobu Railway Co. of Japan.

The Kobu Railway Co., of Japan, which is building a double track electric railway 5¼ miles long, has awarded the contract for its new motor equipments to the Japanese engineering and contracting firm of Takata & Co. This contract is for 16 cars, suitable for a gage of track 3 ft. 6 in. The cars are to be of the vestibule type, 30 ft. in length over all, 23 ft. 6 in. over car body and 7 ft. 6 in. wide, with a normal capacity of about 50 persons. Takata & Co., through their New York office, 10 Wall St., have placed the order for the trucks, which will have a 10-ft. wheel base and 34-in. wheels, with the J. G. Brill Co.; the order for the motor equipments, which are to be of the multiple unit control system, each consisting of two direct current railway motors and two controllers, was placed with the Westinghouse Electric & Manufacturing Co. The order for air brake equipments has not yet been placed.

Construction work has begun by the Central Kentucky Traction Co. on its Versailles extension.

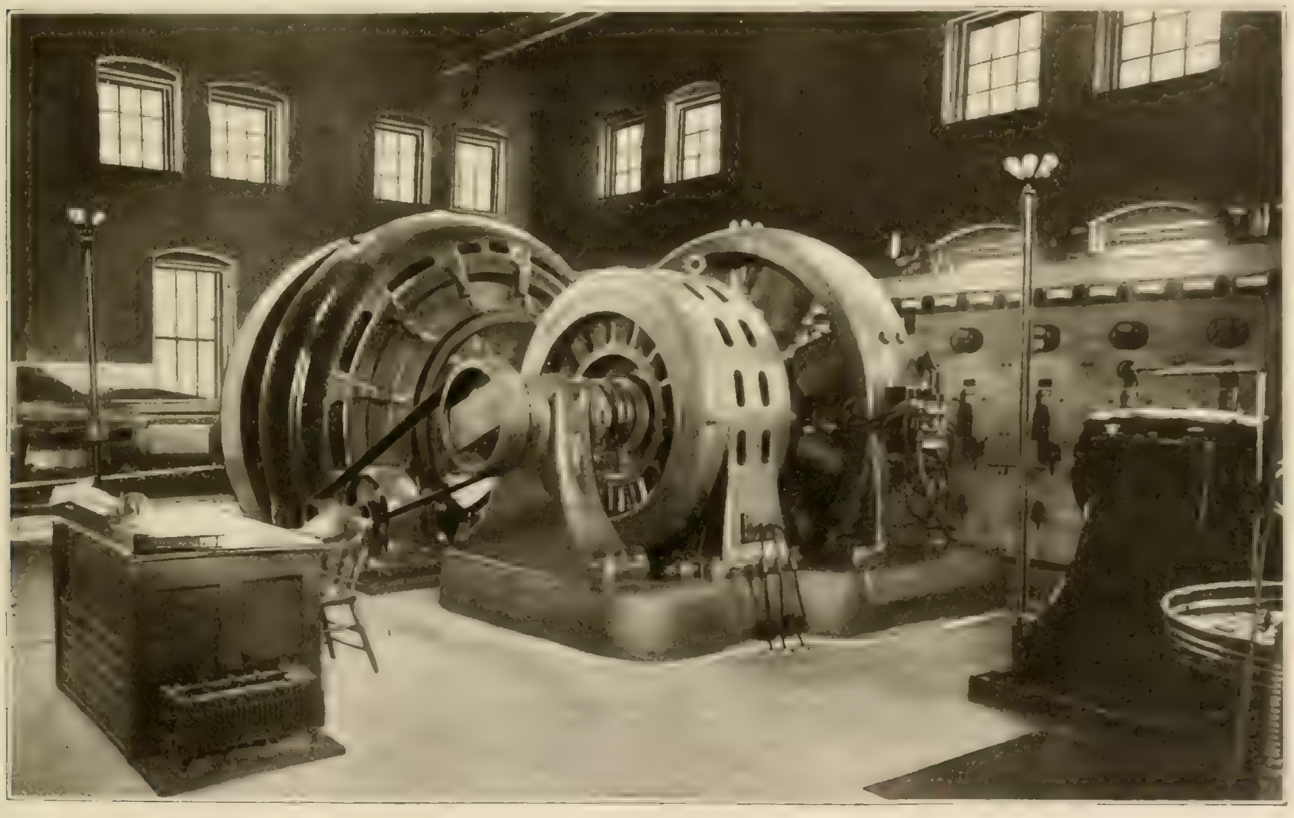
STREET RAILWAY REVIEW

Vol. XV | JUNE 15, 1905 | No. 6

Saginaw & Bay City Railway & Light Co.

A syndicate controlled by Hodenpyle, Walbridge & Co., of New York, and E. W. Clark & Co., of Philadelphia, has recently obtained control of the following properties in Michigan: Saginaw Valley Traction Co., Bartlett Illuminating Co., Saginaw City Gas Co., Bay City Traction & Electric Co., Bay City Gas Co. These separately incorporated companies are now merged into the Saginaw & Bay City Railway & Light Co., and are operated by one management, with general offices in Saginaw and a branch office in Bay City. The operating officers are: H. D. Walbridge, president; B. C. Cobb, vice-president and general manager; C. E. Mershon, secretary-treasurer; M. S. Hopkins, Columbus, O., consulting engineer; J. C. Young, general superintendent; H. C. Morris, Bay City, superintendent.

At the time of consolidation each of the properties was operated



INTERIOR VIEW BAY CITY POWER HOUSE

independently, having its own management and generating station. These electric lines comprise the city systems in Saginaw and Bay City and an interurban line, 13.54 miles long, connecting these cities. These properties have been united and their four power stations superseded by two new ones, which now supply current for operating all the cars and for lighting the city of Saginaw and a portion of Bay City and its suburbs.

City Systems.

The city system of Saginaw comprises 22.7 miles of single and double track lines, including a suburban branch to the company's Riverside Park. The lines in Bay City comprise 17.5 miles of single and double track, which include a 5-mile suburban branch to the company's Wenona Beach Park. Since the syndicate obtained control a large portion of the lines in both cities have been rebuilt. Sixty pound T rail of the A. S. C. E. section are laid on oak ties bedded in concrete. The joints are bonded with No. [illegible] American Steel & Wire Co.'s concealed, expanded terminal bonds. This construction is the standard for unpaved streets in both Saginaw and Bay City. In paved street a Shanghai rail 6 in. high, having a T section and weighing 60 lb. to the yard, is used. The rail is spiked to oak ties laid in a concrete bed. Specially notched gage brick are used. Throughout the cities new special work with hard steel centers has been laid. The overhead work is of the latest type, using wooden and steel poles for span wire construction.

The operating schedules on the different lines in the two cities furnish 5, 10 and 15-minute headway. For this service there are required for winter operation in Saginaw 23 cars and in Bay City 18 cars. The summer schedules have an increased number of cars to suit the patronage. The Saginaw equipment includes 36 convertible cars of 8, 10, 13 and 15 bench types, and 32 closed cars having varied lengths of 16, 22 and 28 ft. The Bay City equipment includes 29 convertible cars and 25 closed cars.

Interurban Line.

The interurban line operates between the centers of the two cities over 13.54 miles of track. This line has been in operation for several years, but on account of the damage done by the excessive floods in 1904, a large portion of the track has been practically rebuilt. The interurban line connects the following cities, having the stated populations: Saginaw, [illegible] manufacturing

[illegible] Bay City and South Bay City, combined, 45,000.

For a distance of 1.61 miles the interurban cars operate over city tracks in Saginaw; for a distance of 2.57 miles the track is on one side of the highway; for a distance of 5.90 miles the roadbed is built on a 100-ft. private right of way and in Bay City the interurban cars traverse 3.26 miles of city tracks to reach the center of the city. Between the limits of the two cities the track and roadbed

BAY CITY POWER HOUSE.

are built according to steam railroad standards, the private right of way portion of the line having a level tangent four miles long built as a 7-ft. fill across the river marsh. This right of way is enclosed by woven wire fencing. About half way between the two cities the line crosses the Saginaw River on a single track, four-span, through truss bridge, 2,000 ft. long, with one panel built as a draw span. This interurban line parallels the Michigan Central and the Grand Trunk tracks on the west side of the river and the Pere Marquette tracks on the east side of the river.

The track is laid with 60-lb. T-rails of A. S. C. E. section, spiked to oak ties, and each joint is bonded with two No. 0000 American Steel & Wire Co's. concealed, expanded terminal bonds. Between the limits of the two cities this line has 22 crossings with steam railway main and side tracks. Four of these crossings are protected by interlocking apparatus, while the others and the approaches to the Saginaw River bridge are protected by split-point derails.

The working conductor is a No. 000, Fig. 8 single trolley wire, suspended on flexible brackets. Thirty-five-foot cedar poles are used. Other than the overhead construction, the poles carry the company's telephone line and the direct current trolley feeders. These feeders consist of a 250,000 c. m. weather-proof cable, which extends 4½ miles north from Saginaw and is only tapped to the trolley line at its extreme end, and another feeder of 500,000 c. m. cross-section, which connects the Saginaw and Bay City power houses and is tapped to the trolley wire at frequent intervals. This places in parallel the two generating stations at the ends of the line and assures an equalization of the loads. The present reconstruction plans include a 10,000-volt high-tension transmission line, which will be carried on the interurban poles and will connect suitable apparatus in the two stations at the ends of the line, so that in event of engine or generator trouble all the load may be carried by either one of the stations.

The winter schedule on the interurban line, operating under 40-minute headway, requires three interurban cars, and the summer schedule has a 30-minute headway with added cars as traffic demands. A freight train making three trips each way every day handles all classes of freight and express. There are freight receiving depots at both ends of the line and the steam railroad freight rates are met with the same classification.

The freight and express motor cars are built with closed bodies and have a length of 40 ft. over all. They are equipped with four G E-66 motors and series-parallel platform control.

The standard interurban passenger car is 51 ft. over all with a length of 40 ft. inside the car body. These cars were manufactured by the John Stephenson Car Co., Elizabeth, N. J. The smoking compartment has rattan covered seats for 16 passengers, and the general compartment has red plush covered seats for 40 passengers. All the seats are of the "walkover" type. The interior finish of the cars is mahogany with a semi-empire ceiling and compound Gothic windows. The cars have single-door vestibules with oval windows in the side of the vestibules opposite the doors, and are built to run in either direction, but are usually operated with the smoking compartment ahead. They are fitted with hot water heating pipes and a Peter Smith heater is mounted in the vestibule at the smoking compartment end of the car. The equipment of the cars consists of four G E-67 motors, which have a normal rating of 40 h. p. and are controlled by G. E. Type-M series-parallel control apparatus. The cars are mounted on Peckham trucks. Cast iron wheels and both hand operated and National Electric Co.'s straight air brakes are used. Nichols-Lintern track sanders are provided.

Until the completion of the new power station at Saginaw the interurban feeders were supplied with current from a power station at Carrolton, on the Saginaw River, just north of Saginaw. This station had a generating capacity of 950 kw. of railway units and 1,150 kw. of lighting units. At Carrolton, adjacent to this power station, are the repair and storage barns for the interurban cars and the office of the interurban dispatcher.

Saginaw Barns and Shops.

A new barn and shop building is now nearly completed and will soon be able to care for all the Saginaw city cars. This building is made up of the old barn and a new addition, the combined buildings having dimensions of 240 x 260 ft., and being bounded on three sides by streets, the tracks extending through the building from street to street. The walls of the building are of sand-lime brick. The roof, supported by wooden trusses resting on the brick partitions and walls, is fitted with numerous skylights for lighting the separate sections of the building. The floors are concrete, except in the machine shop, where they are made of heavy planking, and in the storage portion, where cinders are used. The entire front of the building is enclosed by Kinnear rolling steel doors with the vertical posts hinged at the top, so that when the doors are open the intervening posts may be drawn up against the ceiling and added clearance given for handling long interurban cars around the special work at the entrance to the barn.

The old portion of the barn will be used for storage. Here there are eight tracks and a transfer table, all in one bay, which will

VIEW OF FOUR-MILE LEVEL TANGENT.

furnish accommodations for 32 city cars. The front part of the old building has two stories, which are used for the offices of the superintendent of transportation and his assistants, and as locker and reading rooms for motormen and conductors. The fireproof wall that extends throughout the length of the building between the old and new portions is pierced by but one opening, and this is protected by fireproof doors.

The main bay of the new portion has eight tracks extending through the building. Two of these tracks at one end of the building will be arranged with the proper drainage and appliances for car washing, and under two other tracks for a length of 100 ft. are inspection pits. This bay will accommodate 40 cars.

Adjacent to the main bay and separated from it by a fireproof wall is the machine shop. This shop has three tracks the length of the building, with a pit which extends through the central portion of the room and is eight feet wide, the rails being supported on oak stringers and posts. At the rear of the machine shop is the paint shop, through which two of the machine shop tracks extend. This shop is separated from the rest of the building by a brick partition, and the openings over the tracks are closed by steel doors. The paint shop is lighted by two rows of skylights, one over each of the tracks, and the floor is of concrete, sloped for the proper drainage, so that cars received here for painting may first be washed.

The south bay of the building comprises the several small shops and that portion of the repair shop using machine tools. The front end of this bay is divided by brick partitions into several office rooms. Adjacent to this portion is the armature room, 24 x 36 ft. in size, which opens by a double door into that part of the machine shop fitted with working tools, which part is 75 x 30 ft. in size. In this room are two lathes and one drill press, emery wheel, power hack saw, shaper, bed plane, wheel press and wheel boring mill. These are arranged in two rows with a center aisle, and are driven by a 15-h. p. 500-volt motor. Adjacent to the machine shop is the blacksmith shop, 20 x 28 ft. Next to this is the stock room, 26 x 40 ft. in size, and the remaining portion of the south bay, 25 x 75 ft. in size, is the carpenter shop.

The two portions of the machine shop are equipped for handling repair work with an overhead pneumatic hoist system. Over each of the two south tracks is hung an I-beam, the lower flanges of which support the carriages of pneumatic hoists. Another I-beam extends over the aisle between the two rows of machine tools, and over the machine shop pits is an I-beam trackway built in the shape of a circle, so that parts may be readily transferred from any of the three repair tracks to the machine tools. There are eight pneumatic hoists, four of which will suffice for lifting a car from the trucks, and the other four will be used in the repair work on the trucks, motors, etc. These hoists are a product of the Northern Engineering Works, of Detroit, Mich., and will be supplied with compressed air by a horizontal compressor, manufactured by the Chicago Pneumatic Tool Co., driven by a G. E. 20-h. p. 500-volt motor. At this shop will be centralized the repair work of the entire Saginaw city lines.

Bay City Power Station.

The Bay City power station, which furnishes current for the Bay City local railway and lighting service, arc lighting in Essexville and the north half of the interurban line, is located near the center of the city and on the east bank of the Saginaw River. The building is of brick, tastily designed, as may be seen in the accompanying illustration. It is served by a side track of the Michigan Central railroad. The horizontal dimensions are 95 x 70 ft., with a clear height of 25 ft. between the engine room floor and the lower chord of the steel roof trusses which support the slate roof. The boiler room is nearest the river. It has horizontal dimensions of 50 x 70 ft. The remaining portion of the building is occupied by the engines and electrical apparatus. The interior walls are of red brick with a wainscot of white enameled brick reaching to a height of 6 ft. above the floors. All the floor is of concrete-steel construction, covered with rubber mats near the generators and in front of the switchboards.

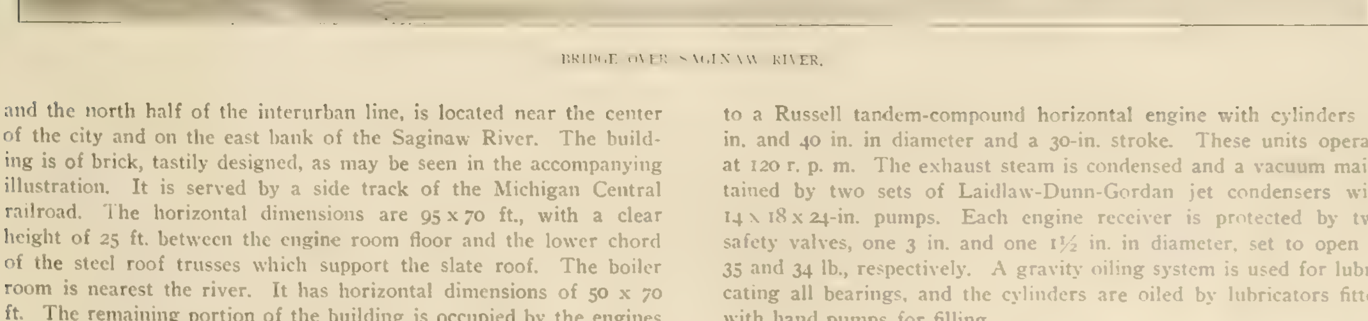
Local coal and [illegible] The coal is unloaded from the steam railroad cars into the hopper of a steel cable coal conveyor operated by a 15-h. p. direct current motor. This conveyor distributes the coal into an elevated storage bunker built along the river side of the boiler room, from where the coal falls to the boiler room floor in front of the boilers. This bunker has a capacity of 200 tons. [illegible] three

BAY CITY [illegible]

Sterling boilers, one 500-h. p. and two 230-h. p., generating steam at 150 lb. pressure. There are two stacks, the natural draft stack is 70 ft. high with a diameter of 70 in., and the induced draft stack is 50 ft. high with a diameter of 90 in. Green economizers are used, there being 40 standard sections built at the rear of the boilers. The induced draft is maintained by two Sturdevant fans, 10 ft. in diameter and driven each by a 10 x 10-in. Sturdevant engine. Each boiler is equipped with an Eames differential draft gage, manufactured by the Appliance Manufacturing Co., Chicago.

The water for boiler feed is metered by Keystone hot water meters, and is pumped by one Worthington outside packed pump and one Hughes duplex plunger pump. Cochrane feed water heaters are used to raise the temperature of the boiler feed to the boiling point before it is fed into the drums. A neatly arranged board for watching the temperatures of the economizers is equipped with pyrometers on the water intake and outlet of the economizers and on the intake and outlet of the economizer gases. A Bristol recording draft gage is also mounted on this board.

There are two main generating units, each consisting of a 500-kw. 600-volt Siemens & Halske direct current generator, direct connected to a Russell tandem-compound horizontal engine with cylinders 22 in. and 40 in. in diameter and a 30-in. stroke. These units operate at 120 r. p. m. The exhaust steam is condensed and a vacuum maintained by two sets of Laidlaw-Dunn-Gordan jet condensers with 14 x 18 x 24-in. pumps. Each engine receiver is protected by two safety valves, one 3 in. and one 1½ in. in diameter, set to open at 35 and 34 lb., respectively. A gravity oiling system is used for lubricating all bearings, and the cylinders are oiled by lubricators fitted with hand pumps for filling.



BRIDGE OVER SAGINAW RIVER.

One of the accompanying illustrations shows the general interior arrangement of the [illegible]

located near the side walls of the room, with their low pressure cylinders over the condenser pits and near the partition wall.

Between the main direct current generators is a G. E. 350-kw. motor-generator set with a belted exciter. The motor of this set takes direct current from one of the main units and drives a 2,300-volt, 3-phase alternating current generator, the output of which is used for commercial lighting in Bay City and for street lighting in the suburb, Essexville. It is by means of this unit and a similar one in Saginaw, with their sets of transformers, that in event of disorder to the direct current units in either station, continued operation of the car lines will still be possible by reversing the usual

SAGINAW-BAY CITY INTERURBAN CAR

operation of these motor generator sets and thus making the damaged power station a substation of the one whose generating units are operating. The regulation of the voltage generated by the alternating current part of the motor-generator set is effected by means of a Type-TA voltage regulator, which so short circuits the field resistance of the exciter that the field current in the generator remains steady but varies in amount to suit the load. This motor-generator set has its capacity supplemented by a similarly connected set consisting of a 200-h. p., G. E., 575-volt motor direct connected to a 120-kw., 2,300-volt, 3-phase generator.

A storage battery, which insures the continued operation of the railway lines in case of minor accidents to the direct current generating units, has its input and output regulated by a G. E. differential booster set, consisting of a 63-h. p., 575-volt direct current motor direct connected to a 480-ampere, 86-volt generator. The storage battery, which is illustrated herewith, is located in a one-story brick building, directly across the street from the power house. This building at one time was used as an office, but has been adapted to the needs of a storage battery equipment by the construction of a brick floor and the removal of the partition walls. The horizontal dimensions of the building are 35 x 75 ft. and the walls are veneered with brick. The battery consists of 276 cells of B 7-21 "Chloride" accumulators. The plates are hung in wooden boxes, which are lined with lead and mounted on porcelain insulators supported by wooden blocks. The battery is designed to furnish current for peak loads up to 450 kw. above the rating of the generating equipment.

There are two switchboards for controlling the output of this station, one at each end of the engine room and between the two generating units. The board for controlling the railway output consists of nine panels of black slate fitted with Westinghouse instruments and with recording ammeters and voltmeters on the battery circuits, also a recording wattmeter for measuring the output of the entire station and an illuminated dial voltmeter mounted on a swinging bracket at the end of the board. The lighting board, which is at the opposite side of the room, consists of 10 blue marble panels and is of the General Electric Co.'s make. There are panels for the control of the input and output of the motor-generator sets and feeder panels for the city lighting circuits and for the street lighting circuits, which feed through tub transformers to the arc lights in Essexville. On each of these alternating current feeder panels is an ammeter, voltmeter, recording wattmeter and an oil-break switch with overload trip. Above the center of the board, mounted on a pivoted bracket, is a synchronoscope, and at one end of the board, mounted on a swinging bracket, is a set of ground detectors.

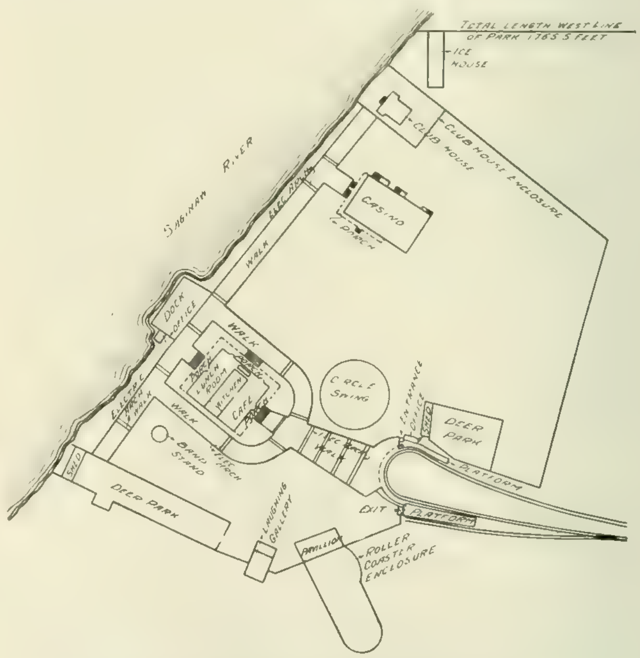
The engine room and its included apparatus and machinery are served by two sets of differential blocks, each of three tons capacity. Each of these sets consists of a block suspended from a trolley which travels along the lower flanges of an I-beam, suspended by similar trolleys at its two ends from two other I-beams, one resting on the end wall of the room and the other spanning the middle of the room directly under the center of the roof trusses. With this arrangement the differential block can be placed over any piece of apparatus in its half of the engine room, and as there are two similar sets the entire apparatus is thus served.

Bay City Car Barn and Shop.

Near the power house is located the car barn and shop for the repair and storage of the Bay City local cars. This building is of red brick with a roof supported by wooden trusses and consists of three main bays. The west bay, 30 x 250 ft. in size, has one track extending its entire length. The front portion of this bay is used for offices, rest rooms and for a stock room. In the rear of the stock room is the machine shop, in which there is a pit 60 ft. long under the track. The middle bay of the building is 24 x 250 ft. in size. The two tracks have pits under them, extending half the length of the building. The paint shop is in this bay. The other portion of the building is 50 x 250 ft. in size, and has four tracks, with pits under each of them. This portion of the building is used for storage.

Parks.

The Wenona Beach Park is located five miles north of Bay City on the shore of Saginaw Bay, and is an exceptionally high class summer resort. The cars are operated from Bay City to this park on a 30-minute schedule throughout the year, with extra cars to accommodate excursions and the regular summer traffic. The round-trip fare is 15 cents. Other than the usual park pavilions and amusement enclosures which are to be found here, is a large casino, located close to the bay shore and near the company's pier, which extends 400 ft. into the bay. This casino is of pleasing design, with high towers at its corners. The seating capacity is 1,600, and for 15 weeks during the summer season continuous vaudeville, including a moving picture machine, forms the chief attraction of the park. The general admission to the casino is free, and reserved seats may be had for 10 and 15 cents each. In a nearby building is a large dining-hall, in which is served a 50-cent table d'hote dinner, and in connection with the dining-hall are lunch counters and a restaurant.



ARRANGEMENT OF BUILDINGS, RIVERSIDE PARK.

Up the Saginaw River from the city of Saginaw, a distance of three miles, is the company's Riverside Park, the general plan of which is shown by the accompanying illustration. The casino in this park, in which is produced a continuous vaudeville performance, has a seating capacity of 1,500 persons, and is operated in a similar manner to the Wenona Beach Park casino. This park has a large number of the usual entertainment features. Both of the company's parks are operated by a park manager, who reports to the general manager of the combined properties.

Distribution of Freight Expenses at Birmingham.

In the "Review" for April, page 208, was published a short article descriptive of the freight business done by the Birmingham Railway, Light & Power Co., and in connection with this, reference was made to a plan for securing accurate data as to the cost of the freight and express departments, designed by Mr. W. B. Brockway, for the Newman interests. By courtesy of Mr. Brockway, we have received the directions for apportioning various items of expense among the several freight accounts. This classification is as follows:

201. Maintenance of Track and Roadway.—Charge to this account proportion of maintenance of track of the railway department, on a car mileage basis.

202. Maintenance of Electric Line.—Charge to this account proportion of expenditures for maintenance of electric line, on a car mileage basis.

203. Maintenance of Buildings and Fixtures.—Charge to this account all expenditures for repairs and renewals of buildings and fixtures used in the operation of the freight property only. Includes labor, material, water, tools, hauling of material, and all other expenses incident to the work.

206. Maintenance of Cars.—Charge to this account all expenditures for repairs and renewals of baggage, express, freight, and slag cars, from the operation of which revenue is derived in the freight department. Repairs and renewals of the electrical equipment should be charged to account No. 207.

207. Maintenance of Electric Equipment of Cars.—Charge to this account all expenditures for repairs and renewals of the electric equipment and wiring of baggage, express, freight and slag cars, from the operation of which revenue is derived in the freight department, including labor, material and other expenses incidental to the work.

209. Miscellaneous Shop Expense.—Charge to this account, on a car mileage basis, proportion of expenditures of account No. 9 of the railway department.

210. Power.—Charge to this account, on a car mileage basis, proportion of expenditures of the operation of the power plant as covered by accounts No. 10, 11, 12, 13 and 14 of the Railway Department.

216. Superintendence.—Charge to this account, on a car mileage basis, proportion of account No. 16, superintendence of transportation.

217. Wages of Motormen.—Charge to this account wages of motormen engaged in the operation of cars for the freight department.

218. Wages of Trainmen.—Charge to this account wages of messengers, brakemen, car couplers, and other car service employes in connection with the operation of freight trains, except motormen, which should be charged to account No. 217.

219. Agency Service.—Charge to this account wages of agents, checkers, cashiers, janitors and porters at the different stations.

220. Wages of Car House Employes.—Charge to this account, on a car mileage basis, proportion of account No. 20 of the railway department.

221. Car Service Supplies.—Charge to this account, on a car mileage basis, proportion of account No. 21 of the railway department.

222. Agency Expense.—Charge to this account all miscellaneous expenses at the different stations such as rent, fuel, light, water, ice, office furniture, except printing and stationery, which should be charged to account No. 227.

226. Officers and Clerks.—Charge to this account the wages of the freight traffic manager, and clerks at the general office whose duties are in connection with the freight department.

227. Printing and Stationery.—Charge to this account the actual expenditures for printing, stationery and stationery supplies for the freight department.

231. Advertising and Soliciting.—Charge to this account the actual expenditures for advertising the freight business and salary and expenses of the solicitor.

232. Miscellaneous General Expense.—Charge to this account the actual expenditures for telephone service, proportion of maintaining and operating a private telephone system, telegrams, subscriptions and donations on account of the freight department and contingent expenses connected with the management of the department not otherwise provided for.

233. Damages.—Charge to this account all expenditures on account of damages to persons and property and loss of freight in transit.

238. Insurance.—Charge to this account the cost of fire insurance on buildings and cars used in the operation of the freight department.

Arnold Report on Municipal Street Ry. of Chicago.

Mr. Bion J. Arnold has completed and submitted to Mayor Dunne the plans and specifications for the construction of a municipal street railway system. The report is divided into six parts, as follows: Part I, Notice to bidders for the construction and operation of a municipal street railway for the city of Chicago, which system will first be installed on Adams St., from Clark St. to Desplaines St.; Desplaines St., from Adams St. to Harrison St.; Harrison St., from Desplaines St. to Western Ave.; Western Ave., from Harrison St. to Twelfth St.; Twelfth St., from Western Ave. to 40th (Crawford) Ave. It will be extended over the following streets, upon which the rights of the present occupants have already expired: Halsted St., from Harrison St. south to the center of the Chicago River; Ogden Ave. from Harrison to 40th (Crawford) Ave.; and will, at the pleasure of the city council, be extended into any and every other part of the city of Chicago, upon streets in which the rights of the present occupants have expired or will expire during the years 1905 and 1906.

Parts II, III and IV contain the instructions to the bidders, a digest of general requirements and a list of specifications and drawings, while Part V is a digest of specifications. Part VI, Bid Sheets, concludes the report and is subdivided as follows: Aggregate bid No. 1, for the complete double track railway known as the "Adams St. Line," the total length of double track being 5.72 miles. This includes track work, paving, conduit, cables, overhead work, sub-station equipment, rolling stock, and telephone system. Aggregate bid No. 2 covers the "Halsted St. Line," 1.597 miles of double track underground conduit construction and 0.041 mile of special work. Aggregate bid No. 3, for equipping the "Ogden Ave. Line," which will include 1.810 miles of double track, surface conduit beam construction, and 0.028 miles of special work. Aggregate bid No. 4, covering the power plant equipment and buildings, transmission circuits to sub-stations, car repair shops and equipment. And a unit price bid sheet for such additional construction as the city may require.

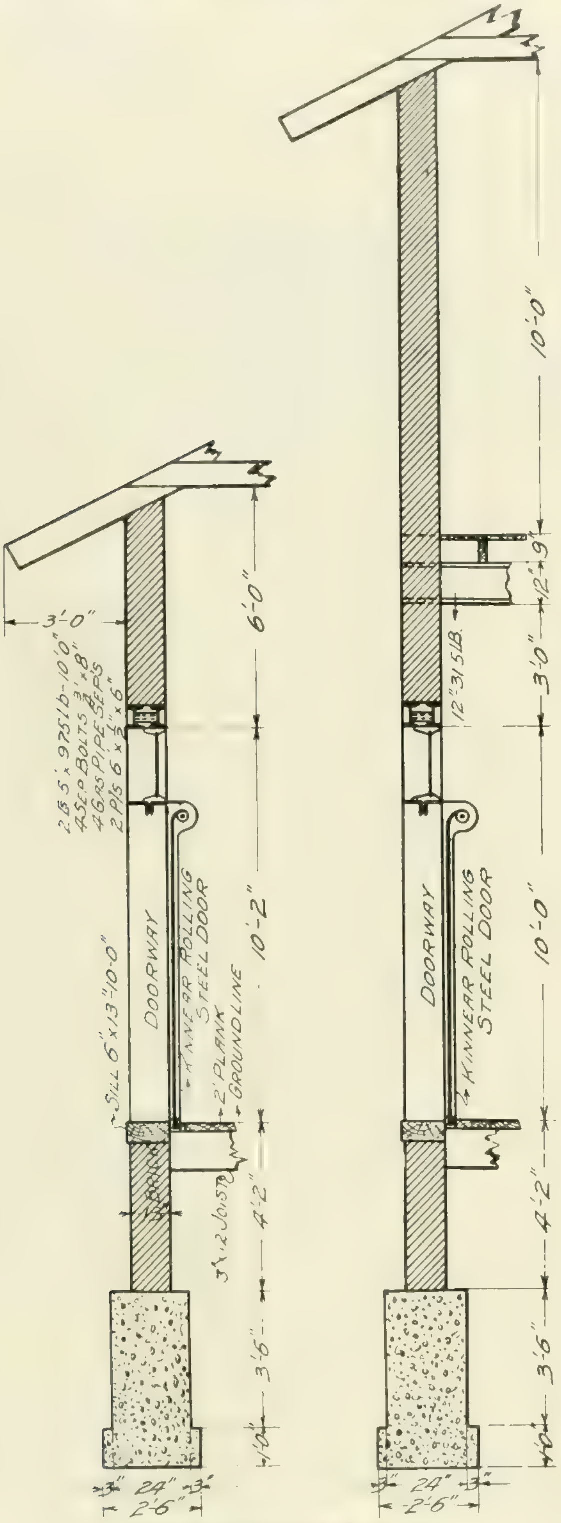
Accompanying the report and the condensed specifications and forms of proposals are 28 maps and 27 diagrams. The terms of the notice to bidders are those provided for in an ordinance passed by the city council in March, payment to be made for construction in Mueller certificates. The working basis of the report lies upon the expired franchises of the Chicago Passenger Railway lines of the Union Traction system. The specification and forms, however, are arranged so that they can be made to cover the lines of the Union Traction Co. and the Chicago City Railway Co., if desired. In this way they may give a basis for a comprehensive estimate of the cost of municipalization of all the street railways in Chicago.

Trolley Topics.

Trolley Topics is the title of a recent publication of the Rochester Railway Co., and contains time tables for the many lines operated by that company, as well as those of the Rochester & Suburban Railway Co., the Rochester & Eastern Rapid Railway Co., the Buffalo & Detroit Steamship Co. and several other steamers operating on Lake Ontario. This folder will be published weekly and distributed on the cars each week from now until September. It is the object of the publication to keep its patrons informed in a general way of what is going on at the various resorts, towns and parks reached by the company's system, and to furnish time tables. Besides the above it contains a few short stories and jokes, a map of the railway lines entering Rochester, as well as the city system, and advertising. Trolley Topics is published by the passenger department of the Rochester Railway Co., of which Mr. B. E. Wilson is general passenger agent.

Indianapolis Express Terminal.

We know of no instance of more careful planning for meeting future requirements than has been shown in the organization and development of the properties of the Indianapolis Traction & Terminal Co. When the Indianapolis street railway system was acquired in



SECTIONS STORAGE HOUSE WALLS.

1899 by its present owners the probable growth of electric railways in the territory tributary to Indianapolis was considered in all its phases, and the contracts made between the city, the city company, and the then existing interurban lines entering Indianapolis were very comprehensive and show a most unusual gift of accurate prophecy in the makers.

In the "Review" for January, 1905, we illustrated the interurban terminal station which has been erected to carry out early plans to care for the passenger traffic of the interurban lines entering Indianapolis. In connection with that article it was noted that the Traction & Terminal company had acquired considerably more land than was needed for the passenger terminal and office building, but no announcement was made as to the intended use. While the need for a freight and express terminal was not acute, the parties to the Traction & Terminal company's contracts had the matter in mind, and a provision was made in all contracts with interurban companies for a union freight and express station.

The new express station will occupy the northwest corner of the block on which the passenger station is located, and will front north on Ohio St. and west on Capitol Ave. There are to be three separate buildings, known respectively as Nos. 1, 2 and 3, No. 1 occupying the west side of the lot with its west wall flush with the sidewalk line. All three buildings are 195 ft. long and 24 ft. wide, except at the north ends, where off-sets in the wall of a few feet were made necessary to give clearance for cars on the curves with the track layout adopted. Shed No. 1 at its north end, and shed No. 3 at its south end, are two stories in height, the second story portion on each building being 60 ft. long. The space thus provided on the second floor will be utilized for offices by the express departments of the interurban companies. The second story section of shed No. 3, which is adjacent to the passenger train shed, will also make convenient headquarters for such inspectors as are needed in the passenger car service. All of the freight buildings are constructed of brick walls, pressed brick being used for the exposed walls, carried on concrete foundations, and are covered with slate roofs. The terminal being directly opposite the State Capitol, it was designed to be as attractive in appearance as was compatible with its use.

In each building there are five side doors and end doors, 8 ft. in width and 10 ft. in height. These large openings are provided with Kinnear steel rolling doors. A transom, with wire glass set in iron frames, is placed over each door. The floors are laid with 3-in. oak planks carried on 3 x 12-in. joints 11 ft. long, spaced 14 in. between centers.

Besides the office room for the accommodation of the interurban companies mentioned, there is at the south end of shed No. 3 a basement room 100 ft. in length for the storage of supplies needed for the interurban cars.

The three freight buildings are served by nine tracks as indicated in the plan view. These are all laid with 70-lb. T-rails of A. S. C. E. section. Lorain special work is used. The whole of the space between the buildings is to be paved with brick with surface flush with the top of the rails. The foundation of this pavement is 4 in. of concrete.

As provided in the contracts, all interurban lines entering the city will make use of this terminal. The charges for the service rendered by the Traction & Terminal company are 75 cents for each car entering the station and 15 cents per car-mile.

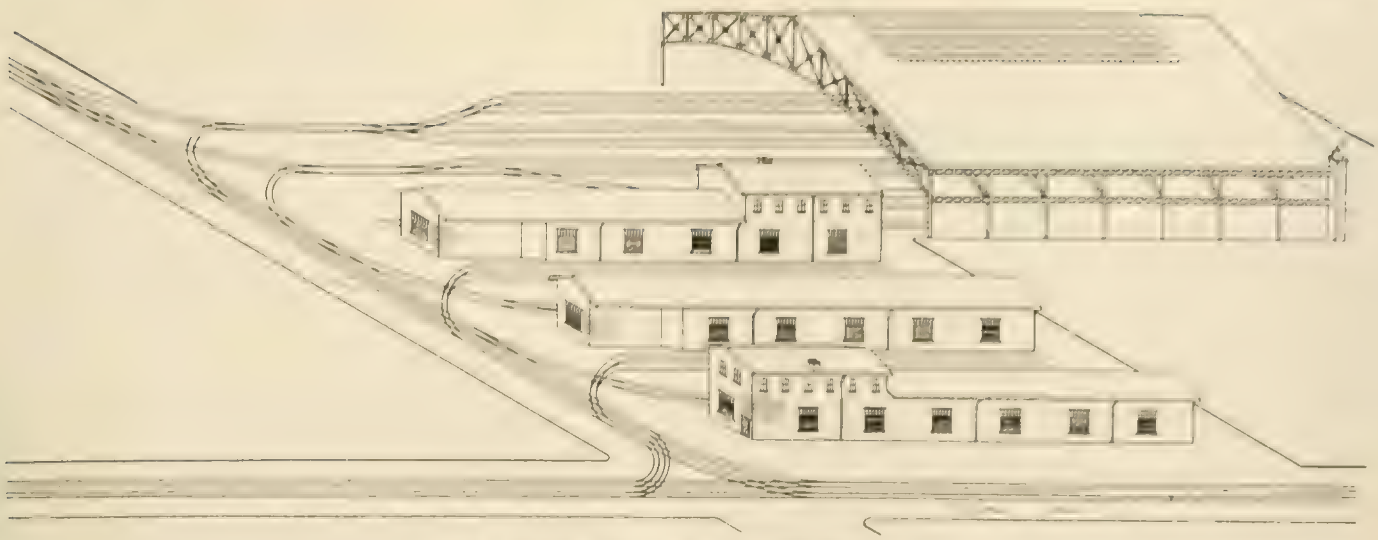
The work of construction has been carried out by the Indiana Co. under the direction of Mr. E. B. Peck, general manager, and Mr. Thomas McMath, chief engineer.

Electric Cars for Lima.

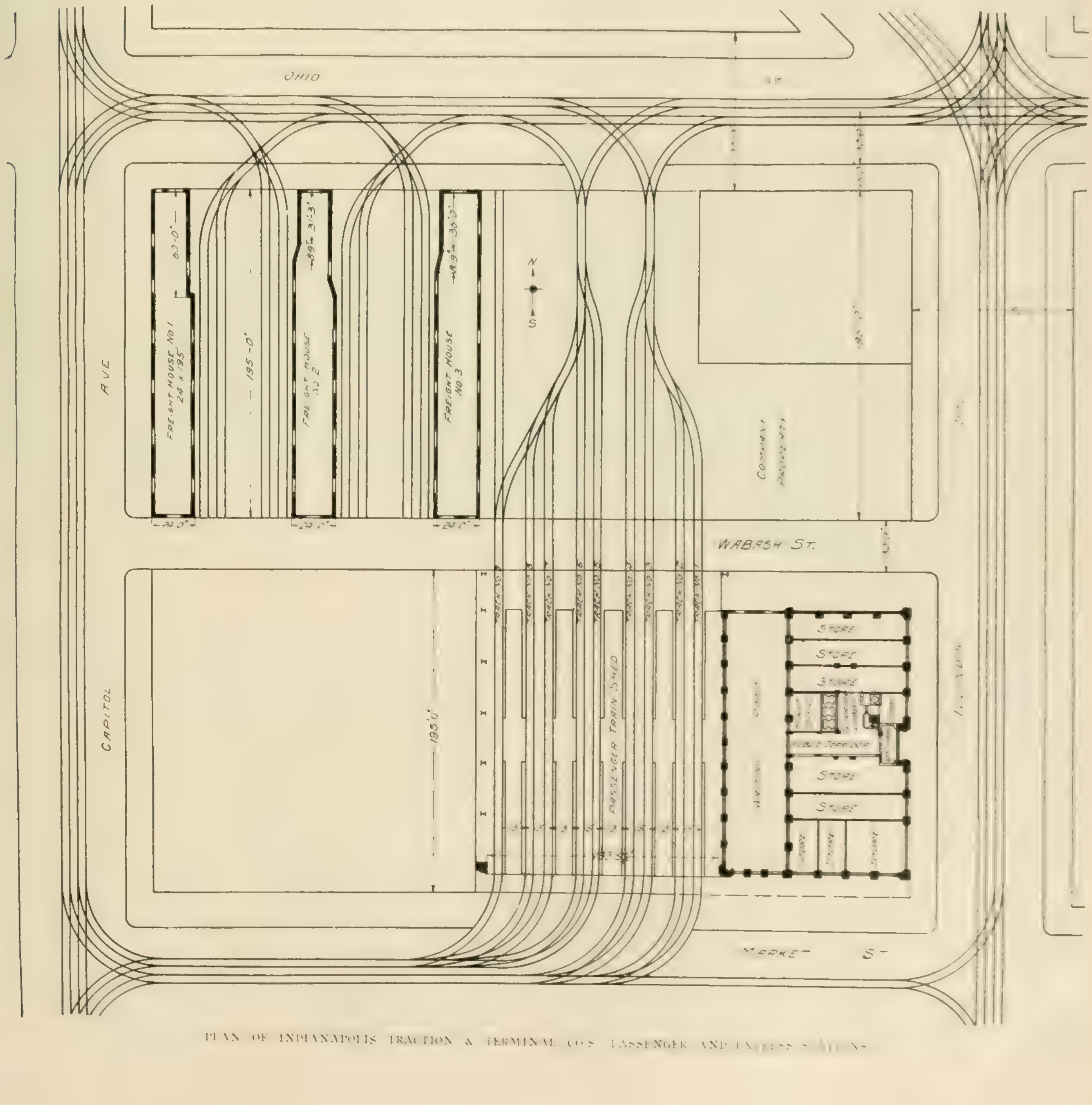
FROM U. S. CONSUL GOTTSCHALK, CALLAO, PERU.

The Empresa del Tranvia Urbano de Lima (Lima Horse Car Co.) will receive proposals from the United States for the material which it intends to purchase in order to transform its present line into an electric trolley road. The company will need some 45 cars, with a seating capacity of 40 persons each. These are to be run by overhead trolleys. It will also purchase wires, rails, transformers, rotaries, etc. American exporters of these classes of goods should address Senor D. Joaquin Godoy, Gerente, Empresa del Tranvia Urbano, Lima, Peru, sending plans and proposals, and not English catalogues merely.

The Metropolitan Elevated Railway Co., Chicago, has asked the city council for the privilege until April 1, 1942, of doing a general mail and express business over all its lines. Presumably the ordinance was introduced in the interest of the Aurora, Chicago & Elgin Railway Co., which enters the city over the Metropolitan tracks and has its terminal at 5th Ave. The petition has been referred to the Transportation Committee.



UNION EXPRESS TERMINALS FROM THE NORTHWEST



PLAN OF INDIANAPOLIS TRACTION & TERMINAL CO'S PASSENGER AND EXPRESS STATIONS

Light Electric Railways*.

BY J. R. CRAVATH.

It has for some time been apparent to engineers that have had to advise regarding numerous proposed interurban electric roads in certain states (of which Illinois and Iowa are the most notable examples) that there is a need for a class of electric railway that does not require the heavy investment needed to build the typical interurban of to-day. In other words, there are scores of places that would not yield an interurban road a gross revenue of $3,000 per track mile per year, and there is little prospect that they ever will, yet half or two-thirds that income would be certain and continuous. On account of the numerous opportunities for roads of a cheaper class in our rich, agricultural states, which have comparatively few large manufacturing towns, many engineers have looked forward with much hope to the single phase, alternating current railway motor as making possible a considerable saving in the cost of construction and operation.

It is the purpose of this paper to consider whether it is not feasible to work out a new type of light electric railway construction which will involve only about one-third the cost of the typical high-speed interurban road with which we are familiar, which can prosper on a much smaller revenue, and yet fulfil all the transportation requirements of many rural communities. The advent of the single phase railway motor at least makes such a thing more worth considering than it has been in the past.

On a road of the character proposed, maximum speeds of 15 to 20 miles per hour will answer the purpose. This speed should be feasible on a roadway of 28 in. gage, with light, double truck cars of 8 to 10 tons weight. As 28 in. is about one-half standard gage, we can no doubt safely use cars of one-half the width of standard gage cars. This would permit a passenger car of 5 ft. in width.

There is evidently considerable latitude in the length of such a car, but for very light traffic, a car having the full height of the body, 18 ft. long, is suggested. This will seat comfortably 12 passengers. Equipped with a motor truck at one end only, it will probably weight not to exceed 10 tons, and with a motor truck on both ends, 12 tons. Freight cars would probably best be all trail cars for a road of this kind, and some of them should be designed to easily dump their loads into steam road freight cars or grain elevators.

A 28-in. gage road laid with 30-lb. rails offers a considerable reduction cost over any road of standard gage. The ties used can be half the standard 8 ft. length and less than the usual 6 x 8 in. in cross section. The cost of grading would be reduced from standard gage construction. The overhead trolley construction should be of the simplest possible character, since it will have but light traffic passing under it. By using single phase, alternating current motors with a trolley voltage of 3,000 to 4,000 volts, no feeders will be needed to supplement the trolley on a rural road 20 miles long with power supply from one end. The trolley wire itself can be No. 0. The poles will therefore need to be heavy enough to support only the trolley wire bracket. It is assumed that the catenary construction would be used. In most cases power could be purchased from a light and power company at the principal terminus of a line, thus keeping the cost of power within practicable limits, as the amount of power required would not justify a separate power house.

The following estimates on the cost per mile of railway built according to the foregoing ideas are of course somewhat conjectural, as no such road has ever been built. The figures are based on cost of present railway construction, with the assumption that all supplies and rolling stock should be standard articles of manufacture:

Cost of Road and Equipment per Mile.

Right of way donated	
Roadway and track	$4,635
Overhead line, including telephone	889
Rolling stock, buildings, etc	2,313
Total cost per mile of track	$7,837

The next question to determine is whether a road of this kind is capable of earning enough to pay interest on the investment. Suppose we assume a road 15 miles long. A good passenger and freight service for a rural community could be given by a schedule calling for the equivalent of 15 round trips of trains consisting of motor cars hauling freight cars whenever necessary. On a 15-mile road this would mean 300 train miles per day, or say 135,000 train miles per year, allowing for some reduction from foregoing schedule during the winter.

The following is believed to be a fair estimate of the ordinary operating expenses of such a road:

135,000 train miles per year at $.085	$11,475
Cost of operation per track mile ($11,475, 15 miles)	765
Interest at 6 per cent on $7,900 per mile cost of construction	474
Interest and operating expenses per track mile	$1,239

Obviously, there are plenty of locations where a road could easily earn this, and in addition enough to cover depreciation. In these locations standard-gage high-speed roads would be prohibited by financial considerations.

As supplementing the engineering and construction matters taken up in the foregoing part of the paper, some figures have been compiled by the author on the traffic possibilities of a purely rural territory. Let us assume that a road is to be built from a good-sized county seat, 15 miles into a country which has no railroad stations nearer than said county seat. I estimate the tributary territory to such a road to be 106 square miles. Taking the figure of $70 as the possible gross revenue per square mile, the revenue from 106 square miles would be $7,420, or $494 per track mile.

It seems reasonable to assume that a prosperous rural community would yield $10 per year per capita in passenger revenue. We will assume a rural population of 10 per square mile. A territory of 106 square miles, with 10 persons per square mile, makes a total of 1,060 population, and $10 per capita per year for this population is $10,600, or $706 per mile of track for the rural population. We will suppose that the road has, at about 10 miles from its terminus, a town of 1,000 inhabitants. These should give a revenue of $5 per capita per annum, or a total of $5,000. This is equivalent to $333 per mile of track.

Earnings and operating expenses per track mile summarized:

Passenger earnings (rural)	$706
Village passenger earnings	333
Freight earnings, lowest estimate	494
Mail and light express	100
Total gross earnings	$1,633
Operating expenses	$765
Net	$868
Interest on investment	$474
Surplus	$394

Considering the need for better railway transportation as one solution of the good roads problem in the middle west, and the number of places calling for roads of this class, it is a matter of importance both to the country at large and to electric railway engineers and manufacturers to give serious consideration to the light railway problem. From the manufacturer's standpoint it opens an immense field for this class of railway equipment, while from the farmer's standpoint the increase in value of farms served by such a road would ultimately pay well for the construction.

*Abstract of paper read before Chicago Branch, A. I. E. E., May [illegible], 19[illegible].

The Ohio Brass Co's. Fire.

The plant of the Ohio Brass Co., Mansfield, O., was partially destroyed by fire, Wednesday, May 24th. Fortunately, its office and records, finishing and machine shops and insulating building, cooper shop and pattern vault were not burned, so that the majority of its force is working. The bond department is now operating in a neighboring factory, and will continue to do so pending the completion of new permanent buildings which will be erected at once to replace those burned. Much raw material is on hand and in transit, and extraordinary efforts are being made by the company to avoid inconveniencing its customers. The company has resumed the manufacture of nearly all its products and intends to break the record for quick recovery from the effects of the fire, and there will therefore be practically no delay in filling orders for any of its materials. The portion of the plant which was destroyed will be rebuilt on a larger and better scale than the old one.

Some Interesting Features of Electric Railways in Switzerland.

The Waldhaus Hotel Dolder trolley system is a single track, narrow gage tramway in the province of Zurich. One car with a seating capacity of 32 passengers is sufficient to handle the traffic of this line. This car is heavily built and is mounted on a single truck. Power for operating the car is furnished from a gas station.

The construction work of this line presents a substantial and pleasing appearance, as may be seen in the accompanying illustrations. The narrow-gage track is placed near the curb on the streets, and is ballasted with broken stone. The trolley wire is supported by bracket construction with iron poles set in line with the shade trees inside the curb. These poles are fitted with special castings, in which the horizontal piping of the trolley brackets is held. The other part of the bracket, an arc of the same kind of pipe, is secured to the pole and the horizontal pipe by double sets of castings with set screws. The single round trolley wire is supported from the bracket arms by rigid hangers.

Two different styles of guards for the trolley wire are shown, one in each illustration. Each is a simple metal frame, secured to the bracket arm and carrying a number of protecting wires grounded on the frame work. In the illustration, which shows the intersection of the electric track with steam track, the trolley pole construction is of particular interest because of the high class of the workmanship when compared with the methods used by American trolley roads for supporting their wires at such critical points. It will be noticed that the wire is doubled and two sets of ears used on each of the two brackets supporting the span over the intersecting track. And to prevent interruption of service in case this span should break from any cause, feeder taps are taken off at these points, carried down the center of the poles and connected underground.

An interesting and more extensive Swiss road, the Burgdorf-Thun electric railway, is operated by alternating current. This system has 16 passenger cars, seating from 26 to 46 passengers each, and 67 freight cars of 12 to 15 tons capacity each. The type of motor car operated by this company is shown in one of the illustrations. Current is collected from the overhead wires by two pairs of sliding bow trolleys mounted one pair at either end of the car. This arrangement furnishes two rubbing contacts on each overhead wire, thus insuring freedom from interruption in any part of the circuit. These trolley bows are made as light as possible, so that they will readily follow any irregularities in the overhead work.

The power station of this system is at Cander, where 16,000-volt, three-phase current is generated and distributed along the right of way to transformer sub-stations. There are 14 of these sub-stations, the general type of which is shown in one of the illustrations. The transformers in these sub-stations reduce the line pressure from 16,000 to 750 volts, and their secondaries feed the two overhead conductors and the track rail, these making the three legs of the three-phase system.

MOTOR CAR, BURGDORF-THUN ELECTRIC RAILWAY.

These sub-stations are of thoroughly fireproof construction. The foundation on which the transformer rests is a massive monolith of concrete, placed about 12 ft. from the track center. The upper surface of this block is made in a series of ridges to provide proper drainage for the floor under the transformer house and air ducts for ventilation. The transformer house is made of sheet metal fitted inside a riveted-steel angle-iron frame. This house is fitted with weather tight doors and space is provided above the transformers for the protective and disconnecting devices. Open space is left under the eaves of the roof. Air may thus enter the house under the transformer by way of the ducts in the concrete block foundation, then becoming heated, rise and pass out under the eaves. The frame work of the house extends above the level of the overhead lines.

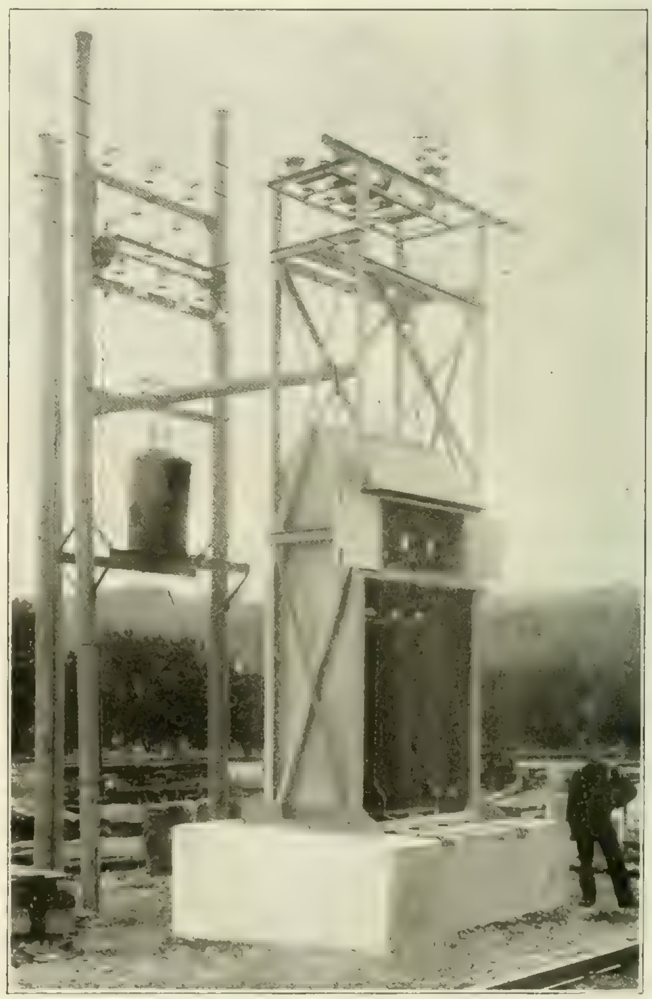
The three primary 16,000-volt leads are carried on standard porcelain line insulators from the nearby strain-structure to the framework of the transformer house, where they enter the peak of the roof through long porcelain floor tubes sealed at the top. The 750-

OVERHEAD CONSTRUCTION—WALDHAUS—HOTEL DOLDER LINE.

WALDHAUS—HOTEL DOLDER TROLLEY LINE.

volt secondaries leave the transformer house through similar tubes, and feed the overhead conductors through span-wire feeding ears. Span wire construction is used on the double track for supporting the four trolley wires; the usual span wire with its insulated hangers and globe strains is supplemented by a catenary span with supports at each trolley hanger.

NARROW GAUGE MOTOR CAR—STANSSTAD-ENGELBERG TRAMWAY.



FIREPROOF TRANSFORMER HOUSE—BURGDORF-THUN LINE.

The Stansstad-Engelberg tramway is an interesting narrow gage line. The cars of this line are drawn by motors of the type shown in the accompanying illustration. This road operates 11 passenger cars with a seating capacity of 30 to 36 passengers each, and 19 freight cars of 5 tons capacity each. The narrow gage track is built in a substantial manner with rock ballast. The overhead wires are supported by span wires from wooden poles. The motors are operated by three-phase current, using the two trolley wires and the rails for the three sides of the circuit. Current is collected from the overhead wires by two bow devices on each motor. The framework of each collector is built as a unit, for mechanical reasons, but it is divided electrically in order that the two phases of the current from the two conductors may be kept separate. The use of two bows on each motor car insures the continuity of the feeding current.

The motor cars used for hauling the trains on this line were built by the Swiss Locomotive Construction Co., of Winterthur. They are single truck cars, having the two axles rigidly connected by outside connecting rods, fitted to crank pins on the outer faces of the wheels. The power from the three-phase motor mounted on a steel framework inside the car body is transmitted through a set of reducing gears which finally engage with the pinions on the driving axle. The space below the floor of the car is so fully occupied with the driving gear, etc., that it is necessary to mount the controlling apparatus in the cab and above the motor.

Some Data from Census Report on Street and Electric Railways.

There has recently been issued by the United States Census Bureau a special report for the year 1902 on street and electric railways. This report was issued as a regular publication of the Department of Commerce and Labor, and was prepared under the supervision of Mr. W. M. Steuart. Its contents are comprehensive, including as they do statistics covering all electric railways in the United States irrespective of their length or location and all street railways irrespective of their motive power. The book is divided into two parts, the first part prepared by Edward Dana Durand and the second part by Thomas Commerford Martin.

In the first part of the book are considered at length those subjects which have to do with the financing and operating of electric railroads. This portion of the book is divided into chapters on traffic, capitalization, financial operations, employes and their salaries and wages, the economical, financial and social features of interurban railways, consolidation of street railways, franchises, public regulations and public ownership and a chapter on street railways in European countries. Throughout these chapters are many tables of all manner of data concerning the operation, costs and income for street railways in general and for them classified in different ways. Several full page maps illustrate the network of interurban lines existing throughout different states. The data here published are of exceptional value as having been issued by the Government and have and will be widely quoted.

The second part of the book treats of the history and construction of railways and the general equipment and output of power stations. Several full page cuts illustrate typical examples of electrical railway rolling stock and generating apparatus.

The third decade of the last century saw the first street railway car, called the "John Mason," which was drawn by horses over strap rails laid on stone ties through Fourth Ave., New York City. Some 20 years later the Sixth Ave. Railroad of New York City was built, and its moderate success gave encouragement to further development. Between 1850 and 1855 half a dozen roads were constructed; 30 in the next five years; over 80 between 1860 and 1870; and at the time of the census of 1890 there were 769 street railways in operation in the leading cities of the country. The cable system was introduced in 1873, and for a time promised to be an important factor in the field wherever there was a dense traffic, but it enjoyed barely a quarter of a century of useful operation.

In this historical portion of the book are described in an interesting way the earlier efforts of the inventors whose struggles have brought electric railway operation to its present stage of perfection. The roadbed, track and electric construction are next described.

The mileage operated by electricity increased from 1,262 miles in 1890 to 21,902 miles in 1902, with a corresponding decrease in the trackage operated with other power. The total trackage reported in 1902 was 22,589 miles, consisting of 16,652 miles of first main track, 5,090 miles of second track and [illegible] miles of sidings and turnouts. The report contains a [illegible] covering [illegible] pages in the book which segregates this total mileage into the amounts of track of different characters and length, and also gives the mileage of bridges and tunnels owned, the mileage having different types of line construction and the number of steam railroad crossings and the sizes of feeder wire. These quantities are given for each individual road throughout the United States.

It is interesting to note that at the time of the report, 97 per cent of the total mileage was operated by electric power and 1.9 per cent by other mechanical traction, while only 1.1 per cent was operated by animal power as compared with 69.7 per cent in 1890. The portion of track now operated by electric power has, of course, increased since these figures for 1902. For the United States, exclusive of Massachusetts, where densely populated communities are often legally a part of the town government, which often includes rural districts, 13,208 miles of trackage, or 65.8 per cent of the total, were reported as within urban limits, and 6,856 miles, or 34.2 per cent, as outside of such limits. The compressed air motors were used on but 6.06 miles of track. There were 259.19 miles operated with animals, 240.69 miles by cable and 169.61 miles by steam.

The average length of line per operating company for all companies was 20.38 miles in 1902, as compared with 7.41 miles in 1890. Thus the average operating company in 1902 controlled almost three times the length of line that was controlled by the average company in 1890. In 1890, of the companies reporting, only 8 operated more than 50 miles of line, while in 1902 the number of such companies had increased to 69. Of the total number of companies reported for 1890, 94.9 per cent operated less than 20 miles of line each, and their combined length of line amounted to 71.5 per cent of the total in the United States; in 1902 corresponding percentages were 75 and 30.7, respectively. Thus, while there were still in 1902 a large number of companies that operated less than 20 miles of line, the proportion of the total length of line operated by them was not half so great as in 1890.

The report considers in detail the different types of track construction used by the street railways in the more important cities, and it is a noticeable fact that concrete takes an important part in nearly all these types of construction work, either in the form of a bed laid entirely across the track or as stringers in which girder rails are bedded. It is stated that the T-rail has found extensive use among the street and interurban railways, although it is obvious that the conditions on street railways differ materially from those on steam railways. The main considerations which have led to its adoption for use, as compared with the girder rails, are that it is without the tram and groove of girder rails; it does not invite street traffic; it is generally easier to lay; it is cheaper, the price per ton being less than for the girder rails; and, finally, owing to its symmetrical section, a lighter rail can be used under given conditions than would be the case if the girder type was resorted to.

The weights of rail sections vary widely in the different cities. In Buffalo a 94-lb. girder rail using a narrow groove is laid in paved streets, in outlying streets a tie rail section is used. The Chicago City Railway Co. reported that it was using a 9-in. girder rail weighing 95 lb. per yd. The Denver City Tramway Co. was the first to use Shanghai rails for heavy traffic, the section employed being 6-in. high and weighing 72 lb. to the yard. The Detroit United Railway Co. lays narrow grooved rails in paved streets, the last laid at the time of the report being 90-lb. rails. The Milwaukee Electric Railway & Light Co. has the approval by the city authorities of T-rail construction for paved street, using a section which is 7 in. high and has a head 3 in. wide, so that interurban cars may have treads and flanges more nearly approaching steam railroad standards. In Minneapolis and St. Paul T-rail is also used, the section being 8 in. high and weighing 79 lb. per yard. The Philadelphia Rapid Transit Co. uses for its standard track construction in streets having a heavy traffic a grooved rail which weighs no less than 137 lb. to the yard, but where the traffic is light a section weighing 93 lb. was found sufficient. In San Francisco are used rails of the girder section weighing 109 lb., 100 lb. or 70 lb. to the yard, according to the nature of the traffic and pavements.

A portion of the report is devoted to bonding and a description of the importance of this part of track construction, and it is stated

that in spite of the many bonding devices a good many engineers give their preference to a track which is practically jointless. There are two principal methods used in securing this result; one of them consists in electrically welding the joints and plates together, and the other consists in casting a sleeve of iron around the ends of the rail joints at the side and bottom. A third method which has recently come into vogue consists in using a welding mixture known as "Thermit," which is made of powdered aluminum and iron oxide. The combination of aluminum with oxygen evolves an immense amount of heat, and this reaction has recently been brought under control. A welding portion of the mixture is poured into a small crucible at the joint with a thimbleful of ignition mixture added, and the whole is ignited. The reaction is immediate, and the molten thermit flowing into the mold around the rail makes the joint.

Throughout the entire country there are 1,643 miles of track that have been constructed with cast welded joints. This mileage is scattered over all parts of the country, but is limited more particularly to a few of the larger city and urban roads.

At the time of gathering the data for this report there were 11 third-rail systems in operation in five different states, with a total of 342.11 miles of track, this mileage being limited to elevated railroad systems and high-speed interurban lines. Since this report this third-rail mileage has been greatly increased by the equipping of the New York elevated tracks and the construction of many high-speed lines throughout the country. The portion of the report on roadbed and track concludes with the discussion of conduit systems, showing how these have developed from the first cable railways and describing some of the ingenious surface contact systems which have been tried in attempting to do away with the open slot.

Graphical Mathematics.

BY A. G. HOLMAN, M. E.

Early in this series it was shown that additions could be conveniently performed graphically by laying off spaces representing the numbers to be added upon a scale graduated with a series of equal spaces. Also that multiplication is in principle only the successive addition of a number to itself the necessary number of times. This process of repeated additions as a process of multiplication is actually made use of in certain forms of calculating machines, where a key representing one number is rapidly touched the number of times that there are units in the multiplier, and the product read from a dial moved by suitable mechanism. But it is evident that as a process for use upon a chart, while addition and subtraction can be conveniently stepped off on a scale, it is not practical for the more extended operations of multiplication and division.

Although multiplication upon a regular scale appears impracticable, there is a method by means of special graduations which reduces the process to an extremely simple form and offers a much wider range than the method of triangles previously explained.

Multiplication by Direct Addition.

An examination of the scale shown in Fig. 36 will show the method. The reasons for this rather surprising result will then be explained.

It will be noticed in Fig. 36 that the spaces are not equal, but rapidly diminish in size as we ascend the scale. The space between 1 and 2 represents 2, the space between 1 and 3 is the graphic representation of 3, and so on. Now the peculiar property of this scale is that if two spaces are added, the result, as read upon the scale, will not be the sum, but the product.

For example, take the space for 2, by spacing dividers or on a strip of paper, and add it to 3, by laying off distance 1 - 2 above 3. The sum of the two spaces will fall upon graduation 6. In the same way the sum of spaces 2 and 4 falls upon 8, the sum of 3 and 3 upon 9, and sum of 2 and 5 upon 10.

Or reversing the process, subtract space 2 from 10 by setting one point of dividers upon 2 and the other upon 10 and then raising the dividers and resting the lower point upon 1. This graphically subtracts space 1-2 from space 1-10, and it will be noted that when this is done the upper point of the dividers falls upon 5. That is, subtracting one space from the other divides one number by the other, and in the reverse process if spaces are added the product may be read from the scale.

The principle of this scale is usually explained by the comparison of two series of numbers. If one series starts with zero and goes to 10 by successive additions of 1, and the other begins with 1 and is successively doubled, the result will be as follows:—

0	1	2	3	4	5	6	7	8	9	10
1	2	4	8	16	32	64	128	256	512	1024

Now if any two numbers in the upper series are added, the number under their sum is found to be the product of the two numbers under the figures added. For example, add 2 and 3 of the upper series. The sum is 5, and under 5 is 32, which is the product of 4 and 8, the numbers respectively under 2 and 3.

Hence a scale properly spaced and graduated after these proportions will bear the required relation between sums and products to bring the results shown in Fig. 36.

Construction of Scale.

The most convenient method of laying out a diagram for application to any particular class of problems is to take the original graduations from a slide rule or "Calculating Scale," which is spaced with extreme accuracy in the proper proportions. The spacing upon the diagram need not necessarily be of the same size as upon the rule.

It will be seen from Fig. 37 that the inclined line, graduated the same as in Fig. 36, can be placed so that the unit mark falls upon the vertical line and the other graduations carried across as indicated by the dotted lines. The vertical line is thus graduated on a smaller scale, but in the correct proportions. A satisfactory scale may also be laid out independently of other graduations by the use of a table of logarithms, which may be found in any hand book.

It will be understood that logarithms, stripped of the air of mystery that sometimes seems to surround them, are simply a series of artificial numbers bearing such a relation with the figures which they represent that the sum of the "logs" is the log of the product, which is just the relation which we have found in the scales here illustrated.

Hence if a line of any desired length is to be spaced for a "multiplying scale," first divide the line into 1,000 equal spaces. Then note in the table (neglecting some of the figures to the right and taking only three places of figures) that log 1 is 0. Therefore mark one end of the scale 1. Next, that log 2 is 301, so at this division on

FIG. 36.

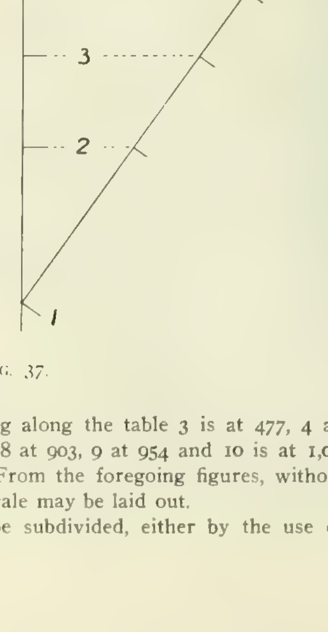


FIG. 37.

the scale mark 2. Following along the table 3 is at 477, 4 at 602, 5 at 698, 6 at 778, 7 at 845, 8 at 903, 9 at 954 and 10 is at 1,000, or the other end of the line. From the foregoing figures, without the use of any other table, the scale may be laid out.

Any of the spaces may be subdivided, either by the use of the

original spacing placed diagonally, as in Fig. 37, or by the use of the same series of logarithms just given. For if any small piece is to be divided into 10 parts, the graduations may be estimated by first dividing into 10 equal spaces. Then, for example, the fifth space, according to log 5, will be 6.9 of these spaces, the sixth will be 7.7, etc.

Combination Scales.

In Fig. 38 the scale at the left, marked A, has two series of graduations both beginning at the line X as 1, and running in opposite directions. The advantage of this arrangement, for certain operations, is that the sum of two spaces, or the product of the numbers, can be taken by one motion instead of stepping it off at two motions on a single scale.

Thus to multiply 5 by 4, put one point of dividers on 5 below the line X and the other upon 4 above X. The space so taken will evidently give the product of 5 and 4, which may be read by placing the dividers on scale B with one point at the bottom line (1), when the other point will fall upon 20.

An inspection of scale B shows that the portion above 10 is simply a repetition of that from 1 to 10, only that by the nature of the proportion each of the upper spaces represents a number ten times as

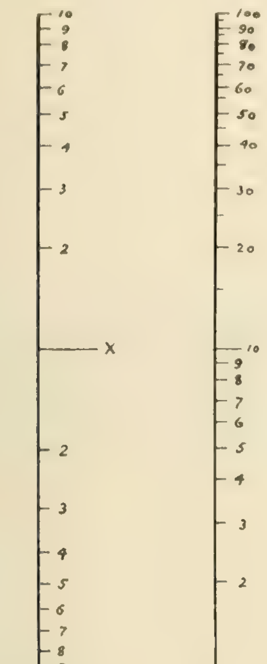


Fig. 38.

Fig. 39.

large as an equal space on the lower scale. In this way the scale can be continued to any desired extent, each succeeeding space corresponding to 1-10 increasing 10 fold. This fact illustrates the compactness of a logarithmic scale. While a series of equal graduations runs off to an inconvenient distance in representing large quantities, this scale soon reaches large numbers, and the only limit is that there is not sufficient space for showing fine divisions upon the upper portions of the line.

Combination Operations.

It will be noticed that in the use of scales A and B of Fig. 38 several operations may be combined. The product taken from A can be again multiplied upon B by setting the lower point of the dividers upon this factor instead of the unit line. For example, 6 x 5 x 3.

On scale A place points of dividers below X on 5 and above X on 6. Then carry this space to scale B with lower point on 3, and upper point will be at 90, the answer.

The illustrations given are simple examples which could be done mentally, but the same principle applies with a larger chart and fine graduations to deal with larger quantities. If the last operation required were division instead of multiplication, a continuation of scale B below 1 in a reverse direction would allow a subtraction of the required space to be made with one motion. If the special class of problem always [illegible] provide for this can be made.

In Fig. 39, on the right [illegible] graduations of the description already explained. On the other side is a line marked with the Greek letter Pi. This graduation represents the ratio of the circumference to the diameter of a circle (3.1416). Hence if a [illegible] diameter and lower point is then set on this special graduation, the upper point will fall upon the scale at a place indicating the circumference.

If the scale was designed to perform this operation regularly, the special space could be inserted somewhere so that it would be taken in as part of some other operation. For instance, a diagram similar to Fig. 38 could be arranged for areas of circles.

In this case the proper space for Pi, upon the same scale as the balance of the graduations, could be inserted below X. The graduations from X to 2, etc., would fall that much lower upon the scale. Then, as the area is equal to the square of the radius multiplied by this constant, the opening of dividers so that a point would rest upon the radius figure above and below X would square the radius and multiply it by the constant, and the result could be immediately read upon scale B.

This is taken as a simple illustration, but various engineering factors can be readily incorporated in the same manner.

Advantages of Charts.

As "Calculating Scales" in various forms are available and can be used in many of the operations described, it is a fair question why charts or special diagrams are worth considering.

The argument is much the same as for special machinery in place of standard tools. Nearly every machine shop operation can be done in due time upon an ordinary lathe, but repeated operations of a certain sort can be done much more rapidly and by cheaper labor on a special machine. So a special chart, laid out for a certain class of problems, places the process within the reach of all, without the necessity of learning or recalling all the principles involved.

It is also a rule for an occasional operation placed in convenient form for ready reference.

This series of illustrations of graphic methods lays no claim to being an exhaustive treatise on the subject, but is merely suggestive of some of its possibilities, which may be pursued to almost any extent with interest and profit.

Tramways at Malta.

Mr. John H. Grout, U. S. Consul at Malta, writes the State Department that a system of electric tramways has just been put in operation at Malta. There are now 10 miles and this will soon be doubled. Mr. M. D. Jeffs, of New York, is general traffic manager. About 200 persons are thus far employed. The road was constructed and is operated by Messrs. Macartney, McElroy & Co., and is regarded as an American company, although the headquarters of the company is in London, England. From the opening day the road has enjoyed good patronage.

May Meeting Indiana Electric Railway Association.

The May meeting of the Indiana Electric Railway Association was held at the Traction & Terminal Building, Indianapolis, May 11th.

The committee on interchangeable coupon books reported that the question had been put to various roads as to whether they would favor the use of the Ohio book. The Ft. Wayne & Wabash Valley and the Indiana Union Traction Co. replied that they would join in the use of the Ohio book. The Indianapolis & Northwestern and the Terre Haute Traction & Light Co. replied that they would not use the Ohio book. The Indianapolis & Cincinnati Traction Co. did not favor using the Ohio book, but would join other companies in its use. The Indianapolis & Eastern replied that the question was still under advisement and not yet decided.

The paper read at this meeting was on the subject of "Repairs to Equipment," by Mr. M. M. Nash, superintendent Terre Haute Traction and Light Co., and will be found on page 354.

After a discussion of the rate question and the probable effect of a rate war with competing steam lines, the association adjourned.

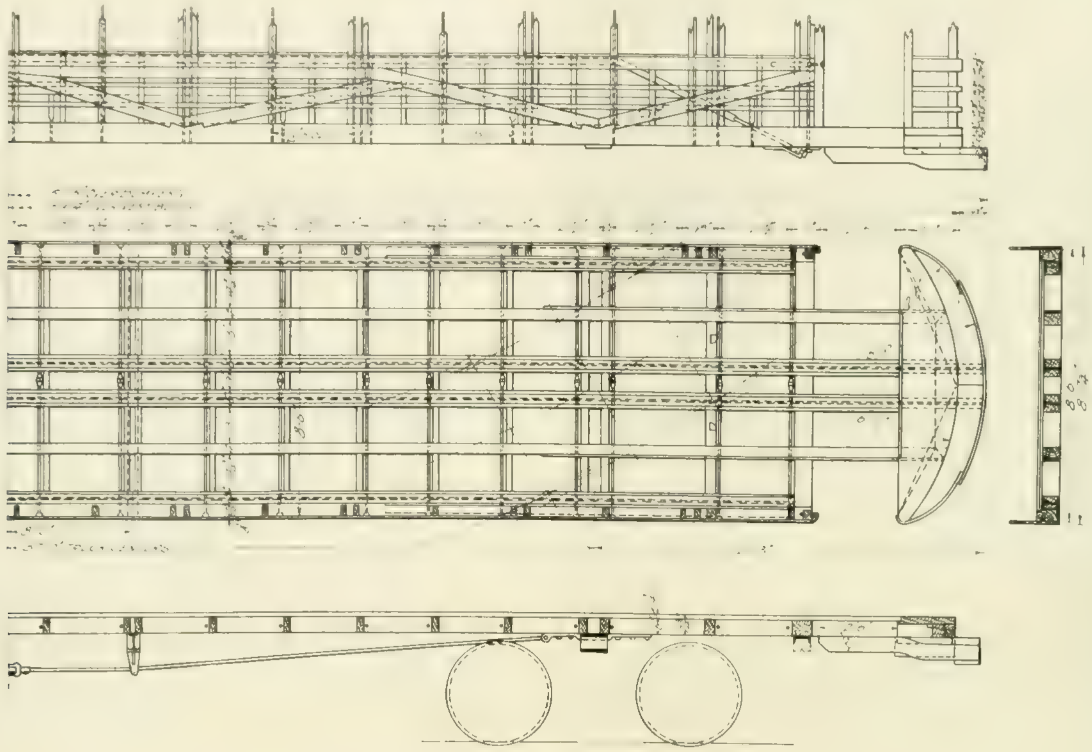
New Combination Car for Ft. Wayne & Wabash Valley.

The Ft. Wayne & Wabash Valley Traction Co. has recently ordered a new combination car from the Cincinnati Car Co., which is to be one of the largest and finest interurban cars that has yet been built.

The general dimensions of the cars are as follows: Length over bumpers, 61 ft. 6 in.; length over vestibules, 59 ft. 4 in.; center to center of trucks, 35 ft.; height from underside of sill to top of roof, 9 ft. 9 in.; height from rail to underside of sill with 37-in. wheels, 3 ft. 5 in.; width over grab handles, 8 ft. 10 in.; width over sheathing, 8 ft. 7¼ in.; width over sills, 8 ft. 6 in. The cars will be divided so as to provide for a baggage compartment, smoking compartment, buffet, ladies' or non-smoking compartment, and an enclosed observation platform. The buffet will be equipped with cooking utensils, range, ice chest, water coolers, lockers for china and silver ware and will be in charge of a special attendant.

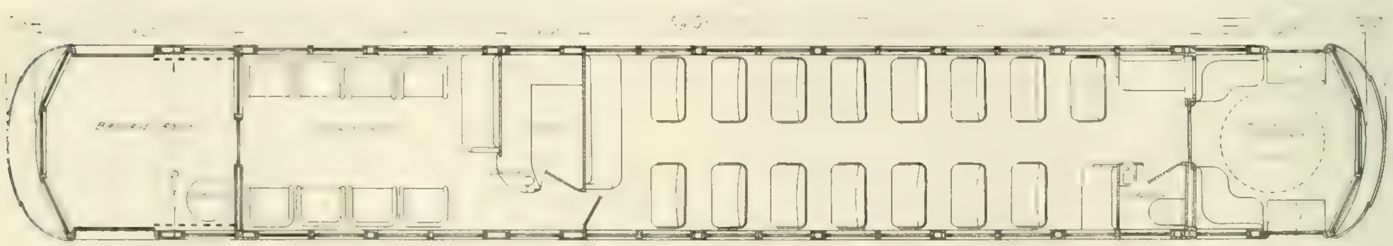
The floor of the baggage compartment will be of plain oak, while white quarter sawed oak, planed, scraped and sanded smooth and varnished, will be used in the other compartments. The floor in the smoking compartment will be covered with a royal Wilton carpet, the center aisle of the ladies compartment will be furnished with figured rubber matting and the floor of the observation car will be covered with interlocking rubber matting. The ceilings in both passenger compartments will be full empire painted and decorated with gold, while that of the observation end will be of horizontal veneered mahogany, with a dome 3 ft. 6 in. in diameter, placed in the center of the ceiling. The panels, including wainscoating, will be of Mexican veneered mahogany and all sash and door frames, molding, etc., will be of Honduras mahogany. All trimmings, such as basket racks, lighting fixtures, door locks, handles, sash lifts, etc., will be of Persian brass beaded pattern throughout. The deck and upper sash will be glazed with light green opalelscent glass, all other glass being 3-16-in. polished plate glass.

The smoking compartment will be equipped with eight mahogany chairs and one couch, upholstered in genuine dark green Sterling leather. The ladies compartment will have 15 Hale & Kilburn high back, head roll seats, with oval pedestal base, spring edge seats and upholstered with figured mohair plush. The observation end of the car will have two cozy corner seats, upholstered in leather, and eight camp chairs with back rest. Storage space for the camp chairs will be provided under the couches in the ladies and smoking compartments.



PLAN OF SIDE AND FLOOR FRAMING.

For lighting inverted dome fixtures with 12-in. holophane globes mounted on swinging brass frames will be used. These frames will contain five 110-volt, 16-c. p lamps each. Three of these will be placed on the center line of the ceiling in the ladies compartment and two in the smoking compartment, while one will be placed in the dome of the observation end. The smoking compartment will also have six bracket lamps with 5½-in. holophane globes.



FLOOR PLAN OF FT. WAYNE & WABASH VALLEY CAR

The equipment of the cars will include double end quadruple equipments of Westinghouse No. 85 motors with unit switch control, geared for a speed of 60 miles per hour at 525 volts; Westinghouse straight air brake equipments, D-2 compressors, automatic slack adjusters, illuminated gages, etc. Baldwin M. C. B. trucks, of the Indiana Union Traction Co. type, will be used, the dimensions of which are as follows: Diameter of wheels with tires, 37¼ in.; diameter of cast steel wheel centers, 31 in.; wheel tread, 3 in.; depth of flange, ⅞ in.; thickness of flange, 1 in.; thickness through tire at tread, 3⅛ in.; wheel base, 6 ft.; diameter of axles at motor bearings, 6½ in.; at gear seat and wheel seat, 7½ in.; journals, 4¼x8 in.; extreme length of axles, 85¼ in.

The underframe of this car has for its principal elements two

center sills which extend from end to end of the car, being 61 ft. 6 in. long, and two side sills which extend the length of the body only. The center sills are 6-in. I-beams with a piece of timber on each side, making the composite sills 6x6 in. The side sills are 6-in. I-beams with timber filling, give a width of 4 in. and, in addition, on the outside of the sill is placed a 6x4x9-16-in. angle, the flange facing outward, and on this flange rests a 4¾x7¾ in. timber to receive the parts. There are also two intermediates of 4x6-in. timber reinforced at the platform end and over the forward truck by a ¾x6-in. steel plate. The cross members are two body bolsters built up of 1¼x10-in. plates, two needle beams, which are 6-in. I-beams, placed 8 ft. apart at the center of the car and a 6-in. channel at the rear of the car body. Between the longitudinal sills are placed 1¾x6-in. blocks about 27 in. between centers and the sills are held together by tie rods. These are ⅝ in. in diameter and are set up by turnbuckles acting on right and left threads, the turnbuckles coming between the center sills. There are 23 tie rods, one being placed each side of each body bolster and the others spaced about 27 in. apart. From bolster to bolster are truss rods running under the needle beams. Other truss rods are concealed in the side of the car, these rods are 1½x2½ in. in section except the ends which are 1⅜ in. round.

Dubuque Ball Park.

The Union Electric Co., of Dubuque, Ia., has for several years actively supported the Baseball Club of that city, contributing to the expense of maintaining the ball park. The Dubuque club is a member of the 3 I League, which includes Springfield, Peoria, Bloomington, Decatur, Dubuque, Cedar Rapids, Davenport and Rock Island, and has scheduled 68 games for the coming season. The numbers attending at the Dubuque Park are from 750 to 4,000 per game. The accompanying illustration shows the park on the occasion of the first practice game of the season, Apr. 9, 1905, when Dubuque defeated Minneapolis in a 12-inning game. The grand stand shown has just been completed at a cost of $1,500. This stand seats 2,500 people, and besides the stand there are bleachers which will accommodate 1,500 men.

DUBUQUE BASE BALL PARK

"Electric Traction."

In a report on the subject of "Electrical Traction," presented before the International Railway Congress in Washington, May, 1905, Mr. Victor Tremontani, manager of the electrical department of the Italian Mediterranean Ry., discusses the various phases of electric traction on steam railways and summarizes his conclusions as follows:

III—FROM THE SERVICE POINT OF VIEW

Electric traction offers a number of advantages of a technical nature, in working and in economy, over the existing methods of steam traction, and although—to judge by the limited number of practical trials made up to the present—the problem does not appear to have been solved completely and finally (except in certain special cases—metropolitan, suburban and mountain railways), the question of this new and seductive method of traction to large railways is worthy of serious investigation, not only in the case of companies working metropolitan lines and those working the suburban traffic of some of the large provincial towns, but also of others and more particularly those which have to meet the fierce competition of electric tramways.

The application of electricity to the traction of railway trains is now a necessity and requires to be seriously investigated and applied, particularly in the case of [illegible] land, where [illegible] there are abundant natural [illegible].

II.—THE [illegible]

In the present state of science it appears probable that electric traction on railways proper will only be possible practically by the use of current generated by stationary plant at central stations, transmitted to the locomotives by insulated conductors laid along the permanent way and utilized in the motors on the train. This is now rendered more easy by the advance which has been made in high tension generation, distribution and conversion, currents at 60,000 volts being now generated in several stations, enabling any amount of electric energy to be conveyed with certainty, ease and economy to sub-station up to a distance of 400 kilometers (249 miles), so that it would now be possible to supply a line of railway 400 kilometers in length from a single generating station.

The continuous current system has been thoroughly tried, and its use in traction on railways has demonstrated its excellent qualities of large range of load (great acceleration) and elasticity; it is to be preferred where it is a question of a railway with heavy passenger and goods traffic and where a frequent and quick service is required.

The 3-phase current system is complicated and has the disadvantage of loss of a considerable amount of energy in the resistances when starting.

A great movement in favor of the single phase system has taken place during the last few years in Italy and in Germany, and is spreading little by little also in America. This last system is theoretically better than the preceding and, although the applications of the single phase motor to railway traction are but in their infancy, it may be definitely stated that in them will be found the solution of the problem for light railways and for those lines which run into towns where this motor can also utilize the continuous current supply.

III—FROM THE SERVICE POINT OF VIEW

In the first place it must be borne in mind that the ideal traffic for passengers is that obtained by a service similar to that on tramways, but at high speed—that is to say, that the existing trains which start at intervals of several hours should be replaced by light trains running at short intervals. Now, in order to obtain greater speed for the existing trains, the steam locomotive cannot be used, as it has nearly reached its limits of economy and power, and we must turn to the electric motor, which can easily give the extreme speeds at present in demand for express trains. To obtain the frequent service desired by the public, steam trains cannot be multiplied without largely increasing the working expenses, whereas with electric traction the increase in number of the trains entails but small additional expenditure.

With the adoption of electric traction on railways a new service should be commenced with frequent fast trains of smaller size. The ideal with electric traction is the automotor vehicle itself forming the whole train.

The reporter is of opinion that the following conclusion may be drawn: That in the future trains of great length will no longer be run (except for long distances), and that numerous short trains will be run instead. This result will in a great measure depend on the advances made in electric technology, but even now the possibilities of electricity and of its mode of transmission are realized as affording several good solutions, none of which can be regarded as final, but all of which have their advantages according to the mode of application and to local conditions.

Some Operative Features of the Aurora, Elgin & Chicago Railway Co.—II.

Power House.

The generating station is at Batavia on the Fox River, which location is practically the electrical center of the 200 miles of track for whose operation is furnishes current.

The principal features of this plant were fully described in the "Review" for August, 1902, but further data on some special points will be of interest.

The operation of the auxiliary apparatus is for the most part by electric motors. The auxiliary units comprise: Two horizontal flywheel type vacuum pumps direct connected to 25-h. p. direct current motors, two vertical triplex feed pumps with 8-in. bore direct connected to 35-h. p. direct current motors, four triplex circulating pumps with 19-in. bore direct connected to 35-h. p. direct current motors and two 10 x 6 x 10-in. duplex steam pumps.

WHEATON YARDS AND SHOPS.

The electrical control of the motors driving the auxiliaries is well arranged. A single panel board mounted on the wall nearby controls each motor. These boards are fitted with a circuit breaker, starting resistance and a main single-pole double-throw knife switch. Current for all these motors is controlled from the auxiliary board. This current supply is taken from the 125-volt exciter bus-bars and led through circuit breakers and line switches to the respective control boards near the motors. Single-pole double-throw line switches are so connected that any individual motor, pump or group of pumps can have its current metered by a recording wattmeter on this board. A set of double-pole single-throw switches is also mounted on the board and used for controlling the current fed to the crane, stokers, elevator, compressors and lighting circuits throughout the power station. The cables from this board to the auxiliary apparatus are rubber covered and sheathed with lead protected by woven jute, so that the flooding of the auxiliary pit up to the level of the motors themselves would in no way impair continued operation.

Close by the auxiliary board is a 4-h. p. air compressor set with two storage tanks of 10-cu. ft. capacity. The automatic governor which controls this motor compressor set keeps the pressure on the storage tanks at 40 lb. per square inch. This air is used for forcing the cylinder and journal oil from the stock room to the pumps of the oil feeding system and is also put to other various uses, such as cleaning switchboards, etc.

There are three main generating units each consisting of a 1,500-kw., revolving-field generator and a 32 x 64 x 60-in. Cooper-Corliss compound engine operating at 75 r. p. m. with 175-lb. admission pressure and generating 2,300-volt, 3-phase, 25-cycle alternating current.

Between the two sides of each main engine and facing away from the generator are instrument boards for each generating unit. These boards are made of a single sheet of wrought iron with an angle iron riveted on the edge to furnish the proper stiffness. On each of these boards are mounted compound gages, speed counter, recording vacuum gage, steam pressure gage, pilot lights and an indicating wattmeter showing the rate of output of the generator. On the lower part of these boards at a convenient height is a steel shelf of ample proportions for holding oil cups, small wrenches and similar tools.

Space and foundations have been provided in the north end of the building for the addition of a fourth unit. This space, at the present time, is being utilized for repairing the high potential transformers, which work the company carries on with its own employes. This space is readily adapted for such use because it is served by the engine room traveling crane which can unload damaged electrical apparatus from the cars running directly into the engine room and easily load and unload all heavy material for transportation between the power station and sub-stations.

In the center of the engine room floor and between two of the generating units are the exciter units and a 500-kw., 600-volt rotary converter which was installed last fall and is used for feeding the railway circuits near the power house. In ordinary operation exciting current for the main units and auxiliary uses is furnished by a motor generator set, consisting of a 450-h. p., 2,300-volt induction motor, connected to a 300-kw., 125-volt direct current generator.

The west side of the building throughout its entire length and for a width of about 20 ft. is occupied in the basement by the bus-bar compartments, oil room and a workmen's room with bath, toilet and lockers; on the engine room floor by the chief engineer's office,

the step-up transformers, blower motors, work shop and store room for the electrician, two galleries at the end of the side of the building and above the latter named part are utilized, one for visitors, the other for the main switchboard which controls the output of the station.

The method used in interconnecting a generating unit and its step-up transformers and motor operated oil switch with the high potential bus-bars is simple. All the current from the main generators is switched on the high potential side of the raising transformers. The bus-bar compartment is kept under [illegible] oz. air pressure. Its length is 150 ft. along the west side of the basement and no inflammable materials of any sort are to be found in it.

The path of the current from generator to line is as follows: From the generator the 2,300-volt current is carried to the bus-bar compartment by three asbestos covered cables. Immediately below the three step-up transformers, which stand on the engine room floor and over openings in the ceiling of the bus-bar compartment, are the primary connections for the transformers. On the 26,400-volt secondary side of the transformers, the wires are all bare copper mounted on standard line insulators supported by a grounded steel rack. These leads, after passing through current transformers and choke coils, again pass up through the ceiling and through the double sets of contacts of the Type H, motor-operated oil switch. From the opposite side of the switch the high potential bare wires drop directly to the three main bus wires. These three bus wires are of hard drawn copper and extend horizontally in brick and concrete three tier cells throughout the length of the bus-bar compartment. This same scheme is used for connecting all three generating units to the bus wires and these wires are sectionalized by single-pole line switches mounted on glass bases inside the fireproof compartments. The bus wires are carried on standard line insulators held up by steel pins bedded in the concrete which forms the bus wire cells and each wire is kept under tension by heavy springs at its ends "deadended" to porcelain strain insulators mounted on rods also bedded in concrete. These bus wire compartments stand about 4 ft. from the west foundation wall of the building and suitable openings are provided in this side of the compartments for making taps from the buses to line switches standing on the floor above and operated by electrical motors and a system of remote control with operating buttons in the switchboard gallery the same as the switches in the generator circuits between the step-up transformers and the bus wires. From the lower side of these line switches the high potential wires enter stone and brick chimneys built as a part of the west wall of the power station and rise vertically to a point near the eaves of the building. The tops of these [illegible] of concrete and the wires pass [illegible] in this slab and vertically through standard glass line insulators set over the openings in the concrete. It was necessary to [illegible] holes through the tops of these insulators and thus string them on these wires so that they would cover the 6-in. holes in the concrete and not permit the passage of air under pressure from the bus wire chimneys to the exterior. The weight of these vertically hanging wires is sustained by standard insulators so that at all times the wires hang clear in their respective chimneys.

From the lightning arrester banks at the tops of the chimneys the line wires are led through openings in the wall of the building and out to line insulators mounted on a steel rack on the outside wall of the building. At this point the copper conductor used in the interior wiring connects with the standard aluminum feeder used throughout the distribution system. Opposite this exit of the wires and across the track [illegible] a strain structure which cares for all tension in the dead ending of the distribution circuits as they enter the building.

WHEATON MACHINE SHOP.

The average monthly output of this station is 1,600,000 kw. hours.

Sub-Stations.

Power from the generating station is distributed on three-phase high potential lines to six sub-stations having a rotary converter capacity of 5,500 kw. General Electric 500-kw. rotary converters are used and the machines are distributed as follows: 1,500-kw. capacity at Maywood, 11 miles from Chicago; 1,000-kw. capacity at Lombard, 20.5 miles from Chicago, these two installations are on the Wheaton-Chicago double-track branch; 1,000-kw. capacity at Clintonville, 2.7 miles from Elgin, and 500-kw. capacity at Ingalton, 11.1 miles from Elgin, on the Wheaton-Elgin single-track branch; 1,000-kw. capacity at Aurora sub-station, 1.5 miles from Aurora and 500-kw. capacity at Warrenville 9.1 miles from Aurora on the Wheaton-Aurora single-track branch; 500-kw. capacity at the power house.

The six sub-stations in this distribution system supply 600-volt direct current for 200 miles of electric railway track, made up of the Aurora, Elgin & Chicago third-rail line, the Elgin city line, the Elgin, Aurora & Southern Traction Co's. line which extends along the Fox River for a distance of 40 miles and connects Elgin with Aurora, the Aurora city lines and one half of the track between Aurora and Joliet on the line of the Joliet, Plainfield & Aurora Railroad Co.

No changes have been needed in any of the sub-station buildings and the operation of the apparatus, even though at times under severe overload has occasioned but the ordinary amount of

trouble. The changes in the general plan and the extra demand for direct current at certain portions of the distribution system have made it necessary to move some of the rotaries from their original sub-stations, but as all sub-stations were built with foundations for extra machinery little trouble was occasioned by these changes. The output of the 11 rotaries for the first three months of the present year was as follows: January, 1,398,900 kw. hrs.; February, 1,328,000 kw. hrs.; March, 1,170,000 kw. hrs.

As originally placed, the storage battery used for operating the oil switches in each sub-station was located on the main floor, in a wooden case with glass doors, near the rotary and switchboard. This arrangement proved unsatisfactory on account of the spilling of acids and the escape of fumes. A portion of the basement under the ticket office is now used as a battery room. All the walls are of concrete and brick and outside ventilation is provided so that no trouble is anticipated from acids.

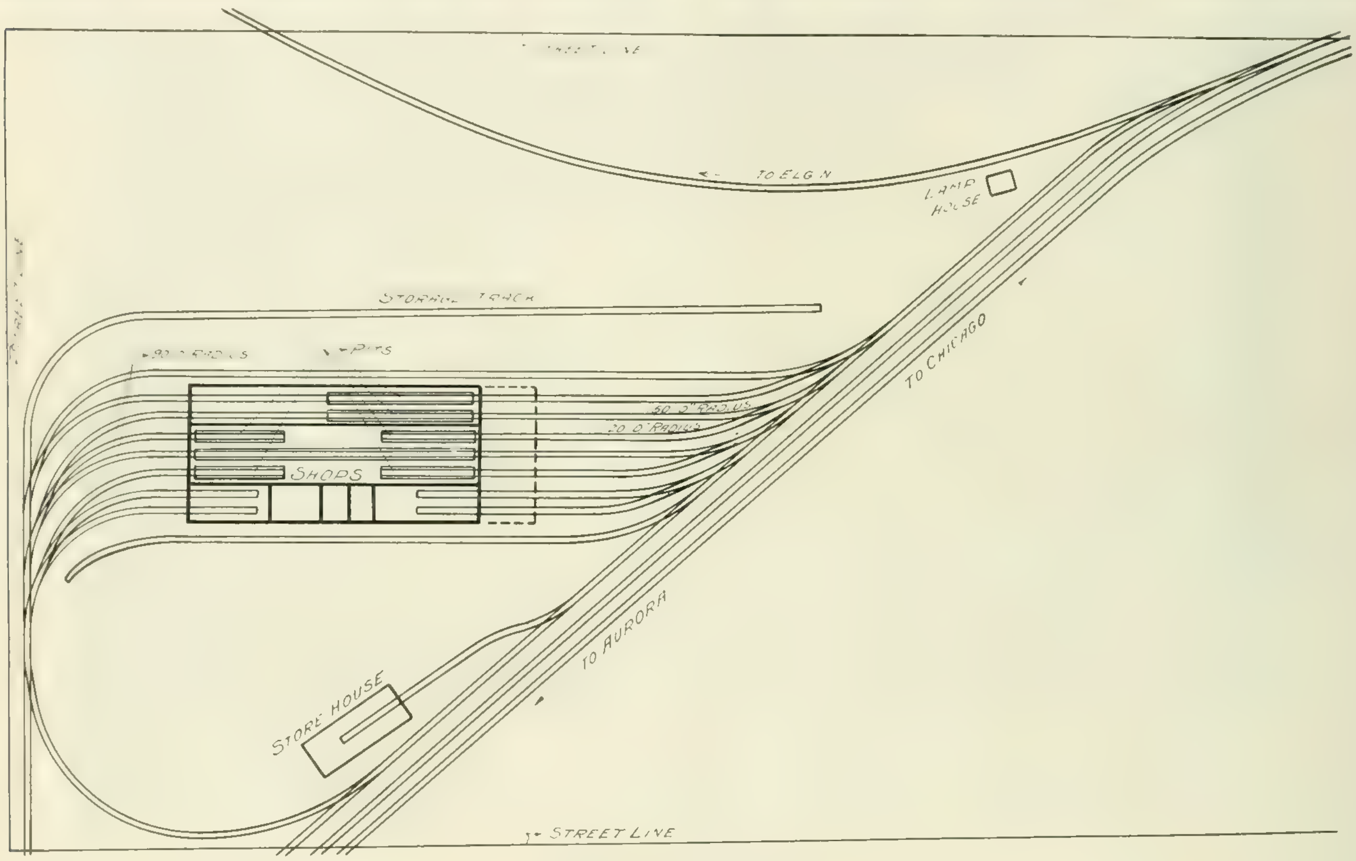
All sub-station rotaries have been equipped with a speed limiting device which is placed on one end of the shaft and so constructed that when the armature, in event of failure in the alternating current supply, exceeds a set speed, the direct current supply is cut off from the rotary and running away prevented.

A blank is used for recording the daily performance of the sub-station machinery. The original size of these sheets, which are perforated for loose leaf binding, is 8½ x 14 in. Each sheet is a complete record for the operation of a single sub-station during a period of 24 hours, and as a similar record is used for the generating machinery, any error in the recording instruments or their reading can be readily noticed and adjusted while yet fresh in the memory. The daily consultation of these records also furnishes assurance against continued heavy undiscovered feeder or third-rail leakage.

Distribution System.

The three-phase 26,400-volt wires which distribute current to these six sub-stations were furnished by the Pittsburg Reduction Co. They leave the power house as three separate lines, one extending cross-country to the Ingalton sub-station and on along the track to the Clintonville sub-station, one along the track to the Warrenville sub-station and then on to the Lombard sub-station, and still farther on to the Maywood sub-station, one cross country to the Aurora sub-station. A standard line also connects the Ingalton and Lombard sub-stations, thus forming a loop from the power house through Ingalton, Lombard, Warrenville and back to the power house, assuring the continued feeding of sub-stations even though one branch of the high potential line be down. The high potential lines are carried on 40-ft. cedar poles with 7-in. tops. These poles are spaced 80 ft. apart on straight tracks and extra poles are set at all sharp angles in the line. The style of construction as originally built had two cross-arms 4½ x 5½ in. in section spaced 24 in. apart, the top arm being 30 in. below the top of the pole. This gave room for two three-phase lines with three insulators on either side of the pole and holding the wires at the corners of an equilateral triangle 30 in. on a side. Glass insulators 7 in. in diameter and 4½ in. high were used in the original construction. These were mounted on a combination wrought iron and wooden pin which held the wire 9 in. above the cross-arms.

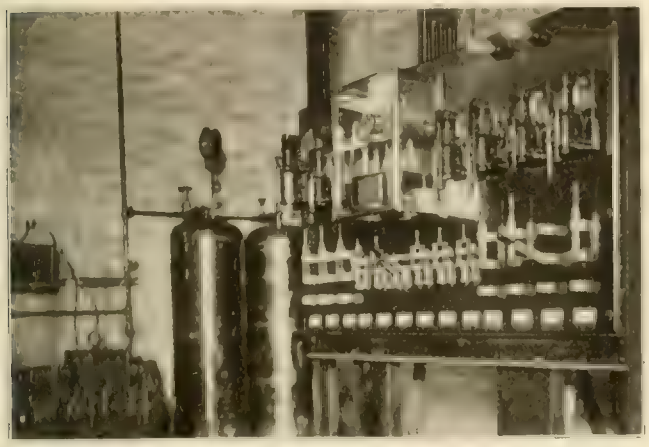
During the first months of operation many breakdowns occurred throughout the entire high tension system, due principally to the puncturing and breaking of the glasses. The display on these occurrences especially at night was at times startling and many freaks of burning took place. In some cases a small hole was pierced through the seat in the top of the insulator, the current passing through the wrought iron insulator bolt and into the cross-arm. No effect could be noticed at the top of the pole except a small glow, perhaps a half inch in diameter at the point where the aluminum wire rested on the top of the insulator, but a serious effect often took place near the base of the pole or wherever there was a crack or deep knot hole in the wood. At such places the poles would first begin to burn, the flame coming forth from the knot holes very much the same as the blaze of a gasoline blow torch and accompanied by the same roaring sound. In some cases the poles burned in this manner until they toppled over when the short circuiting or breaking of the high potential wires first gave notice of any disorder on the line. It was also noticed that many poles first began to burn at those points where bolts or lag screws broke the dry outside surface of the wood, the leakage in some places being heavy enough to melt the galvanizing from the bolts. When these breakdowns began, the disorders appeared so often that no opportunity was given for re-setting the burned poles, so a pole which had had its top burned beyond usefulness would be chopped down and the wires allowed to hang free for a double length span. These interruptions necessitated a change in the pole top arrangement which was soon made.



TRACK LAYOUT, WHEATON YARDS.

The top wire which formerly was supported on one side of the pole on the upper cross-arm was moved to a new position at the top of the pole, using a wrought iron pole pin fastened with one through bolt and one lag bolt. The pole wire on the lower cross-arm was moved to the extreme end of this cross-arm but on the opposite side of the pole. This makes an isosceles triangle with a base of 90 in. between the two wires on the lower cross-arm, and sides 70 in. between the upper wire and the lower ones. The lines were thus rearranged throughout the entire system except between Wheaton and Lombard where it is necessary to carry a double line of three-phase feeders in order to preserve the loop system of feeding. The glass insulators have been replaced by Locke porcelain insulators, No. 307. This type is a three-piece cemented and glazed porcelain insulator with a diameter of 7⅜ in. and a height of 6⅜ in. Since thus reconstructing the line but little trouble has occured and this has been caused by lightning. There are in all 67 miles of high potential three-phase pole lines.

Power for the third-rail line is fed to the rail at seven points on the system; power for the Elgin city lines is taken from the



CONTROL BOARD FOR AUXILIARIES.

third-rail at several appropriate points in the city of Elgin. At the southern limits of the city feeders are led from the third-rail across the Fox River to supply power for the trolley line between Elgin and Aurora. This feeding point is about one mile from the Clintonville sub-station. At Batavia the Fox River line is also fed from the third-rail. The tap is made just outside at the generating station and current is carried across the river by two sets of four feeders each, one set feeding north, the other set south. A third set of feeders taking current from the third-rail near the Aurora sub-station also extends across the Fox River and feeds the south end of the Fox River line at a point near the north city limits of Aurora. Current for the Aurora city lines is carried to a distributing station near the center of the city, part way by the third-rail, and part by overhead cables. A separate set of cables has been installed from a meter on the switchboard in the Aurora sub-station to a connecting point with the feeding system of the Joliet, Plainfield & Aurora line about a mile distant.

There are in all 81 miles of third-rail which is used throughout the entire system except for a short distance in the city of Aurora. The third-rail itself has caused no trouble during operation, but the third-rail cables which electrically join the two ends of the third-rail where it is necessary to leave a break for road or other crossings have often broken down their insulation and burned themselves out. In many cases it is thought that this was caused by moisture creeping through the cable head and destroying the insulation.

Wheaton Shops.

The repair shops for the entire road is centrally located on a large piece of ground about one-half mile west of the Wheaton station and at that point where the double tracks from Chicago to Wheaton separate, one going southwest to Aurora, the other running northwest to Elgin. This location is about the geographical center of the system. The accompanying illustration of the track outlay in the yards clearly shows the great flexibility for shifting cars from any one of the main lines to the different storage tracks or bays of the repair shop.

The repair shop building has one main bay with three tracks and two adjacent bays [illegible] building faces east. The construction throughout is fireproof with no inflammable material in its details except the planking in a small portion of the floors. The walls are of brick and the roof is of corrugated sheet iron, supported on steel trusses and lattice girders. Rolling steel doors, seven at each end of the building, close the openings over all tracks.

The north bay has two tracks extending through the building. This room is used for [illegible] brick with suitable drainage to rapidly carry away the wash water. For one-half the length of the bay the brick floor is on a level with the top of the rails, the other half of the floor is depressed to a level about 16 in. below the rails and added height is thus furnished for more easily inspecting and making slight repairs to the trucks and apparatus under the sides of the cars. Pits are built under the two tracks throughout this half of the bay. These pits are built of brick laid in cement and are provided with iron steps at each end, thus making the entire construction fireproof. Along the walls of this bay and at a height of about 5 ft. from the floor extend water and compressed air mains. Frequent taps with suitable valves are provided along the mains so that every facility is offered for lessening the amount of labor necessary for cleaning and washing cars. This north bay has track room for eight standard cars and is separated from the main bay by a fireproof wall with but one connecting door.

The center or main bay is occupied by the machine tools and general motor and truck repair appliances. The middle one of the three tracks in this bay extends throughout the length of the building and the two parallel tracks at each end extend but one-third of the distance from the ends of the building towards the center. The entire bay is spanned by a Whiting Foundry Equipment Co. 20,000-lb. capacity electrically operated crane. For one-third of the length of the building from either end, pits are provided under all tracks, being similar in design to the cleaning-room pits earlier described, and the floor between the pits is depressed. The middle portion of the bay is planked over and arranged as the machine shop for doing all repair work. Installed upon this floor are two Reed lathes, one wheel turning lathe, one hydraulic wheel press, two emery wheels, one drill press, bolt cutter, blower fan and power hack saw. These tools are belted to two lines of shafting held on brackets along the two walls of the bay. Each line of shafting is driven by a motor.

The south bay of the building is of the same general dimensions as the north bay and is also separated from the center bay by a fire wall. Brick partitions divide this south bay into five separate rooms. The west one of these rooms is used as a paint shop. It is lighted by a row of windows on the south side and has no doors opening into other parts of the building. This room has two tracks, each long enough to hold one car and the floor throughout the whole room is planked on a level with the tops of the rails. At one end of this paint room the space has been arranged for varnishing doors and windows and the entire end wall of the room is fitted with a rack for storing the extra windows and doors.

Another portion of the south bay has been equipped with tools for forging and blacksmith work. In this room is the horizontal fire-tube boiler which furnishes steam for heating the entire repair shops. The blacksmith shop is connected to the machine shop by a large double door so that heavy work can be brought by the overhead crane and placed close to the anvil.

Another portion of the south bay is set apart for armature rewinding and the repair of all small electrical parts, such as arc head lights, heaters, etc. Adjacent to this room is the office of the master mechanic, and a store room for all the small supplies used in his department.

The east end of the south bay is the carpenter shop. This room has two tracks, each of sufficient length for one car and an added space at the end of the tracks is fitted with carpenter's benches, a grindstone and band saw. A single door connects the carpenter shop with the machine shop.

The general arrangement of this shop with its tracks extending throughout the building, having their end openings fitted with steel doors, and the placing of the numerous smaller shops along the sides and connecting with the central bay, furnishes an economical and compact arrangement for the handling of the repair work on the company's cars, which need very careful watching and timely repairing on account of the exceptionally severe service to which they are subjected.

Repairs to Equipment.*

BY M. M. NASH, SUPERINTENDENT TERRE HAUTE TRACTION & LIGHT CO.

The subject, "Repairs to Equipment," is one of great interest and importance to the welfare of a street railway, inasmuch as the successful operation of a city or interurban road depends, to a very large extent, upon the repair department.

The writer believes that at the head of this department should be put a man who thoroughly understands his business, and who will look after the interests of his company as though they were his own, practicing economy in every possible way, but not neglecting or slighting any part of the work, as it is not economy to slight the repairs to electrical equipments. To successfully handle his shop, the master mechanic should be allowed to employ thoroughly competent men, and to so lay out the work that individuals can be held responsible for the special classes of work which they are set to do. He should be allowed to pay good wages, in order to obtain the best results, and should not, under any circumstances, be forced to take men into his department simply because they are friends of some official, for such men, as a rule, do not give proper attention to their work or to handling it economically.

Many managers are prone to criticise the expense of the repair department, and though the writer does not wish to question the good judgment of these men, he believes they should look at the results obtained rather than the first cost of obtaining them. It has been his experience as a repair man that the very best labor and material obtainable proved cheapest in the long run, and though this may seem costly from the standpoint of payroll and supply account analysis, the expense is surely justified by the knowledge that on heavy days, when a company is obliged to put all of its cars into service, the schedule will be uninterrupted by breakdowns. On such occasions as this the manager, who is prone to criticise the expense account and tell his maste: mechanic that he is spending more money in his department than he should, is the first to congratulate himself and boast to others on the good condition of his equipment.

The writer has had varied experience during the past 15 years in street railway repair shops, and well remembers the first shop of which he was master mechanic. The company with which he was connected had for equipment of its cars the old type G. E. F-30 and WP-30 motors, which the management was on the point of throwing out and replacing with a later design when he took hold of the repairs. At that time the shop force consisted of 39 men, all of whom were necessary to look after the repairs on 34 regular cars, and though these men worked hard day and night to keep the cars running, there were always from 5 to 10 cars lying idle in the shop, and there was never a time when the men could go home at night knowing that all the cars were in shape to operate. The writer found, after being there a short time, that the material was the cheapest that could be bought, and it was evident that the repair men had never been instructed how to systematize the work, nor, in fact, how it should be done. The cars would come in with hot armature and journal bearings, with armatures and fields burnt out, with controllers short-circuited, with broken gears, and, in fact, everything that could possibly happen would and did happen. To clean up the equipment was something which never seemed to enter the heads of any of the men, and when the writer suggested that this might be done the men laughed and told him that he would quickly get over that idea, as they did not have time to change and repair the damaged parts, much less keep the equipment clean.

After sizing up the situation, the writer determined to secure better material and better assistance, and straightway proceeded to do so. All of this cost more money and the repair account consequently increased, but in three months' time, with the repair work systematized and with good material, the cars were always ready for service when wanted, and instead of 39 men, only 14 were required. To accomplish this end it was necessary, of course, to spend a good deal of money, but after the cars were in good condition, the repair force organized and good material in the supply room the expenses of the shop were reduced fully 50 per cent.

This illustration serves to emphasize the point that "what is worth doing at all is worth doing well," and goes to show that the use of good material and a well organized repair force, with systematic methods of doing the work, is productive of the most good with the least outlay.

The equipment of a repair shop is even more essential in properly handling repairs, and the writer believes that every facility should be provided in the way of machinery and tools, as the economy resulting from their use more than justifies the first cost. In addition to the usual apparatus of a repair shop, such as bolt machines, planer, drill press, speed lathe, etc., a wheel-boring mill, a wheel press and a lathe that will swing a set of 33-in. wheels on the axle, are great money savers for any street railway company, even though that company operates only from 25 to 75 cars.

Another very important piece of apparatus is a stationary motor driven air compressor, so piped that the controllers and motors may be blown out every night, as it is well known that carbon and copper dust are direct causes of many troubles. Furthermore, the piping could be so arranged that the cars themselves could be cleaned by air, especially open cars and such box cars as have upholstered seats. With such a piece of equipment air hoists could be used, thus saving a great deal of time and labor in handling wheels, axles, motors and other heavy pieces.

With such apparatus, economy in labor and in time is introduced at every possible point, and the resulting saving in cost and in the ability to repair cars in a short time with a comparatively small working force is largely increased, so that although the first cost may seem high, the machines can be made to pay for themselves in a reasonable time.

Periodical inspection of cars is a great factor in economical maintenance, and this should be made at least once a month, the cars being taken into the shop and carefully looked over for loose bolts, worn armature and journal bearings, and, in fact, everything which if not caught in time might seriously disable the car. Such an inspection, of course, should include the controller, circuit breakers and other electrical equipment, as well as the mechanical.

If, in addition to these inspections, a complete record is kept of all work done upon a car and its equipment, and the cause of the trouble making such work necessary, the operating officials can know at all times the condition of the equipment as a whole, the reasons for the repairs and the manner in which they are made, thus enabling them to easily follow the details, and keep in close touch with the operation of the repair shop. Furthermore, should it at any time be necessary to detail a car for some service which would prevent its getting into the shop again for a considerable period, a glance over the record would tell what cars could with safety be put out on this service.

It is true that with the best of care a car will once in a while become disabled, but as a rule, careful inspection will discover many defects which, though slight at the time, if attended to then will avoid serious trouble later on.

The writer believes that in making these periodical inspections motors should be taken off the trucks, the armatures taken out and the fields carefully looked over, the commutators trued, if necessary, and if in the opinion of the inspectors the bearings would not last until the car is brought in the next time or for a reasonable period, the bearings should be changed. Where split gears are used on the axle their bolts should be very carefully examined, and if necessary, changed. The controllers, resistances, circuit breakers, etc., should be thoroughly overhauled, as should also all parts of the air and other brakes, and, in fact, every part of the equipment, from the wheels to the trolley, should be carefully examined.

In order that these inspections may result beneficially, the writer believes it essential that special men be detailed to examine special parts, and that these men should be held responsible for the condition of these special parts. In other words, the man who looks after the trucks should not be the man to examine the air brakes, and the one who looks after the air brakes should not be the one to examine the controllers and resistances.

These periodic inspections should be done during the day, but it is essential, for economic maintenance, that careful inspection be made every night by a competent night foreman or inspectors, depending upon the size of the road. It is not expected that the night car house force should do heavy repairs, as the cars are only in storage a very short time, but it is necessary that the bearings be properly oiled, the motor brushes looked after and the wheels closely examined, particularly cast iron wheels, and to obviate any possible expensive repairs the controllers and resistances should also be thoroughly gone over.

*Read before the Indiana Electric Railway Association, Indianapolis, May 11, 190[illegible]

In relation to the wheels, the writer believes that if there is any doubt in the mind of the person examining them as to their good condition or the good condition of any part of the brake equipment, the car on which this defective or thought to be defective equipment is carried should be side tracked and reported to the master mechanic in the morning.

By making inspections in this way the possibility of expensive repairs and serious trouble is largely eliminated, and the danger of accidents, due to defective wheels, brakes, etc., greatly decreased.

In previous paragraphs the use of good material has been advocated, and the statement has been made that this would prove cheaper in the long run than to use poor material. In this connection, bearing metal can be well used as an illustration. This material can be obtained anywhere at from 12 to 30 cents and more per pound, and though it may seem more economical to use the cheaper quality, the writer believes from his experience that if this be done the cost would prove greater, taking into consideration the labor of rewinding armatures that have dropped down, due to melting of bearings, the material necessary therefor, the labor in changing armatures and the consequent loss of car and equipment from service, than the cost of using a higher price metal.

The life of bearings depends largely upon the method of lubrication and the kinds of lubricant used. It has been and still is the custom to use for this purpose a so-called motor compound, which is a thick, greasy substance, but lately the writer has had some experience with a lubricant more in the nature of an oil, which is fed into the bearings through a piece of felt from an oil cup. This has given satisfaction in increased life of bearings and consequent reduction in cost, and the company with which the writer is now connected is installing this system as rapidly as possible on all of its motors. This matter, while not coming exactly under the heading of the subject, is still one which has a direct bearing on the cost of repairs to equipment, and is one which the writer hopes to hear fully discussed at this or a later meeting.

Another factor of repair cost is the rewinding of armatures, and in regard to this all are doubtless agreed that it is much cheaper to do this work in your own shops than to have it done outside. There is, however, a difference of opinion as to the advisability of forming your own coils, some master mechanics contending that it is cheaper to build coils in the shop than to have them furnished by the manufacturer of the motor, while others take the opposite view. It has been the writer's experience that the results obtained from using coils purchased from the manufacturer are much more satisfactory and economical for the reason that such coils are better formed, more carefully made and tested, easier to put in place, and it is not necessary to bake the complete armature when ready for installation. Furthermore, they seem to last longer in service than does the home-made coil, which increased life, together with the saving of labor, compensates for the increased cost.

The writer has endeavored to outline the ideal method of conducting a repair shop and to give some idea of what is necessary in the way of shop equipment, organization, etc., to obtain the best results. It is impossible, of course, for all companies, especially the smaller ones, to afford the best, as circumstances must govern them to a greater or less extent. The property with which the writer is now connected unfortunately falls at present under the head of this exception, and what follows is a brief description of the car shop methods adopted by this company.

Its car equipment consists of single and double truck, two and four-motor, open and box cars, numbering in all about one hundred. The car equipment in the way of trucks, motors and controllers is varied, there being many different kinds and makes, thereby making it necessary to have a large and varied assortment of repair parts constantly on hand. Both air and hand brakes are used, and these, too, are of different types and makes, as are also the electric heaters. To look after such an assortment and maintain it properly requires a great deal of attention, much more than would be the case with equipment less varied in nature. To do this we have arranged our shops so as to expedite the work as much as possible, and are following as closely as we can the methods previously outlined.

Our car shop equipment does not include wheel presses, air compressor, boring mill and that class of machinery, and we therefore cannot handle any of our wheel repairs, which are all done outside, and which consequently costs us considerably more than would be the case were we able to take care of it ourselves.

To remove wheels, the car is [illegible] trucks and body supported by jacks, so as to permit the lowering of the wheels and axles into the pit. These are then run to one side and raised to another track paralleling the one on which the car stands, and are then pushed out of the way and loaded onto flat cars for removal to the wheel works. The new set of wheels is then rolled into the pit and raised into position. To make this change requires about two hours [illegible]

Not having an air compressor, we cannot economize in labor or time by the use of air hoists, and therefore we remove motors by means of hydraulic jacks in the pit, directly in front of the winding room, so as to avoid any unnecessary handling of armatures back and forth in the shop.

The arrangement of the shop is such as to enable us to do our carpenter work in one portion, blacksmith and machine shop work in another portion, and painting in still another portion, the paint shop being separated from the rest of the building by fireproof walls, with heavy, double, sliding fireproof doors.

Not having an air compressor, we must consequently clean all cars by hand, and this is done in the car house proper under the supervision of the night foreman.

Inspections are made regularly, and a record is kept of all work done on each car and its equipment. Further than this, our trainmen are instructed and expected to report each night, in a book provided for the purpose, all defects in connection with their car which they have noticed during the day. It is the duty of the night foreman to carefully look over these reports and to make such repairs as he can with the force at his command. If the repairs to any car are of such nature as to require attention which the night foreman and his helpers are unable to give, he is instructed to hold that car out of service the next day, so that it can be overhauled by the day force.

We have, in so far as possible, detailed a man to each class of work, and are therefore able to hold some one person responsible for the condition of each part of the car and its equipment. Of course, with only 100 cars, the men are not constantly employed on their special work, and are therefore available to the car house foreman for other work, which they do under his direction or under the direction of the man responsible for that work.

Our car house being pretty well crowded, it is impossible to wash the cars at night, and consequently this must be done during the day. We have built a wash pit of cement, so arranged that the water runs to the center and drains through iron grating to the drain pipe. A car is placed over this pit and thoroughly washed with a brush, to which water is furnished by a hose passing through the handle of the brush and attached to a standpipe, after which it is rubbed down with chamois and run off to one side to dry. Soap and other dirt removers are used only in extreme cases.

The brief description will show that though we are unable to follow to the fullest extent the method outlined for best operation of a repair shop, we have adopted its most salient features, modifying them to suit local conditions.

In conclusion, the writer would say that to secure the best results constant attention is required, but if a company properly equips its shop, secures a good master mechanic, furnishes him with competent help, organizes that help, systematizes their work and gives them good material to work with, care and worry will be reduced to a minimum and the resulting economy and satisfactory condition of the equipment will fully justify the means.

A Sad State of Affairs.

The New York Sun of February 26th published the following remarkable report from Somerville, N. J.:

"The trolley line of the Public Service corporation passes under the Central Railroad in a subway. An overhead wire in the subway came in contact with the iron truss of the bridge about midnight. The bridge became so heavily charged with electricity that one of the iron trusses was melted, and the rails of the main track became red hot. The current spread through the rails for a distance of five miles on either side of the bridge, and knocked out the signal lights between this place and Bound Brook. This made it necessary to discontinue the running of trains."

Observation Cars on the Pacific Electric Ry.

[illegible]ty of Los Angeles, Cal., and the territory adjacent thereto, through which the Pacific Electric Railway Co. operates, is a Mecca for sight-seers and tourists a greater part of the year and it is to the electric railways that they turn for the quickest and most comfortable means of transportation. To meet this demand a special tourist service is being operated on the lines of the Pacific Electric Ry. and special cars have been built for this service, two types of which are shown in the accompanying illustrations.

The new observation-parlor cars, of which there are two that

NEW OBSERVATION PARLOR CAR NO. 318

have been in service a very few months, were part of an order furnished by the St. Louis Car Co. and were re-arranged in the shops of the Pacific Electric company as observation cars. These cars measure 48 feet. 1 in. over all, are 8 ft. 10 in. in width and weight approximately 69,000 lb. They are equipped with quadruple motor equipments of Westinghouse type 76, 75 h. p. each, with a maximum speed of 65 miles per hour, Westinghouse multiple unit control and air brakes manufactured by the Westinghouse Traction Brake Co.

INTERIOR OBSERVATION PARLOR CAR

An automatic air device, designed and built in the shops of the railway company, is installed in connection with the trolley poles so that when the pole leaves the wire the air is released from the cylinder and the trolley pole drops to the roof of the car, thereby avoiding damage to trolley and overhead equipment. As may be seen in the accompanying engraving, everything has been arranged for the comfort and convenience of the passenger. In the open section are 22 rattan chairs in pairs on either side of the aisle and in the closed section of the car are 20 chairs upholstered in leather. All chairs are of the revolving base type and were manufactured by Heywood Bros. & Wakefield Co. In each end of the closed section are placed two couches, 4½ ft. long, upholstered in leather and generously supplied with handsome leather pillows with the monogram of the company worked thereon. A neat toilet is installed at one end of the car. Pearl push buttons are placed at each window and 25 incandescent lamps of 16 c. p. each and three large arc lamps supply the light. The interior of the car is finished in red cedar, with trimmings of gold, and the floor is carpeted. The exterior of the car is painted in maroon and trimmed with broad gold stripes, giving the car a very neat appearance. The car is heated by electricity.

The observation car "Poppy" was built by the Pullman Co., at a cost of several thousand dollars and has been in operation some

OBSERVATION CAR "POPPY."

four years. This car is 35 ft. 9 in. in length, 8 ft. wide, and the equipment consists of four Westinghouse type 38-B motors of 50 h. p. capacity each. It has a seating capacity for 32 persons, 20 in the closed compartment and 12 in the open, rattan chairs being supplied for both. The interior of the car is lighted by five incandescent and two arc lamps, while the exterior ends and sides of the car are bordered with 240 incandescent lamps of 16 c. p. each. The exterior of the car is in olive green, trimmed with gold stripes.

This car makes two trips daily of 20 miles each, while the new observation-parlor cars make round trips averaging about 65 miles, giving the tourist an excellent opportunity for viewing the many beautiful orange groves, canyons, missions, etc., as well as a large part of the city of Los Angeles. A special conductor accompanies each car and points out the places of interest along the route. The tourist has the choice of several trips of from two to three hours duration at the nominal fare of $1.

We are indebted to Mr. A. D. Schindler, general manager of the Pacific Electric Railway Co., for data and illustrations.

A Friend of the Wild Flowers.

With the aim of stimulating interest in the flowers of the countryside, the Detroit United Ry. offers a prize of $25.00 to the boy or girl, regularly attending school in any county traversed by the lines of the Detroit United Ry., that is Wayne, Oakland, Macomb, St. Clair and Genessee, for the best catalogue-list of wild flowers to be found in these five counties. It is not necessary to designate them by their more or less unpronouncable scientific names. These lists will be submitted to some well-known botanist and he will select the one which in his judgment is the most complete and accurate. The contest will close at six o'clock p. m., Thursday, June 1, 1905. After that hour no lists will be received. All lists must be mailed or delivered to Mr. John H. Fry, 12 Woodward avenue, Detroit. Each list must bear, legibly written, the name and address of the compiler and the school which he or she attends.

The Lynn & Nahant Street Railway Co. had its official beginning May 17th, when Mr. J. T. Wilson, chairman Nahant Selectmen, drove the first spike in the sleeper under the first rail at the end of the line at Nahant.

Municipal Trading.

BY SAMUEL MORSE, J. P.

The Importance of the Subject

Although the subject of trading by municipalities may not excite the same interest as some of the political questions of the time, it is one of the deepest importance to the country. It affects all classes. Capital and labor are equally interested in the solution of the problems which it raises, and there is not an individual in the country to whom it is not a matter of vital interest. Municipal trading threatens the foundations of our commercial system under which the nation has grown great and powerful in the past, and upon which the continuance of our prosperity depends. The industrial and social changes which the system will effect, if unchecked, will be of the most serious character; and therefore the enormous proportions which it has assumed in recent years make it necessary that the public should fully understand the real scope of its aims and objects.

What Municipal Trading Means

For what is Municipal Trading? It is the expenditure of capital upon, and the management of, a trading undertaking by a local government body. This body is composed to a great extent of men who have no experience in the conduct of large business enterprises, and who have no adequate understanding of the means by which commercial undertakings are built up and conducted. Even if the necessary experience and ability existed, the ordinary work of local government is more than enough to occupy the time at the disposal of the members, and their private duties make it impossible for them to give the requisite attention to the successful conduct of a commercial undertaking. It must also be remembered that councils are not elected ad hoc. The members are continually changed by the electors, and no business can be successfully conducted without the continuous attention of the same directing mind. Nor are the members who conduct the business undertakings of local bodies elected directly with that view. The question of municipal trading never comes before the voters as a separate and distinct issue. It is mixed up at election times with diverse subjects, and probably a member is elected because of his views on education, or tariff reform, or Chinese labor, or any exciting political question of the hour.

It is nevertheless contended by municipal traders that such a body will somehow be able to initiate and maintain large undertakings with striking success. Men who are not elected for the purpose, and who have neither the experience, nor the capacity, nor the time, will be equally fitted to conduct vast business schemes as men of the widest experience, of commanding commercial ability, and who give their whole time to the work. The idea is as ludicrous as anything in the pages of "Alice in Wonderland," and it will be interesting to see a little later on in this address how the theory looks in the clear light of practical results.

Another assumption of the municipal traders is that their trading will be done in the interests of the whole country, and that only those businesses will be undertaken which supply goods required by every member of the community. It is undoubtedly true that many of the duties performed by local authorities do affect the whole population. Public health, for example, is a matter which affects the interests of every citizen. It is of the utmost importance for our welfare that our houses should be in a sanitary condition, that our food should be pure, our streets clean, our roads in repair, our sewers in good condition. These are all matters which vitally concern every one of us, and if local authorities confined themselves to these, the true objects of local government, they would meet with nothing but approval.

But one of the first things entered upon by the supporters of municipal trading was the generation and supply of electric light. Now, electric light is not a necessity for every member of the community. It is not the business of any one to see that I use electricity, or gas, or oil, in my house, or even that I use any form of artificial light at all. And yet this continues to be one of the favorite trades of local authorities, and has now grown to such an extent that, in the United Kingdom, up to March, 1904, nearly £27,000,000 had been [illegible] electricity.

The Re[illegible]

I now come to consider the [illegible] trading have been carried [illegible] bodies for some considerable time, and it is therefore now possible to subject the predictions of municipal traders to the test of undoubted fact. I have [illegible] stated that [illegible] £[illegible] had been invested by local authorities in the United Kingdom, in one department of trade alone—that of the generation of electricity. It would be reasonable to expect that this amount, if employed in any business undertaking by private capitalists, would yield an annual profit of at least £1,500,000. A no less favorable result would certainly ensue in the case of the municipalities if the dreams of municipal traders were realized; but we find that in place of a huge profit for the rate-payers, there was actually a loss of £80,000 last year in regard to over one-third of the undertakings. Even this amount, serious as it is, does not reveal the real deficiency. The actual loss is minimized by setting aside on the average only one per cent for depreciation. In only a few cases was the amount for depreciation adequate. In the majority of instances no provision whatever was made for the wear and tear of machinery, which will probably be used up before the loans to the local authorities have expired. If we take a more extensive survey, the same disastrous consequences appear. An official return was issued to show the figures relating to the reproductive undertakings of Municipal Corporations in England and Wales, for the four years up to 1902. On referring to this return, you will find that for these four years there was a total capital expenditure of £121,000,000. This gigantic amount was managed with so little judgment that it yielded a profit of only 6s. 3d. per £100. A dividend of less than one-third of one per cent (0.3125 of one per cent) would be regarded by shareholders with anything but satisfaction, and with still less satisfaction if it was discovered that even that result was brought about by reserving only 0.16 of one per cent for depreciation. Business men who conducted their affairs with judgment and prudence would not be content with the 0.16 of one per cent which satisfied the municipal corporations, and would not set aside less than 2½ per cent for the purpose of depreciation. And if this course, which ordinary caution requires, had been followed, the profit, small as it is, would disappear, and a loss be shown of no less than £2 5s. per £100 of capital expenditure, or in all, £2,722,500.

It will be useful to turn from the consideration of the figures applying to the whole country, and look at the results in a single borough. Battersea has been called the "Mecca of Socialism," and as socialism is at the root of municipal trading, it is here, if anywhere, that we should expect to find a brilliant vindication of the new system of trading. It is, therefore, with some curiosity that one turns to see how much has been spent by Battersea upon its electric lighting undertaking, and the amount of the profits which has gone to reduce the rates and benefit the public. We find that the undertaking has cost £195,345, and when we come to look for profits we discover none, but, on the contrary, a loss of over £12,000. Out of a population of 175,000, or, taking five persons to the family, 35,000 families, there are only 230 families, or, say, 1,150 persons, who take the electric light. It is evident, therefore, that a large number of the ratepayers in Battersea, as in other districts, must pay a large proportion of the cost of the light which they themselves have not had, but which 1,150 persons have enjoyed at their expense. The theory that you are to pay for what other people get may recommend itself to municipal trading doctrinaries, but it would be curious to know how it is regarded by the level-headed ratepayers of Battersea. A few figures will show at a glance the price which these unfortunate ratepayers have had to pay for the adoption of this wonderful method of conducting business. In 1889 the rateable value of the borough was £689,000, the rate was 5s. 8½d. in the pound, and the debt was a modest £37,000. In the space of 15 years—that is in 1904—although the rateable value had increased to £1,021,115, the rate had increased to 8s. 2d. in the pound, while the debt of £37,000 had grown to £660,696, and is still becoming larger.

Battersea in this respect is only an example of the general position throughout London during the past forty years, as the following figures will show:

*Extract from an address before the Battersea Municipal Alliance, Battersea, England, Jan. 24, 1905.

Year	Rateable Value	Rate in the £		Amount raised
	£	s.	d.	£
1860	[illegible]	4	7	[illegible]
1870	[illegible]	5	4	[illegible]
1880	[illegible]	[illegible]	[illegible]	5,333,10[illegible]
1890	31,387,848	[illegible]	2	7,507,200
1900	37,[illegible],733	6	2	11,154,700
1903	[illegible]	7	1	13,835,075

It will thus be seen that, while the rate in the pound has increased only 54 per cent during the period in question, the amount actually raised has, in consequence of the growth of rateable value, increased over 400 per cent.

Sir Robert Giffen, in a recent article in "The Contemporary Review," has drawn public attention to the dangers of this growth of local expenditure, which is to be attributed mainly to the requirements of local authorities in connection with their new commercial undertakings. Sir Robert points out a very important fact which is apt to be overlooked—that Imperial expenditure and the expenditure of local authorities are supported by the same taxable resources, and that the more one takes from the common fund the less there is for the other to draw upon. A question of Imperial concern is thus raised by one of the necessary results of municipal trading. For, as Sir Robert Giffen points out, the above principle applies to the resource of credit, as well as to any other; and if local authorities borrow a great deal, the credit of the State must be so much restricted. The real danger of the position will be apparent when I state that the local expenditure of the United Kingdom grew from £36,000,000 in 1860 to £144,000,000 in 1901-2—an increase of £108,000,000. In little more than 40 years, therefore, the expenditure of local authorities has been quadrupled. The total local indebtedness at this period was £412,000,000, and nothing requires to be added to impress upon you the importance of that significant figure.

The whole financial condition of the country is being affected by the position which is disclosed by these statistics. The increase in the rates and enormous growth of local indebtedness have necessarily resulted in a general dearness of money, and the easy flow of capital upon which the prosperity of trade depends has been arrested. Public securities have declined in value. Confidence in local authorities has been shaken, and loans to local authorities can consequently only be obtained at an increased rate of interest. Increased interest necessarily means increased rates, and as local authorities must of necessity borrow for the proper purposes of local government, it is of the greatest importance that these loans should not be complicated by additional loans for the purpose of trading undertakings. When new loans are issued, however, by local authorities, no distinction is drawn between loans for ordinary purposes of local government and those for trading concerns. The same rate of interest has to be paid in each case, and therefore the indebtedness on trading concerns is now reacting to the detriment of the ratepayers, even when the loan is raised for objects legitimately within the scope of local government.

This growing confusion in local finance, with all its ramifications in the direction of Imperial affairs and throughout our whole industrial structure, amounting to a "real disease of local government," is no doubt caused to a great extent by the composition of modern public bodies. Men who are accustomed to deal with large affairs, and who understand the complexities of great financial arrangements, are not found to any great extent on our councils. They are for the most part engaged in undertakings similar to those carried on by the corporations, and cannot be expected to spend their time in competing against themselves. The services of these men, which would prove so valuable in the important legitimate duties of local government, are therefore lost to the country. The places which such men ought to fill are taken by others, who are quite unfitted to control the large interests entrusted to their care. The inevitable consequences follow. We have, as Sir Robert Giffen says, "an expenditure that is partly extravagant and unnecessary because local authorities are frequently bad managers, even where they are not corrupt. They spend money on what is not really wanted; they spend more than they ought on what happens to be necessary; they incur liabilities and burden the future with a light heart. Expenditure is pleasant to those who have a little brief authority, and the increase of the number of urban authorities increases the number of those who may enjoy the pleasure." Nothing can be more true than the language of a report issued last year by the Manchester Citizens' Association, which stated that "There are good men on our town councils, but many members are merely the nominees of political parties, and depend for their election not on their fitness for municipal work but on the strength of a political party in the ward. So long as such a system exists so long will it be impossible to get the best men on our councils."

The Remedy.

It will be necessary to find a remedy for these and other formidable evils of municipal trading if a great disaster is to be averted. Trading is a quite unnecessary enlargement of the duties of a local authority, and great as its disadvantages and dangers are at present, these must continue to increase, and seriously affect the stability of the country and the Empire if a solution of the question is not speedily discovered.

I am of the opinion that the only effective remedy is to prevent local authorities from trading at all. The legislators who brought municipalities into being clearly understood the objects of local government, and, if confined to these limits, men of ability and experience will no doubt be willing to again take up the work, and restore to local government that wise, economical and efficient administration which conferred so many advantages on the country in the past. Rates will be lowered, financial stability will be secured, the credit of the country will be improved, trade will be favorably affected, the community will be saved from risks inseparable from the conduct of large undertakings, and the whole position of local authorities will in every respect be rendered stronger.

Private enterprise has hitherto shown the way, and must, I believe, continue to do so in the future. It is perhaps not always perfect when brought into close relations with the public, but there are means by which local authorities can protect the interests of the public. When their consent is sought to the establishment of a monopoly in their districts, they should have power to insist that the best system shall be employed, that reasonable charges should be made for the commodity, that proper wages should be paid to the employees, that the interest paid to shareholders should be limited to a certain rate, and that the surplus should be utilized for specific purposes. Provisions of this character will be an ample guarantee that the public interests will not suffer, while the risks now being run will be avoided, and the increase of debt, which if continued is bound to end in disaster, will be checked.

The only difficulty in the way of bringing about such a result is the strange apathy of the public. The evils of the present system of municipal trading are plain and unmistakable if the facts are examined. Once the public are awakened to these facts, and to their bearing on national and individual welfare, the necessity for action will be realized, and the movement for the extinction of this baneful system become irresistible.

Westinghouse Offices.

The Westinghouse Machine Co. has recently announced substantial extensions in its sales organization. These are the result of the rapidly increasing business, making necessary the more thorough covering of southern and western territories. In addition to the original New York, Boston, Pittsburg and Chicago offices, new branches have been established at Cincinnati, Denver, San Francisco, Charlotte, N. C., and Atlanta, Ga. With these added facilities the extensive mining territory of the West and cotton industries of the South may receive more active attentions. The steam turbine and gas engine business of the company has increased rapidly during the last few years, and the prevailing activity in this branch of power development augurs well for the future.

The representatives of the company are now as follows:

New York, 10 Bridge St., L. L. Brinsmade.
Boston, 131 State St., E. L. Clarke.
Pittsburg, Westinghouse Building, William Bradford.
Chicago, 171 La Salle St., John B. Allan.
Cincinnati, 1111 Traction Building, A. A. Brown.
Denver, 512 McPhee Building, C. C. Chappello.
Charlotte, N. C., So. Tryon St., Stuart W. Cramer.
Atlanta, Ga., Equitable Building, Stuart W. Cramer.
Philadelphia, Stephen Girard Building, M. R. Muckle, Jr., & Co.
San Francisco, 614 Mission St., Hunt, Mirk & Co.

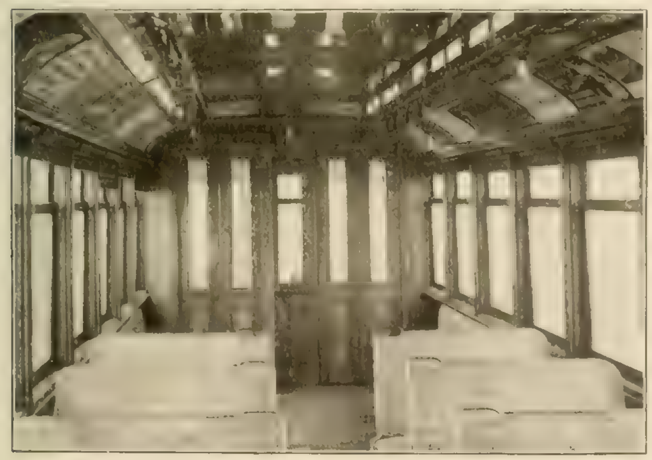
The new cars of the Ft. Wayne & Wabash Valley Traction Co., which will be placed in service on the Ft. Wayne-Indianapolis limited runs, are to be christened with the names of Scott's novels, such as the Talisman, Ivanhoe and Woodstock.

A New Type of Car for Montreal.

The Montreal Street Railway Co. has recently placed in service on one of its important lines a new type of car, which is the invention of Mr. W. G. Ross, managing director, and Mr. Duncan McDonald, manager. The new car, which is illustrated herewith, differs from the general type of cars in service on the line in its system of entrance and exit. The car is of the semi-convertible type, and has in place of a 5-ft. platform one of 7 ft., and instead of the ordinary door placed in the center of the end there are two doors, the brass railing leading up from the steps dividing the platform into two aisles.

DIVIDED PLATFORM AND DOUBLE DOOR CAR FOR MONTREAL.

One of these doors is to be utilized by persons entering the car, while the other door will be used by those leaving the car, and is arranged and made arbitrary by one door opening inward only and the other door opening outward only. When a passenger boards the car, the conductor demands a fare before allowing him to enter; the passenger then passes on through the entrance door into the car, from which he may make his exit at any time, either by the front or rear doors designed for the purpose. Not having to enter the car to collect fares from the passengers, the conductor is enabled to remain at his post on the platform, giving such attention as is necessary to the passenger boarding or leaving the car. The cars



INTERIOR ARRANGEMENT OF ENTRANCE AND EXIT DOORS.

are provided with electric buttons as well as bell cords, and the passenger can easily make his desires known without disturbing the conductor. The exit from the front platform gives the motorman more room and provides a brass railing between him and the rear portion of the platform. At the motorman's foot is a catch which automatically releases and throws open the door.

The advantages that this new design offers are that the conductor can give his undivided attention to receiving and discharging passengers and is enabled to remain at his post at all times, a large portion of street railway accidents, as a rule, happening on the rear platform while the conductor is inside the car collecting fares, a large percentage of [illegible] inability of conductors to remember who has paid and who has not, especially during rush hours, and this will be avoided; the overcrowding of cars will be lessened and the dispatch with which passengers may be received and discharged will be facilitated, the passenger entering one door and leaving through the others. This new design of car has been patented by the inventors in Canada, the United States and European countries.

Tramway Fares in Italy.

Prof. George W. Bissell, chief of the engineering department, Iowa State College, [illegible] Europe, writes us as follows:

Street car and bus fares are apparently cheap, 2 cents, but the transfer system is almost unused and the routes of each car are so short that the cost is not far from 1½ cents per mile. Suburban lines charge about 2 to 2½ cents per mile in Florence, and a little less in Rome. In exchange for the fare the conductor gives the passenger a ticket as voucher, to be shown in case of necessity.

Cab fares are very cheap, especially for three or four in a party. In Florence, with the fare one franc per course, it is frequently cheaper for a party of three or four persons to take a cab instead of the tram. In Rome the cab fare is one franc for one or two persons and ¼ franc for each additional person. In Naples the cab fare is 14 cents.

Reducing Avoidable Losses.

The value of profitable forethought and greater individual accuracy as reducers of avoidable losses is apparent to all, and such things as tend toward the development of these characteristics is worthy of careful consideration. A means toward this end that has met with no small degree of success is the result of a great many years of study by Mr. Earl M. Pratt, of Oak Park, Ill. Mr. Pratt's plan for reducing avoidable losses is by co-operating in information on the daily sources of greater individual accuracy and profitable forethought. Someone, somewhere, knows something so new and useful to each individual that he can afford to help pay for a search for it and also contribute information to the present collection of experiences and experiments. Since 1872 Mr. Pratt has been collecting valuable data and helpful ideas, and in 1902 established the Arcade Index Library, which has been devoted to collecting and exchanging immediately useful information on such subjects as greater accuracy, profitable forethought and resourcefulness. Written and printed articles are added daily to the library, which is sustained by individuals in all lines of work.

The method that has been used by Mr. Pratt in reaching and interesting individuals in this work is lecturing. A short time ago the services of Mr. Pratt were obtained by a large Chicago department store for a series of lectures; the departmental managers were called out for an hour, then the floorwalkers, the shipping clerks, etc. Those who became interested in the work were then furnished with a scrap book, and an exchange of information and ideas followed. A similar line of work was done among the employes of one of the departments of a large western concern, with the result that 1,600 out of 2,000 employes became interested and subscribed to the collection, exchange and promotion of these original researches. Last winter Mr. Pratt secured permission from a large railroad company to study with its employes for the purpose of inventing and collecting every-day helps on memory and forethought. In short, the work outlined is to discover and develop by researches the daily sources of desirable qualities in employers and employes, and through this to demonstrate the necessity of accuracy in thought and action. In connection with this, Mr. Pratt has what he calls "forethought exercises," which the officials of various organizations have found both interesting and instructive, and to which as much time [illegible] profitable results. The success with which this work has met marks it worthy of consideration and investigation, and any inquiries addressed to him, care of the editor of the "Review," will receive prompt attention.

THE
STREET RAILWAY REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV JUNE 15, 1905 No. 6

CONTENTS OF THIS NUMBER.

DIRECTORY OF ELECTRIC RAILWAYS.

The publisher of the "Street Railway Review" has recently completed the compilation of a directory of street and electric railways of North America. This was first published in connection with the "Review" for April, 1905, and in this number it is printed for the second time. To be of greatest value such a compilation must be as nearly up-to-date as possible and we are extremely anxious to have the directory correct in every particular. We ask the co-operation of every railway official and beg that each reader of the "Review" will check up the data given on his company and advise us at once as to any corrections that should be made. The directory will soon be issued in pocket form and before publishing this we desire to secure the latest changes and additions.

STYLE FOR TECHNICAL PUBLICATIONS.

One of the reports presented at the June meeting of the American Society of Mechanical Engineers was from a committee representing the four national engineering societies, appointed to secure co-operation in standardizing abbreviations, symbols, punctuation, etc., for technical papers. This preliminary report discusses briefly the general subject of abbreviations, to which the committee limits the work at the outset, and comprises 14 general rules, to which is appended a list of some fifty examples, including the principal units of measurements, together with the abbreviations recommended.

It is the intention that the recommendations of the committee, if acceptable, be adopted as the style for the official publications of the national engineering societies. These societies should, however, have the warm support of the technical press so that there may be greater uniformity in the abbreviations used.

The committee protests against the use of abbreviations for abstract or descriptive words, citing as an example of what should not be used, "h. r. t. boiler" for "horizontal return tubular boiler." An abbreviation of this nature which has acquired wide currency in the electrical field is the use of a.c. and d.c. for alternating current and direct current, respectively, and there are quite a few writers and electric railway men who even speak of "a.c. current." In deciding upon abbreviations it might be well to consider the British usage, as there are a few instances where there are abbreviations that would be clear here would cause confusion in Great Britain. B. T. U. indicates British thermal unit or Board of Trade unit, which is the British equivalent of kilowatt hour, and the use of that abbreviation might cause some confusion, although they could be distinguished as B. t. u. and B. T. u.

MR. DALRYMPLE ON MUNICIPAL OWNERSHIP.

The campaign preceding the last city election in Chicago was between candidates who announced themselves in favor of municipal ownership of street railways of the city. It was alleged that various benefits would result from such a change, among these being higher wages for employes, and lower fares or free transfers between the lines of the existing systems, or possibly both. After the election the new mayor invited Mr. James Dalrymple, general manager of the municipal tramways of Glasgow, to visit Chicago and advise how these very desirable changes could be brought about.

Mr. Dalrymple, on May 31st, was the guest at a dinner in Chicago and spoke concerning conditions existing in Glasgow. Several of his statements must have been distinctly disappointing to the advocates of municipal ownership here if we are to believe them sincere in their public utterances. For instance, Mr. Dalrymple said:

"A municipality cannot operate its street car lines unless that municipality is pure and free from corruption."

"It has been said that when a municipality takes over its street car lines it means an increase in the wages of its employes. Our men wanted an increase, but they did nót get it. It was not long before we had an entirely new set of men."

"We give no transfers, we could not with our graded fares. We could abolish all fares but the 3-cent fare and not hurt our profits, but I do not believe transfers could be given with less than 5-cent fares."

It thus appears that Mr. Dalrymple has been able to tell the city of Chicago only that which it has heard from other sources times innumerable.

THE PHILADELPHIA GAS SITUATION.

The daily press has devoted a great deal of attention to the Philadelphia gas situation, and in view of the facts it is ludicrous to note the attempts to construe the recent experience of Philadelphia as an argument in favor of municipal ownership of public utilities, with which the comments on the situation almost invariably conclude. What has happened in Philadelphia is, briefly, as follows:

The city installed a gas works which it operated for several years with a deficit of approximately $500,000 per year. The service was poor, no attention being given to complaints of patrons, and the gas was of an inferior quality. After several years of this unprofitable and unsatisfactory administration, the plant was leased to a private company for the term of 30 years, and it was provided that the price of gas to the consumer should be $1 per 1,000 cu. ft., and that the company should pay to the city 10 per cent of the gross receipts during the first 10 years, 20 per cent during the second 10 years, and 25 per cent during the third 10 years. And it was further provided that the city might at any time it saw fit surrender the whole or part of its income from the gas company upon condition that an equivalent reduction in the price of gas to the consumer be made.

This lease, which is now controlled by the United Gas Improvement Co., has been in force about seven and one-half years. Recently the city authorities, otherwise known in Philadelphia as the "gang," found need of large sums of money to carry out public works now in process of construction and proposed, and the gas company was asked what it would give as a commutation of the annual payments to become due under its lease. The gas company offered a lump sum of $25,000,000 in lieu of future payments to the city under its present lease and an amendment extending the present lease for 75 years from the present date. This offer was accepted by the select and common councils, but by reason of the popular indignation aroused, the offer of the gas company has been withdrawn.

From these facts it is certainly absurd to deduce an argument in favor of municipal ownership of the gas plant. The city has been so extravagant in other departments that it could not grant to the consumer the 10-per-cent reduction, which it was empowered to give under its lease with the gas company. Moreover, the city legislature was practically unanimous in approving the offer of the gas company, which would have been far more unfavorable to the city, from a financial point of view, than to permit the present lease to run the full term without alteration. The lesson that should be drawn from Philadelphia is that, as stated by Mr. Dalrymple, of Glasgow, "Politics and municipal ownership will not mix."

REPAIR SHOP ECONOMY.

In good times and bad the reduction of operating expenses per unit of output is desirable in all commercial work. Especially is this true in the repair shop of the modern electric railway, where a great variety of work is daily performed. It is a simple matter to secure operating economy in an undertaking where the process of manufacture is limited to a few definite steps, regularly repeated. As the complexity of the work increases, however, the importance of saving labor grows greater, and the high proportion of labor cost in the repair shop as compared with the cost of material and power warrants careful consideration of the economy of production on the part of managers who are trying to make the most of their equipment.

Turning to specific problems, it is gratifying to record the widespread appreciation of the motor drive which has characterized repair shop practice for more than a decade. Although the convenience of trolley current and availability of motors more or less obsolete for car service duty naturally led to the early adoption of electric driving in street railway work, it is still significant of the progressiveness of master mechanics that such advanced methods of machine propulsion were taken up at a time when the manufacturing world at large had not grasped the advantages of the electric motor in general shop practice. At the same time it is a question today if many railway shops are driven according to the best practice in regard to motor efficiency, speed regulation, and grouping of machines.

Although it may be urged that the cost of power in the repair shop seldom exceeds 3 or 4 per cent of the total cost of repairs, it by no means follows that a saving of 5 or 10 per cent in this cost will be insignificant in the total for the year. It is certain that many of the old series railway motors now used for driving miscellaneous machinery in the shop show a serious lack of efficiency in comparison with the performance of the latest designs of shunt or induction motors built with the special requirements of machine tool operation in mind. The rheostatic regulation of speed necessary with the single series motor and its original design with reference to the street railway cycle of acceleration, coasting, braking and standstill do not insure very efficient performance under the conditions of moderate speed variation and comparatively even loads common in the group driving of machine tools. Improved designs of motors for both railway and shop practice further widen the gap between the efficiency of the old and the new. Doubtless an old railway motor of even the early '90's is better for shop driving than the average non-condensing steam engine with its attendant line shafting and belts, but it is a question if it will not pay some of the roads which have turned their shops into asylums for aged car motors to replace these outfits with modern equipment. As the size of the shop increases the question of individual or group driving becomes more important, and the merits of each method should be carefully weighed before reaching a decision for the particular cars in point. In general, group driving has worked out satisfactorily in the street railway shop, but as the size of car equipments has increased and harder tool steels have been introduced, the desirability of individually driving each operative unit has come more to the front, whether that unit be a group of lathes or a single planer.

The use of power driven hoists in the repair shop has found so much favor in the past few years that it is rare to find an installation which has not adopted several machines operated either by compressed air or electricity. Unfortunately in some cases the good work has been only half done, the continuity of the repair process being quite overlooked. It must not be forgotten that even the diversified work of the repair shop is subject to the same economics of intensified production as any manufacturing process, so that any unnecessary impedance of the repair cycle is exceedingly poor practice. There is little economy in equipping a shop with high speed tools and retarding the progress of broken down apparatus through it by insufficient hoisting and transporting facilities.

Among the labor saving conveniences which have been used with success in the street railway shop few have proved more satisfactory than the wooden horse equipped with ball bearing rollers for handling armatures. This method of quickly transporting an armature weighing from 700 to 1,000 lb. from place to place is singularly free from objections and is an effective economizer of time and strength. Similarly, the use of a small iron tripod for holding the distant end of pipes fed to a cutting machine saves considerable labor in the long run. The attachment of a small crane to the door casing of a supply car with facilities for swinging its arm in or out after the manner of the mail bag catcher used on postal cars is certain to expedite the handling of material. Car heaters used in the armature and field coil drying oven require practically no attendance in comparison with coal burning ovens, and a tank and frame large enough to permit the dipping of a dozen or more coils in the insulating liquid at once is an arrangement far superior to the old plan of painting the coils by hand. Probably from 30 to 50 per cent more work may be done in stitching duck or canvas curtains by a sewing machine driven by a 1/4-h. p. motor, instead of using foot power.

The installation of a derrick for handling rails and poles in the shop yard will often pay for itself on a large system in a comparatively short time, and the use of the pneumatic hammer for chipping out oil channels in journal boxes is a similar labor saver. One company recently reduced the cost of unloading new cars from $5 to 50 cents each and cut the time from an hour and a half to 10 minutes by building a simple framework in its shop yard over the track, consisting of two 12-in. steel I-beams tied together at the ends and supported by four Georgia pine 12 by 12-in. vertical timbers 18 ft. long above the ground set upon concrete foundations 4 ft. deep. Four block and tackle hoists free to move upon the I-beams constitute the means of raising the new cars from the flats and lowering them upon the yard track.

Plenty of light and air are important as labor saving arrangements in the repair shop, and the broadest economy requires systematic protection against fires along already well discussed lines. It is well to remember that the cost of shop operation is paid for

by nickels earned by the cars, and that a saving of [illegible] $500 a year in the expenses of repair shop activity releases the revenue of 10,000 passenger fares for application to other purposes. The fundamental point is the reduction of expense per unit of work done, or the accomplishment of more repairs for the same money output.

WHAT TYPE OF ROAD SHALL BE BUILT?

Early in the life of an interurban railway its promoters are confronted with a serious question, on the answer to which very largely depends the success of the proposed railway as a useful and financial enterprise. This question is, What type of road shall be built? To answer this requires much careful study on the part of the engineer who has the planning of the road in hand. He must be able to submit figures as to possible operation receipts, on which figures the amount of money that can profitably be invested in the enterprise will depend. In compiling an estimate of the probable receipts of a line to be built through a given locality, comparison with the receipts of roads now in operation through similar territory is a helpful check, but this method cannot be taken as a final one, because of the many details, a change in any one of which may call for widely differing classes of service and types of roadbed and equipment. As the number of interurban roads grows it becomes more and more difficult to decide upon the feasibility of a location, and more responsibility is placed upon the engineer because the most desirable territory has already been covered. As the fund of knowledge gained by experience increases, we see new fields in which, if proper care be taken in answering the earlier mentioned question, opportunity presents itself for the satisfactory investment of capital in the construction of lines into rural districts, which heretofore have been thought unprofitable as locations for railways.

Mr. Cravath, in his paper, "Light Electric Railways," which is abstracted elsewhere in this issue, submits a new possible answer to the question by giving interesting details of a type of construction proposed as suitable for rural electric railways in sparsely settled farming districts such as are to be found in some parts of Illinois and in Iowa. Briefly, a narrow gage road is proposed, built and equipped at a cost of $8,000 per mile. To obtain this low construction cost a gage of 28 in. is recommended, with rails, ties and other substructure standards reduced in proportion to the gage. Single-phase equipment would be used upon passenger cars 32 ft. long and 5 ft. wide, having 30 or 33-in. wheels and 26-ft. truck centers, with the car body hung low between the trucks to gain stability for safe operation at a speed of 20 miles an hour on the narrow gage track. It is recommended that the construction of the roadbed and rolling stock be as economically planned as possible, building the track to conform approximately to the natural profile of the land and avoiding heavy cuts and fills by following a contour around a hill, thus increasing the curvature and grades rather than spending money for earthwork.

This question of relative alignment and grade is one whose answer depends upon the peculiarities of any particular locality, but we believe that money properly invested in perfecting a roadbed is well spent, and especially so when it is proposed to haul freight trains of several cars over the track. It is not alone a question of the different amounts of power required to haul the cars over the road, but there are other costs with which the management will always be burdened until a substantial roadbed has been built. Some of these are: The danger of derailment in attempting to operate narrow-gage cars around many curves, which in the type of construction proposed must often be located on comparatively steep grades; the proportionately excessive cost for maintaining lightly constructed track and overhead, and the relatively high rolling stock repair cost which will be occasioned by hauling the equipment over light track that cannot be kept in good surface and alignment.

Another fact which makes it difficult to agree that a narrow gage road would be a satisfactory solution of the problem in question, is that several of the existing roads in Iowa depend very largely for their sustaining revenue upon their service as feeders of the present freight handling steam lines and in order to gain the business they must offer to the shipper low through rates, including the transfer of his products to some destination on the steam railroad lines. It is a question if advantageous rates could be offered by a narrow gage road that would be obliged to transfer the loads between its cars and those of the steam lines, because this transfer cost would necessarily be included in the shipping rate paid by a farmer.

There are undoubtedly many desirable localities as yet unoccupied by rural lines which would return suitable dividends on a type of construction and equipment costing about $8,000 per mile. In some of these localities there may be such natural conditions that a narrow-gage road would not be at a disadvantage, as for instance, if the road had for a terminal a city whose industries demanded the products of the farms along the line, but such conditions are not often found. It would therefore seem that if now or at any future time the transfer of freight between a rural line and a steam line were a factor of substantial gain to the electric railway, and if it were desired to have a property that at all times would be salable and convertible, a light standard gage and not a narrow gage road would best answer the question.

Correspondence.

STEAM RAILROAD COMPETITION.

Editor "Review":

When, as often happens, a steam railway cuts its interurban passenger rates to less amounts than are charged by a competing parallel electric railway it should be the policy of the electric line to preserve its previously established rates of fare, provided these rates are not in excess of 1½ cents per mile. If an electric railway cannot, in spite of competitive rates elsewhere, retain the greater portion of its business on the 1½-cent per mile basis it is without a reason for being; and if rates are cut to one cent per mile or less the volume of business will be greatly increased but the results will be unsatisfactory.

The rates upon the Southwest Missouri Electric Ry. were originally established upon a basis of 1¼ to 1½ cents per mile. The same rates are in effect here now, but there was a period of rate wars in the history of this road during which 10 cents was the maximum fare charged and a ride from Carthage to Galena, 28 miles, could be taken for one dime. After this, during a term of several years, one cent per mile was the regulation fare between any two points.

So after a varied experience with rates and cut rates, I would say that electric railways will not show satisfactory results from operation at fare rates less than 1½ cents per mile (which may be reduced to not less than 1¼ cents per mile on certain classes of tickets), and that these rates should be maintained in the face of adverse rate cutting by competitors. The rates now obtaining here are satisfactory and we have no inclination to increase them.

I quite agree with the argument contained in your editorial in the "Review" for May.

Yours truly,

A. H. Rogers, Pres.,
Webb City, Mo. Southwest Missouri Electric Ry.

ELECTRICALLY OPERATED DRAWBRIDGES.

Editor "Review":

I have read in the "Review" for May, page 332, the very interesting description of the electrical equipment of drawbridges in Australia. I believe it would be of interest to you to know that a bridge equipped with 3-phase induction motors has been in operation since 1903 in St. Petersburg, Russia. The operation of the bridge is controlled from one point by one man and all movements are automatically stopped. The writer installed the electrical equipment and published a description of its construction and mode of operation in the Russian journal Elektrictertva and in the Revue Electrique for May, 1904.

Yours truly,

Pittsburg, Pa. P. Dieny.

New York State Meeting.

At a meeting of the Executive Committee of the Street Railway Association of the State of New York, held May 16th, at Elmira, it was decided to hold the convention on June 27th and 28th, at Lake George, with headquarters at the Fort William Henry Hotel. Messrs. Colvin and Peck were appointed as the Entertainment Committee.

McKinley Syndicate Properties of Northern Illinois. III.

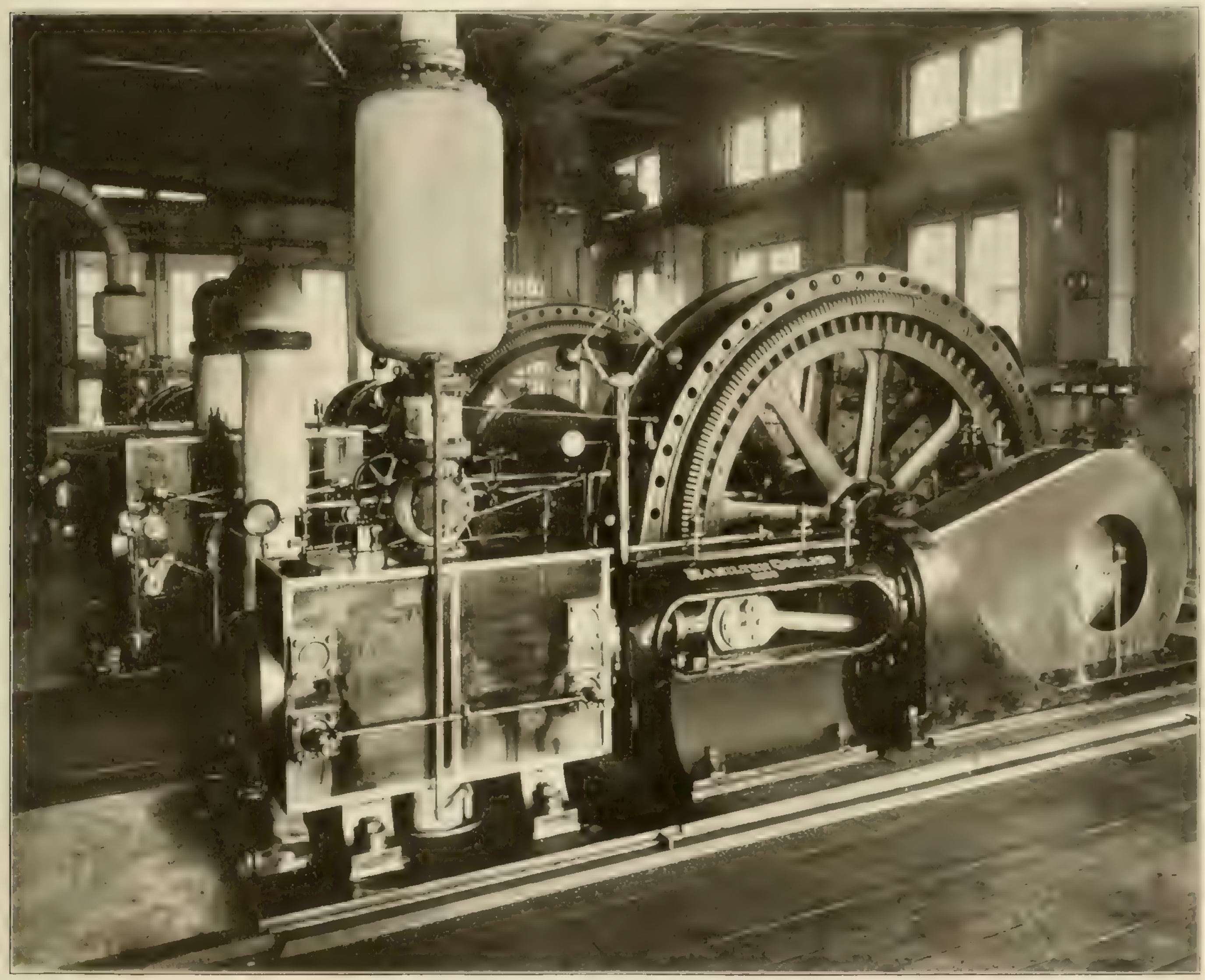
Power Plant of the Galesburg Railway & Light Co.

This installment of the article on the Northern Illinois properties of the McKinley syndicate is a description of a power house recently put in operation at Galesburg, Ill., for supplying both the alternating and direct current used by the street railways in and about Galesburg, and single-phase and three-phase alternating current used in commercial lighting and for power work.

The syndicate properties in Galesburg are incorporated now as three separate companies; Galesburg Electric Motor & Power Co., Galesburg Gas & Electric Light Co., and Galesburg Railway & Light Co. These are managed as one company from the new general office on the Public Sq., but later will all be known as the Galesburg Railway & Light Co.

The local street car system in Galesburg is divided into eight separate lines, operating upon 16 miles of standard suburban and city track. Standard single truck closed cars with two-motor equipments are used on these lines under a headway of about 15 minutes. A line is also operated between the Public Sq. in Galesburg and East Galesburg, where are the immense clayworking and brickmaking plants of the Purington Paving Brick Co., which extend along the trolley tracks for the distance of one mile. The East Galesburg line is about three miles long. The branch [illegible] company's Highland Park, a pleasure resort [illegible] may be seen from the illustration. A 20-minute headway is given East Galesburg, with extra cars for the park service.

An interurban line is operated from the Public Sq. in Galesburg to the town of Knoxville, which has a population of about [illegible] people and is situated five miles southeast of Galesburg. This is a standard single track line built on one side of the public highway for the entire distance between the two towns. An hourly service is maintained.



MAIN GENERATING UNITS, GALESBURG RAILWAY & LIGHT CO.

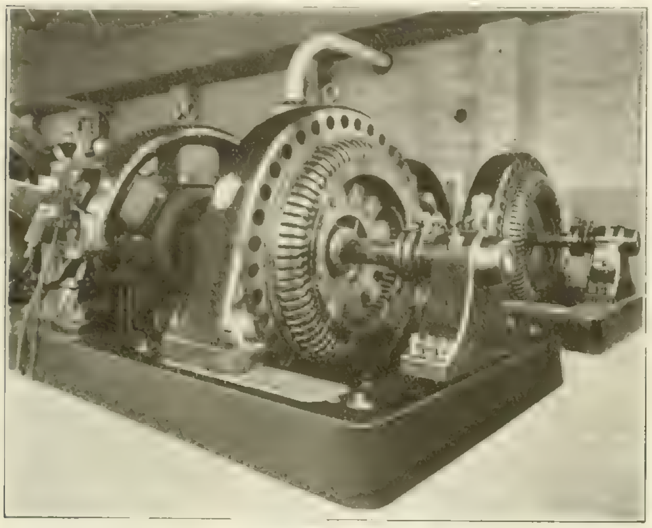
The cars running to East Galesburg and to Knoxville are of a standard double truck type with two-motor equipments and maximum-traction trucks.

The Galesburg Gas & Electric Light Co. owns and operates an extensive commercial electric lighting power distribution system, a central-station heating system and a gas generating plant. This gas plant, located near the center of the city, has a capacity for making and distributing 500,000 cu. ft. of illuminating gas per day.

With the union of these properties as one organization it became imperative that the small, old, separate power stations of the earlier

companies should be discarded and a new plant built which could supply current to the railway, electric light and power circuits and steam to the gas works and the steam heating system. It was also necessary to make provision for supplying three-phase high tension current to a sub-station on the line of the Western Illinois Traction Co., which is now building between Monmouth and Galesburg.

In designing this plant it was desired to make the station simple throughout, to have the apparatus interchangeable in order to assure continuity of service, and to use as few units as possible and still be able to supply the several classes of current desired.



RAILWAY MOTOR GENERATOR SETS

The new power station of the Galesburg Railway & Light Co is adjacent to the gas plant earlier mentioned so that an efficiency by united operation is thus obtained. The walls of the building are constructed of brick, trimmed with cut stone with but little outlay for ornamentation. The exterior dimensions are 126 ft. x 101 ft. A fire wall throughout the entire length of the building divides it into a boiler room 45 x 122 ft. and an engine room 50 x 122 ft. This fire wall is of brick 18 in. thick above the engine room floor. Its foundation is of concrete, as are all the wall and machinery foundations throughout the plant. The engine room has a clear height of 25 ft. 6 in. between the floor and the lattice girders which support the compositions tar and gravel roof covering this part of the building. The appearance of the engine room has been very much brightened by a wainscot of fancy pressed brick which extends around the room and to a height of about 7 ft. above the floor. The basement under the engine room has a clear height of 8 ft. 6 in., it is floored with concrete and that portion of it not occupied by the engine foundations and condensing apparatus has been fitted up as a machine shop and pipe fitting room.

Throughout the building the floors are of concrete placed upon brick arches supported by a floor system of I-beams. As may be seen from the exterior view of the building, provision has been made for very thoroughly lighting all parts of this power plant. The windows and doors are large and unornamented, but well located and supplied with heavy wrought iron fittings. Ventilation is furnished through 14 "Star" ventilators 36 in. in diameter placed in the roof of the building. The building is artificially lighted by 12 enclosed arc lamps and many incandescent lamps hung at convenient points.

The height of the boiler room between the floor and the lower members of the roof trusses is 34 ft. These trusses have an extreme depth of 16 ft. and support a fireproof roof built of tile and covered with tar and gravel. The north wall of the boiler room is parallel to the right of way of the Atchison, Topeka & Santa Fe Ry. over whose tracks are hauled the coal used in this station and the neighboring gas plant. At present the coal is unloaded by hand, being shoveled directly from the cars through suitable openings in the boiler room wall onto the floor in front of the boilers. These openings in the wall are fitted with hinged sheet-steel troughs, which when not in use as coal chutes, fold back into their openings, and serve as fireproof shutters.

As shown in the accompanying vertical section of the plant, a coal conveying system is now in process of construction which, when completed, will carry the fuel to steel bunkers above the boiler fronts from where it will flow to the stokers through gravity chutes. This conveying system feature will also remove the ashes from the pits under the grates. A useful feature which has been incorporated in the design of this conveying system is the small coal hopper placed directly under the front of the traveling grates so that any excess amount of coal falling from the grates as they travel towards the fire box or falling from the hopper which feeds the grates, will be caught below and again carried by the belt conveyor to the coal bunkers above.

The boilers are now supplied with fuel by hand from the coal pile on the boiler room floor. The ash is removed from the hoppers beneath the boilers in a steel push car which runs on a track under the boiler fronts for the entire length of the basement. This car on reaching the end of the track strikes a bumper and automatically trips and dumps the ash through a chute into a hopper outside the building. From this hopper a system of chain buckets elevates and distributes the ash to a storage pile.

The present equipment of boilers comprises four 400-h. p. Stirling boilers, two of which are fitted with Green chain grates driven by a temporary steam engine; the other two are hand fired. Space and foundations have been provided for a future installation of two more similar boilers, and when these are in place an electric motor will be used to drive the shaft which operates the chain grates. Steam is generated at 150 lb. pressure.

The stack has been built to furnish the draft for the ultimate boiler capacity of the station. It is of riveted steel 175 ft. high, with a clear diameter of 9 ft. The interior is lined with fire brick, the first third with a 9-in. wall, the second third with a 6-in. wall and the remaining third with a 4-in. wall. This stack is mounted upon a concrete foundation 24 ft. sq. and 18 ft. deep. Below this concrete foundation, piles were driven to a depth of 22 ft. The fire chambers of the boilers are connected with the stack through a single tapering sheet-steel breeching. Each boiler may have its draft regulated by an individual valve between it and the breeching or the draft for the entire battery may be controlled by a main valve in the breeching

NEW POWER HOUSE, GALESBURG RAILWAY & LIGHT CO.

near the stack. The valve is arranged to form a part of a Locke system of fire regulation, by means of which the rate of travel of the chain grates and the smoke flue opening are properly governed by any change of boiler pressure.

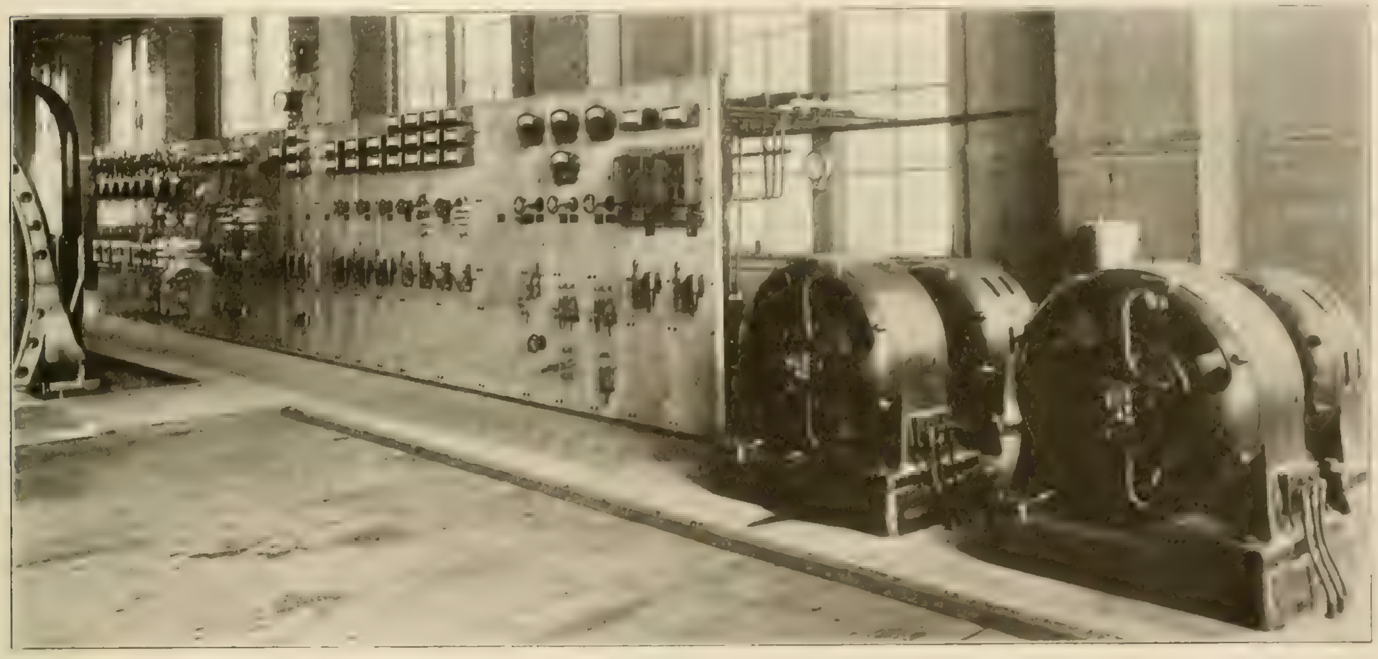
Boiler feed water is now obtained from two deep wells and three more such wells together with a purifying plant will eventually be put in use. This will give a total capacity of 4,000 gallons per hour. The feed water is heated in a Hoppes closed heater and fed to the boilers by two Knowles feed pumps, 12 x 7 x 12 in. and 12 x 6 x 12 in.

in size. The feed water piping system is so arranged that in event of accident feed water may be fed through the [illegible] blow-off main back of the boilers.

The stack, feed pumps, their piping and the apparatus for controlling the steam supply to the heating mains are all located in one end of the boiler room. A 14-in. live steam header extends the length of the boiler room and is divided in its center by a gate valve. Each boiler is connected to the live steam header by long radius piping fitted with Davis automatic stop valves and Chapman gate valves next to the header. The live steam header has six drip taps led off from its lower side to a parallel 2-in. drip main which discharges through a Bundy steam trap into a hot well. This steam header is mounted on steel I-beams spanning the space between the backs of the boilers and the partition wall. From one end of the live steam header a 6-in. auxiliary main is led around the front of the boilers and to the other end of the header. This is the basis of a loop system of live steam feeders for the auxiliary machinery so that in time of trouble the damaged equipment may be isolated and the operation of the remainder of the plant not interfered with.

The design of the piping connections for handling the steam supplied to the city heating mains is a simple one. Steam is distributed about the business and central residence portion of Galesburg in insulated underground pipes built according to the specifications of the Schott system.

The main supply pipe is 22 in. in diameter at the point where it leaves the building. All [illegible] separator. The pressure [illegible] governed by an automatic reducing and regulating valve placed in the main line between the different steam supplies and the oil separator just mentioned. [illegible] diaphragm type. The steam supply fed to the main through this governing valve may be drawn from several sources so that at all times economy of operation can be maintained.



EXCITER SETS AND SWITCHBOARD.

When no engine is running the regulating valve supplies live steam to the heating system direct from the live steam header. During cold weather the generating unit driven by the simple engine is used and its exhaust steam fed through the pressure regulating devices to the heating mains. When the weather is more moderate and therefore a smaller amount of steam required, the heating mains are fed from a tap on the low pressure side of the receiver of the compound engine. This permits of the handling of the load in an economical manner, because the steam not required for the heating system is allowed to do work in the low pressure cylinder and then condensed.

HIGHLAND PARK.

The condensing apparatus is located in the basement nearly under the engine cylinders. An exhaust main extends throughout the length of the building connecting the engines and condensing apparatus with the regulating devices of the central station steam heating system. [illegible]

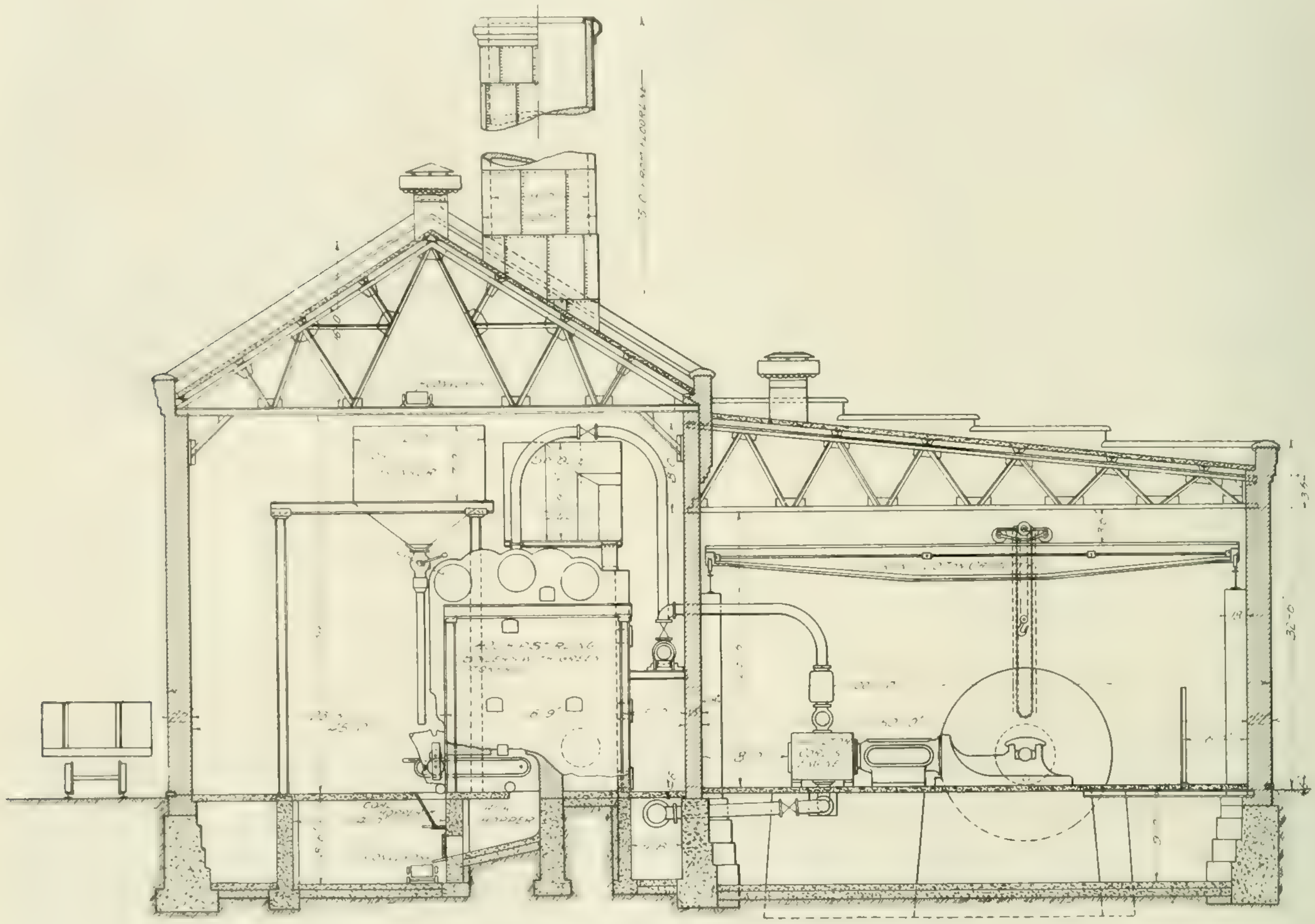
separators to a Wheeler surface condenser of 1,200 h. p. capacity. The tail pumps of this condenser deliver the hot water either to the hot well or to the feedwater heater in the boiler room. Cooling water is circulated by a centrifugal pump of 7,200 gallons per hour capacity. After absorbing the heat in the condenser the water is cooled in a Barnard cooling tower of 1,200 h. p. capacity. The two air fans in this cooling tower are 6 ft. 8 in. in diameter and are driven by a 20-h. p. Bullock direct current motor. This cooling tower is of sheet steel mounted on a concrete foundation at a distance of about 50 ft. from the power plant.

All the high pressure steam piping in this station is extra heavy and covered with magnesia insulating material retained by brass bands. The low pressure piping is covered with asbestos. There is no piping in the engine room except the long radius live steam pipes which pass through the wall direct to the steam separators on the engine.

The two main generating units are revolving-field type alternating rated at 750 h. p. at 1/4 cut-off, 150 lb. admission pressure and 100 r. p. m. Oil is supplied to the cylinders by a force feed system. A complete gravity oiling system for the entire station with an elevated tank and filters will soon be in operation.

Each unit has for its foundation a concrete block of generous proportion extending from the level of the engine room floor to a point where a solid base could be found below the level of the basement floor. Recesses were made in the sides of the foundation at the bottom of the anchor bolt holes so that the lower nuts on the engine and generator anchor bolts are at all times accessible for inspection and adjustment.

There are three exciters for supplying the field current of the main units. One of these exciters is a 200-ampere, 125-volt, 2-pole generator of the General Electric Co.'s make. This machine is mounted on the same base with and direct connected to a single-stage Curtis steam turbine operating non-condensing with 90 lb. steam pressure, at a speed of 3,600 r. p. m. The other two exciters



VERTICAL SECTION, GALESBURG POWER HOUSE.

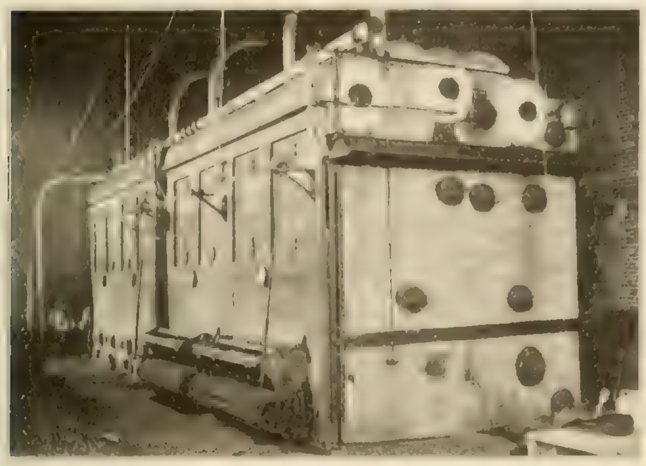
current Bullock generators, each direct connected to a Hamilton-Corliss horizontal engine. Each generator is of 500 kw. capacity furnishing 3-phase, 60-cycle current at 2,300 volts. There is sufficient unoccupied space for the addition of a 1,000-kw. direct connected unit.

The engines for running these generators are not alike, but both are of the Hamilton-Corliss type with valves in the cylinder heads to lessen the clearance. One generator is driven by a simple engine, the other by a cross-compound engine. Steam at 150 lb. boiler pressure is fed to these engines through separators. The simple engine has a 28-in. bore and a stroke of 48 in. The compound engine high pressure cylinder has 20-in. bore and the low pressure cylinder has a 40-in bore. Its stroke is 42 in. Each engine is fitted with an automatic cut-off valve connected to independent ball governors which are set to shut off steam when the speed exceeds a set number of revolutions per minute. The main shafts of both engines have a diameter of 20 in. in the hubs, turned down to 18 in. in the bearings. Each shaft carries a 50-ton fly wheel. The engines are each are each 200-ampere, 125-volt machines direct connected to 45-h. p., 60-cycle induction motors. The turbine driven exciter is placed in one corner of the engine room near the large simple engine. The motor-generator exciter sets are placed at one end of the switchboard.

To furnish direct current for the use of the local street railway system and the interurban lines which are within a direct current feeding radius, two motor generating sets were installed as a part of the power house equipment. These sets are placed side by side and between one end of the station and the simple engine generating unit. Each set is made up of a Bullock 2,300-volt, 3-phase, 60-cycle synchronous motor, coupled to a Bullock 575-volt, 520-ampere direct current generator mounted on the same bed plate. The armatures of these machines revolve at a speed of 600 r. p. m.

The entire electric operation of this station is handled from a switchboard located along the south side of the engine room and on the engine room floor. This board, 40 ft. 8 in. long and 7 ft. 6 in. high, stands with its back to a row of windows so that the wiring

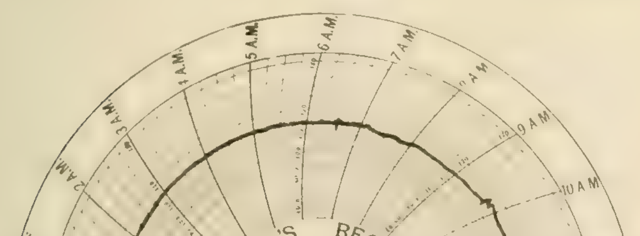
and bus bar connections upon it are well lighted. The board is made up of 26 blue Vermont marble panels mounted in the usual type of angle iron frame. Each of two generator panels has an ammeter on each of the three phases, an indicating wattmeter, [illegible] meter, ammeter on the field, sockets for synchronizing plugs and hand throw main oil switch. There are three exciter panels each with its ammeter, double pole main switch and field rheostat wheel. These three panels are fitted with sockets and plugs so that one voltmeter will serve for the three exciter sets. The panel for the induction motors of the exciter sets have ammeters on the 2,300-volt



STIRLING BOILERS IN POWER HOUSE

side of the two oil-cooled transformers, which reduce the current for the motors from the bus-bar voltage of 2,300 volts to 220 volts. These transformers are mounted in the basement directly below the motor-generator exciter sets. Each of these exciter motor panels also has a hand operated oil-break main switch and a General Electric Type-T A votage regulator. By the use of these regulators is made possible the operation of the incandescent lighting system drawing current from the same generators which supply power for the operation of the street railway.

This device automatically accomplishes this result independently



CARD FROM VOLTMETER ON BUS BARS

of speed changes and variations in load and without the use of a floating storage battery. The regulator operates by opening and closing a shunt circuit across the exciter field rheostat or rheostats, thus keeping the exciter voltage at a point necessary for the maintenance of constant voltage at the bus-bars. The moving parts are very light and vibrate through short distances; thus they can operate at a high rate of speed without any pumping or hunting effect.

[illegible] current control magnet which also takes current for its operation from the same source constitute the direct current portion of the [illegible] The alternating current portion of the regulator consists of a magnet having a potential winding connected by means of a potential transformer to the bus-bars. This magnet also has an adjustable compensating winding which is connected in series with the second- [illegible]

H. E. CHUBBUCK.

[illegible]

counterweight which is balanced by the attraction of the magnet. If an excessive load is thrown on the generator the voltage will tend to drop, the alternating current magnet will weaken and destroy the balance of the core and lever and cause the main contacts to close; this in turn will close the relay contacts and entirely short circuit the exciter field rheostat, thus increasing the exciter voltage until the original balance of the alternating current magnet core and lever is restored and the alternating current voltage maintained at the set point.

These two voltage regulators are interconnected by a set of throw-over switches so that in event of an accident to the apparatus of one panel the regulators may be transposed and continued operation not be impaired. These regulators vary not only the field voltage of the main exciter units but also that of the synchronous motors of the railway motor generator sets. The accompanying voltmeter card shows how successfully this device operates, handling the machine so evenly that no excessive voltages occur even though the same generator carries a load of car motors, commercial lighting and commercial power motors.

The other panels which help to make up the switchboard are briefly described: Three panels are used for controlling the commercial lighting and mixed service. Each of these panels handles one phase as taken from the generator bus-bars and sent out for single-phase use. These three panels are each fitted with a voltmeter, ammeter and handthrow main oil switch. One panel is provided for controlling a three-phase commercial power circuit and one panel for controlling the three-phase circuit of three 110-kw. oil-cooled Bullock transformers which raise the bus-bar potential of 2,300 to 13,500 volts for feeding the transmission line to the substation of the Western Illinois Traction Co. The two panels for the synchronous motors of the railway motor-generator sets are each supplied with an ammeter, power factor indicator, rheostat hand wheel, synchronizing plug sockets and hand-throw main oil switch. The two direct current generator panels for the motor-generator sets are fitted with automatic carbon-break circuit breakers provided with an excess voltage trip. These panels also have astatic ammeters and recording wattmeters. There are six railway feeder panels with 800-ampere circuit breakers similar to those on the generator panels and 1,000-ampere ammeters.

An illuminated dial direct-current voltmeter supported on a swinging bracket at the end of the feeder section serves all the direct current panels. All the alternating current feeder circuit panels and the panels for the synchronous motors of the railway motor generator sets have combined with their hand-throw main oiled switches an automatic trip for protecting the generating apparatus against

[illegible] panels. Reverse relays are also provided for the synchronous motor and step-up transformer feeder panels. A General Electric synchronism indicator with lamps and pointer is mounted on an ornamental bracket above the center panel of the board. There are three blank panels provided for future additions. This switchboard and its instruments and wiring are all of the General Electric Co's. make.

The 2,300-volt bus-bars back of the board are wrapped with cord, painted and supported on porcelain insulators mounted on pipe racks. The exciter bus-bars are bare and are also mounted on insulators supported by piping. The outgoing lines from the station are all insulated wire and supported by vertical racks fastened to the brick walls of the building. These lines are protected by standard lightning arresters and each lighting feeder and generator has a recording wattmeter mounted on the back of its respective panel.

This power station was completed and first began carrying its total varied load at the beginning of the present year.

This power plant and its many unique details were designed by and constructed under the direction of Mr. H. E. Chubbuck, general manager of the McKinley Syndicate properties in northern Illinois.

The officers of the several Galesburg properties mentioned in this article are: George F. Duncan, president; William B. McKinley, vice-president; Edward Woodman, secretary and treasurer; H. E. Chubbuck, general manager; R. A. McLaughlin, general superintendent; F. C. Duncan, assistant secretary and treasurer; D. G. Wallace, chief engineer of power house.

Smoke and Its Abatement.*

BY CHAS. H. BENJAMIN, CLEVELAND, O.

The fact might as well be recognized at once that the supply of so-called smokeless fuels, anthracite coal, petroleum, natural gas, etc., is limited and will not begin to satisfy the demand. The supply of bituminous coal, on the other hand, is practically unlimited, and it is doubtless the fuel of the future. The abundance of it, its cheapness and the readiness with which it burns, even with a poor draft, combine to make it a most desirable fuel.

It will be well at the outset to state three propositions: a. The smoke from bituminous coal is a nuisance, especially in large cities. b. Such smoke can in the majority of cases be easily abated. c. Such abatement can be made a source of profit to the owner of the plant as well as to the community.

Objectionable black smoke is due to the presence of hydrocarbons in the fuel and is produced as follows: The hydrogen and carbon compounds in the coal are driven off as gas by the heat at a comparatively low temperature, and may escape unburned. In this condition they would not constitute smoke in the common sense of the term. If heated to a sufficiently high temperature in the presence of air they burn with a yellow flame. If the air supply is insufficient, is poorly mixed with gas, or if the temperature is lowered in any way, combustion is checked and carbon is deposited in the form of soot or carried off with the gas as smoke.

I cannot illustrate this better than by quoting from a paper read last year before the American Association for the Advancement of Science:

"The combustion of hydrocarbons seems to be always complete at first. If one watches the slow burning of a lump of cannel in the open grate he will see a whitish or yellowish vapor expelled from the coal by the gradual heat of the fire. This is the carbon and hydrogen combined which is distilled by the heat and leaves behind the free carbon as coke. While the escape of this vapor unburned represents a distinct loss of heat, the vapor is not smoke as we understand it. It does not deposit soot and will not stain or disfigure surfaces in its path.

"As the heat increases, and air is supplied, the vapor ignites and burns with a yellow flame showing the presence of solid particles. If the temperature remains high and the air supply continues, the combustion is complete and the colorless carbon dioxide and water vapor pass up the chimney. If, however, the burning gas becomes chilled by contact with the relatively cool bricks of the chimney back or if insufficient air is supplied, the yellow flame becomes red and dingy, while particles of finely divided carbon are deposited on the adjacent surfaces or whirled away up the chimney.

"The ordinary coal-oil lamp is one of the best illustrations of perfect combustion and consequent smoke prevention. The heated gases rising in the chimney produce a draft and fresh air is continually drawn in at the bottom through the hot gauze which warms and divides it so as to insure thorough mixing with the gases from the burning oil. Turn up the wick and the flame becomes smoky—too much hydrocarbon for the air supply. Raise the chimney slightly from the bottom and again there is smoke—too much air at too low a temperature which chills the flame. Insert a cool metal rod into the chimney and soot is deposited on it—chilling of the flame again and disengagement of the carbon, while the hydrogen continues to burn.

"And thus we may learn of the three requisites for good combustion; enough air, a sustained high temperature and a thorough mixing of the gases. The last two are so important that it is entirely possible to have an excessive supply of air and dense black smoke at the same time."

It is difficult to form any estimate of the amount of damage inflicted by soft coal smoke in a city like Pittsburg or Cleveland, but it probably amounts to hundreds of thousands of dollars annually.

In law a nuisance is "such a use of property or such a course of conduct as, irrespective of actual trespass against others or of malicious or actual criminal intent, transgresses the just restrictions upon use or conduct which the proximity of other persons or property in civilized communities imposes upon what would otherwise be rightful freedom." (Century Dictionary.)

Smoke is then a nuisance and can be prohibited by State or municipal enactment as the case may be.

I have no more right to deluge my neighbor's premises with soot than I have to empty my garbage can over the fence line.

The abatement of smoke is in principle extremely simple, but presents some difficulties in the practical application.

Only three conditions are necessary for complete combustion, the proper temperature, the proper air supply, a thorough mixing of the air and the hydrocarbons.

The last condition is as important as any and is one too often neglected. It is this condition which gives the gas or liquid hydrocarbon an advantage over the solid, since the atomizing of the former by the steam or air jet insures the most intimate contact between the air and the fuel.

The use of pulverized coal in combination with air or steam is a close approximation to the above, and, when properly managed, gives good combustion, no smoke and a high efficiency. The cost of pulverizing and the impracticability of storing pulverized fuel have so far hindered the more general adoption of this process, except for metallurgical work.

When coal in the ordinary form is used as a fuel, smoke abatement involves some means of varying the coal supply and the air supply according to the demands made upon the boiler. When ordinary hand firing is resorted to, the great irregularity of the coal supply will cause poor combustion and smoke unless the air supply is varied to correspond. Steam jets are frequently employed under these circumstances, and, if properly put in, will improve the combustion by drawing in additional air over the grate and mixing it with the products of combustion in front of the bridge wall. The steam jet should be semi-automatic, the steam and air being turned on by the opening of the fire door and gradually closed off by a dash-pot attachment.

The best solution of the smoke problem, so far, has come from the introduction of mechanical means of handling the coal, which give a uniform feed to the fuel and a corresponding delivery of air for combustion. The use of mechanical stokers has been brought about by the natural demand for machine handling in large power plants as more economical than human labor, rather than by a philanthropic desire to benefit the community.

It has been estimated that one able-bodied man with a shovel and slice-bar can take care of 200 h. p. of boilers. With good mechanical stokers he can handle double, and with complete coal and ash-handling equipment three times this amount.

Stokers may be divided into three principal classes: Inclined shaking grates—traveling or chain gates—and underfeed stokers.

The inclined grate, as exemplified in the Wilkinson, Brightman and Roney stokers, has a hopper in front and slopes down and

*Abstract of paper read before the American Society of Mechanical Engineers, Scranton, Pa., June, 1905.

back, having a clinker grate just in front of the bridge wall, while the double incline, as in the Murphy and Detroit stokers, has a magazine on either side and slopes in two planes parallel to the axis of the boiler, meeting in a clinker grate at the bottom. The principle of action is practically the same and involves the slow coking of the coal on a dead-plate, the pushing forward on to the top of the incline and the gradual descent, impelled by oscillation of the grate bars, until the combustion has left nothing but ash and clinker at the bottom. Air is usually admitted both below and above the grate, and the hydrocarbons which are distilled at the top of the grates pass through the intense heat of the burning coke on their way to the bridge wall and are completely burned. The double incline usually has a revolving clinker bar which disposes of some of the ash automatically, but as a rule both forms need considerable cleaning.

When used with a fuel which does not cake or clinker too much and when not crowded too hard these stokers are economical and reduce the smoke considerably.

If, however, it becomes necessary to slice and poke the fire on account of caking coal or overcrowded boilers, unburned masses of coal are rolled to the bottom and holes are made in the fire through which cold air rushes. Both of these circumstances make for poor combustion and a smoky fire. As a rule firemen poke the fire on stokers too much, doing more harm than good.

I have seen inclined grate stokers, carrying a heavy fire and developing much more than the rated capacity of the boiler with very little slicing and hardly a trace of smoke. Cleaning is usually a source of black smoke for a few minutes, but this is mostly unnecessary if the fireman understands his business and get his fire ready for cleaning beforehand. I think the middle door in the Murphy furnace is sometimes a disadvantage, as it tempts the fireman to meddle with the fire when he had much better leave it alone.

The traveling or chain grate is rapidly coming into favor as a means of stoking automatically. It consists, as in the Babcock & Wilcox and Green stokers, of an endless horizontal chain running on sprocket wheels and carrying the coal back under the boiler, finally dumping the refuse over the back and into the ash-pit. The distilling process and the gradual burning of the coke are much the same as in the stokers just described. In order to prevent waste through the grates the latter are usually quite close, and it becomes necessary to use more draft than with ordinary grates.

A damper is used underneath the grate to prevent an excess of air from passing up behind the grate. Some tests recently made by a large corporation which uses a considerable number of the chain grates showed an evaporation of only 5.7 lb. of water per pound of coal. An examination disclosed the fact that a large excess of air was passing through the comparatively bare grate at the rear end. The introduction of a damper to regulate this brought about a great improvement.

With the same fuel and same conditions as before an evaporation of 8 lbs. of water per pound of coal was obtained.

Intending users of chain grates would do well to bear this in mind.

From observations covering a period of several years I have come to the conclusion that this type of grate is the best one yet devised for abating smoke.

The fact that it is horizontal, so that unburned coal cannot run to the rear end, and the further fact that it is self-cleaning and need not be disturbed by the slicebar, make it an almost ideal furnace in this respect. If run by an intelligent fireman who understands adapting the depth and travel of the fire to the work to be done, it will also be a very economical furnace.

The underfeed stokers operate on an entirely different principle, the coal being fed in underneath the grate and forced up through a rectangular opening in the center. A forced blast is used and the air for combustion is blown up through the coal, the tuyeres being on either side of the rectangular opening just mentioned. By this arrangement the fresh coal is always underneath and the distilled gases are obliged to pass through an incandescent mass of fuel in company with the air. With a proper pressure of blast perfect combustion is thus almost unavoidable. The ash and clinker are now at the top of the fuel, which forms a gradually rising mound in the center and pushes the clinker over to either side, whence it is removed by hooks through doors at the front. The heat generated is [illegible] sheet of clinker which can be [illegible] fire.

In the American stoker the coal is forced under the grate and up by a revolving screw, somewhat similar in shape to the ordinary gimlet pointed lag screw.

In the Jones underfeed stoker a plunger driven by steam operates to feed the coal. This plunger can be arranged to start and stop by hand or to run [illegible].

My experience has shown the underfeed stoker to be economical in operation and practically smokeless.

A criticism frequently made in regard to mechanical stokers is that they will not respond quickly to sudden changes in the load, that it is difficult to keep a uniform steam-pressure under such circumstances, and that for this reason they are not economical. There is some truth in this. It is easy to conceive of circumstances, especially in electric plants, under which it would be difficult to maintain a uniform steam pressure with either the oscillating or the traveling grate. For regular fluctuation of load, as in electric lighting or railway power-houses, the obvious remedy is the introduction of storage batteries and the provision for ample boiler reserve.

Minor fluctuations can be taken care of by the fireman unless they become too numerous or too violent. In the latter case the underfeed stoker with the plunger feed comes the nearest to satisfying the demand. With the power of instantly regulating the motion of the plunger and the pressure of the blast, it is thus possible to meet emergencies of this kind more promptly than by hand firing.

With the complaint sometimes made that stokers cannot be forced I have no sympathy. With an ordinary inclined grate stoker under a horizontal tubular boiler, I have forced a boiler to 75 per cent above its rating with practically no smoke and with an evaporation of over 8 lb. of water per pound of bituminous slack. It all depends upon the draft and upon the intelligence of the fireman.

Probably, however, none of us believe in forcing a boiler to this extent; it is bad for the boiler, bad for the stoker and bad for the coal pile.

The economy resulting from the abatement of smoke is naturally a potent argument in its favor. This phase of the subject has, however, but little to do with the ethics of the question. Once prove that it is practicable to abate smoke and the community has a right to insist on its abatement regardless of economical considerations.

Fortunately this difficulty does not exist in most cases, for it may be stated as a general proposition that smoke abatement means economy in fuel consumption. The proof of this statement is extremely simple; fuel economy results from good combustion; good combustion is accompanied by little visible smoke.

It must be remembered that the converse is not necessarily true, for a smokeless chimney does not always mean good economy. An excess of air may insure entire oxidation of the combustible matter and at the same time so dilute the chimney gases as to cause serious waste of heat.

The problem to be studied by the manufacturer should be how to obtain the most perfect combustion of the particular fuel which he uses and then the smoke question will take care of itself. Let him make frequent analyses of chimney gases, compare different pressures of draft and different dispositions of dampers and he will be repaid for his trouble in more ways than one. Personally I believe in the automatic stoker as the most economical solution of the problem.

In forming this opinion I do not rely upon expert tests for efficiency; there are so many variables entering into the question that it is difficult to make accurate comparisons in this way. As it is entirely possible to improve the efficiency of a furnace 10 or 15 per cent by intelligent hand firing, there is much difficulty in determining the actual saving effected by a stoker. During a competitive test between the hand-fired furnace and the stoker the conditions are often entirely different from those obtaining in every-day use, and these changed conditions are usually more to the advantage of the hand firing. By this I mean that good hand firing is the exception rather than the rule, on account of the dirty, disagreeable nature of the work and the low grade of help employed.

With the introduction of mechanical handling there is a reduction in the quantity of manual labor and there should be an im-

provement in its quality. Manufacturers should understand that if they expect to get the benefit of improved [illegible], they must have men competent to run it to the best advantage.

The surest method of determining the relative economy of the two methods is by comparing the coal bills before and after the change, making due allowance for any variation in the work done. This has been done in a number of instances to my knowledge and the result has always been favorable to the stoker. About a year ago I addressed letters to a number of business men and manufacturers who have installed mechanical stokers of various sorts in factories and office buildings, asking for information as to the value as smoke-abating devices of the particular stokers used, and as to the fuel economy and the cost of repairs.

The replies in every case were favorable to the stoker, both as regards smoke abatement and as regards general efficiency. There are in the city of Cleveland 15 large office buildings, ranging from 8 to 18 stories in height, which have mechanical stokers in connection with their power and heating plants. It is doubtful if any such building will be erected in Cleveland in the future without an equipment of this sort.

One manager of a 10-story office building writes that he has three 200-h. p. stokers which have been in use for four years burning slack coal, and that the only repairs have been the replacing of brick linings as a total expense for the four years of only $50.

An extract from another letter is as follows: "The stokers cost approximately $1,500. The annual saving of fuel is $550."

Personal letters from well-known business men in Cleveland testify to a saving in fuel varying from 15 to 25 per cent.

For the benefit of those who rely largely upon expert tests for their opinions, I introduce a summary of several such tests which have come under my personal observation.

No.	Kind of Boiler.	Kind of Stoker.	Boiler H. P. Rated.	Boiler H. P. Developed	Kind of Coal	Per Cent of Ash.	Evaporation from and at 212 Per Lb Dry Coal.	Evaporation from and at 212 Per Lb Combustible
1	Return Tubular	Murphy	1670	2241	Slack	20 0	7.78	9.71
2	" "	"	1670	2046	"	12.9	8.88	10.14
3	" "	"	2087	1923	"	13.3	8 07	9.31
4	" "	"	175	232	"	19.0	9 75	12.
5	" "	Jones Underfeed	100	216	"	14.6	9.07	10.62
6	" "	Hand Firing	100	193	"	13.7	6 71	7.78
7	Scotch	Jones Underfeed	....	232	"	8.67	7.68	8.42
8	"	Hand Firing	..	170	Run of Mine	14.31	6.86	7 99
9	B and W.	Chain Grate	600	852	Slack	13.1	10.08	11.60
10	" " "	" "	100	115	"	19.4	6.39	7 94
11	Return Tubular	" "	125	179	"	17.5	10.35	12 56
12	" "	Hand Firing	125	134	Run of Mine	12.	7.8	8 76

Tests 1 and 2 show the improvement made by more careful handling of the stokers, while 2 and 3 illustrate the advantage of overloading rather than underloading the plant.

In test 2 only 12 boilers were used and in test 3 the number was increased to 15, the load being nearly the same. The poor showing in test 1 was due principally to waste of coal in the ash.

Tests 5 and 6 show the improved results from stokers as compared with hand firing under a heavy overload, while Nos. 7 and 8 give the results of similar tests on Scotch boilers. No. 9 was an acceptance test for a city plant, conducted by trustworthy and experienced engineers.

No. 10 is introduced to show how not to do it. Not only is the ash high, showing poor judgment in running the stoker, but actual measurement proved the air supply to be excessive, about 350 cu. ft. per pound of coal burned.

With induced draft such as was used in this test, it should be possible to get along with from 200 to 250 cu. ft. of air per pound of coal. Tests 11 and 12 show the possibility of carrying an overload with a chain grate, using a poor quality of coal and getting better results than could be obtained with a better quality of coal hand fired.

If I have said little in this paper about means for smoke abatement other than stokers, it is because I believe that the stoker is the best remedy where it can be used, and it should always be adopted in new power plants.

Whenever for any sufficient reason the stoker can not be introduced, there are other devices which will mitigate the smoke nuisance considerably and also save fuel. The steam and air blast has already been mentioned. A recent improvement which promises well is the combination of steam jets at the bridge wall with oil vapor, creating an intense heat at that point and consuming the hydrocarbons as they pass through. The expenditure of oil is comparatively small and considerable economy is said to result.

Brick arches and baffle walls have also assisted in maintaining a high temperature and in properly mixing the gases. The use of a reverberatory furnace or outside oven in which the coal and its gases are thoroughly burned before going to the boiler is another satisfactory method of reducing smoke, and may be used as well with as without a stoker.

In short, whatever produces good combustion abates smoke. In apartment houses and stores where the boilers are used for heating only and the steam pressure is low, the use of fuels which are comparatively smokeless is about the only satisfactory solution.

If the use of such fuels is supplemented by intelligent and careful firing, the results will be reasonably satisfactory.

In closing I wish to call attention briefly to the legal aspect of the question, although this may not interest engineers as much as does the scientific aspect. I believe that the municipalities have a right to insist upon the abatement of black smoke by all users of steam boilers, without regard to the purposes for which the steam is used or the means to be adopted for abatement. This, because smoke is a public nuisance and because it can be abated without hardship to the owner of the plant. Nevertheless, when the evil is present and has been present for a period of years, it is not good policy to be too radical in the enforcement of the statutes. The law should be definite and stringent and the penalties adequate, but they should be enforced with discretion by officials who have some technical and practical knowledge of smoke abatement.

It is absurd to talk of putting this matter into the hands of the police or of the health officer. The official having charge of this work should be a trained engineer, if possible a technically educated man, and he should be entirely above graft in any of its disguises.

As a rule, very little attention should be paid to complaints, since they are usually inspired by prejudice and neighborhood jealousy rather than by any knowledge of the actual conditions. The inspector should be in a position to know the condition and characteristics of each chimney, and these should be determined by systematic observations made by a trained assistant.

The observations should be made each five minutes and should cover all the time during which the chimney is visible.

To summarize the facts and principles of smoke abatement, I would repeat:

(1) Black smoke is a public nuisance and should be regulated by legal means.

(2) It is a result of imperfect combustion and can be largely abated by proper methods of stoking.

(3) Mechanical stokers offer the best means of accomplishing this result, in medium-sized or large plants.

(4) As smoke abatement is a result of better combustion, economy of fuel is the natural and obvious result.

To these I would like to add one more, a principle which is common to all reforms:

(5) An educated and intelligent public sentiment must be the moving and compelling force, without which mechanical devices and legal enactments will both fail.

Limited Service Between Rochester and Geneva, N. Y.

On May 1, 1905, a limited train service was instituted on the Rochester & Eastern Rapid Ry. between Rochester and Geneva, N. Y., a distance of 44 miles. Five limited trains, called the "Orange Limiteds," run each way daily, making only three stops, and the run is made in 1 hour and 45 minutes, which is less than the schedule time of the fastest train on the competing steam line. The cars used on these trains have been renovated and interiors re-decorated. All forms of regular tickets and mileage are good, but in addition each passenger is required to present a limited train ticket, costing 10 cents, irrespective of distance. These trains, notwithstanding the short time they have been in operation, are being liberally patronized, and their success is assured.

Piping and Power Station Systems. VII.*

By WILLIAM L. MORRIS, M. E.

Blow Off Piping

A blow-off system is the next to be studied, and although this may seem but a minor matter, if it is not properly laid out it may be a major torment. A blow-off system is primarily introduced for the purpose of removing the water and precipitation from the lower parts of the boilers, economizers and similar parts of the general system. The difficulties to be overcome in a blow-off system are the sudden changes in temperature with their attendant expansion and contraction stresses, the providing of a means for liberating the vapors and reducing the temperature of the blow-off water before it reaches the sewer, and finally the providing for the repairing of underground work which must be left free to expand and contract. Fig. 45 shows a blow-off system for the proposed station. The blow-off cisterns should be located about fifty feet from the building and the system should be operative with the use of one basin only, because the other may be used for an intake as shown in Fig. 22.

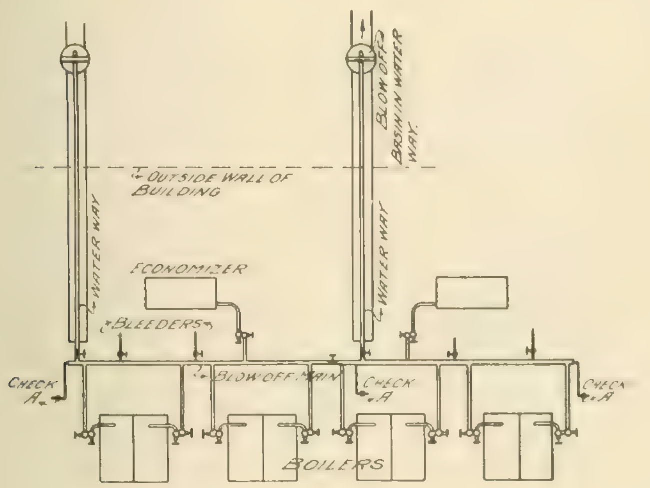


FIG. 45

The underside of the partition and the bottom of the cistern should be about six inches, and four feet, respectively, below the bottom of the water way, with the blow-off pipe pointed towards but not carried into the water way. The different blow-off lines should be free to move longitudinally or transversely, and the ends at the cistern should be passed through a metal sleeve which will permit free expansion. It is safe to say that a blow-off line keeps moving continually. If trouble is to be averted the branches to the boilers must be long. There is less trouble from water-hammer in pipes if the discharge end is above the water line, otherwise, the water at boiler temperature expands to steam which drives the water out of the line, then, as soon as the valve is shut, this steam condenses and draws the water back into the pipe in "slugs." When these slugs strike the bends in the pipe line the sides of the fittings are often broken. The strains produced by water-hammer are wholly distinct and foreign to the pressure carried in the pipe, in fact, a line open to atmosphere can be damaged greatly by water-hammer. The writer has knowledge of a 14-in. exhaust elbow, about ⅝ in. thickness of metal, which had its entire side broken out by water-hammer, the strain being much the same as though a man had struck the fitting with a sledge of the same weight and moving at the same velocity as the water.

If it is necessary to place the end of the blow-off discharge below the water, then check valves, marked A in Fig. 45, should be placed in the line to break the vacuum formed. These checks should be placed above the main. Air cushions could be used to [illegible] when shifting the discharge outlet from one cistern to the other. Check valves are inexpensive and reduce the back water flow very materially by filling the main with air, thus causing an air cushion, and it is a good plan to place [illegible] though the main discharges are above the water, but such valves may be of somewhat smaller size.

While washing a boiler through the blow-off valve, this valve must necessarily be left open. For this reason, two blow-off valves for each boiler are shown in Fig. 45, and with this arrangement the valve farthest from the boiler can be used to shut off the main when the boiler is being cleaned. The center piece of the valve close to the boiler meanwhile can be removed, thus allowing the

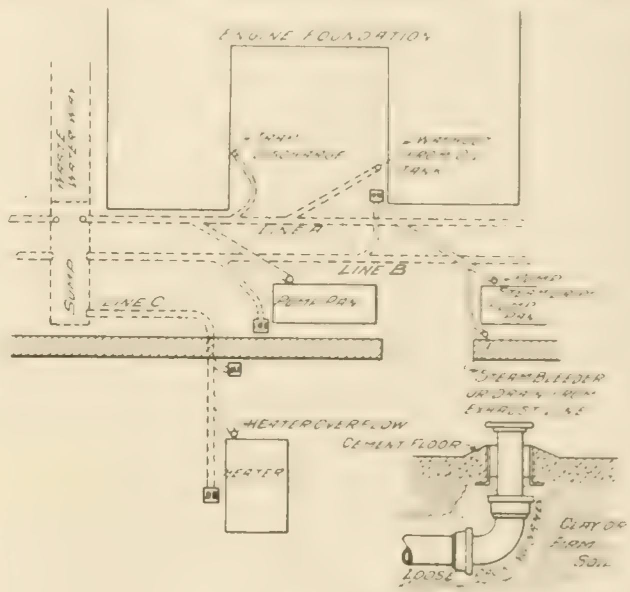


FIG. 46.

wash-water to flow to the sewer instead of to the blow-off main. This arrangement avoids the possibility of a fireman blowing off his boiler and thus scalding a boiler cleaner who at the same time may be working on the other boiler, and it has the added advantage that by keeping the wash-water out of the blow-off there is less liability of this valve becoming blocked with scale. In case the outer operating valve leaks, the inner valve may be closed and the outer valve repaired while the pressure is on. Details of valves arranged for washout and also details of the blow-off cistern will be given later.

The branches from the blow-off main to the boiler must have ample length of pipe in them to allow for expansion and contraction. The blow-off for the problem station would be about 175 ft. long and at extreme temperatures would differ in length about 4 in., but by anchoring this main at the center, either end would travel only about 2 in. It is a very common practice to run short, stiff boiler connections to the blow-off main. This is often a source of trouble because 2 in. of movement at the end of the main require at least 12 ft. of 2½-in. pipe for the boiler branch in order to provide a safe swing.

It may be desired to run the water column drains into a large funnel and pipe the funnel to the boiler blow-off branch, tapping in between the blow-off valves and blow-off main. In order to prevent the blow-off backing through the funnel there should be a check valve in the pipe leading away from the funnel. If the funnels are

placed at each boiler, it will not be necessary to provide vacuum-breaking checks in the main because the eight funnel drain checks will serve the same purpose.

In blowing off the economizer care should be taken that the valves are operated to suit the control of the feed pump because if the pump is controlled by feed pressure, time should be given it to increase in speed and so, by the valve being opened slowly, maintain the pressure on the economizer. Located within sight of the operator of the economizer blow-off, there should be a gage with a three-way cock; one pressure pipe running to the header and the

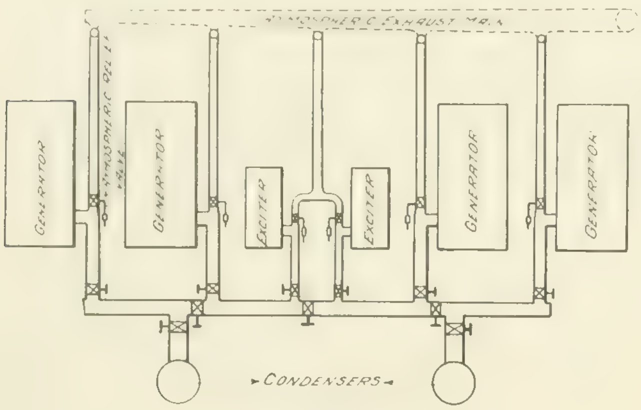


FIG. 47

other to the top of the economizer. The operator can note the steam pressure, then throw the cock to the economizer pressure and, while blowing, not allow the pressure to drop below a point which will cause the economizer to generate steam, which pressure can be determined by observing the temperature of the water. This is one of the most delicate features of economizer operation. The feed pump cannot ordinarily supply water as fast as it can be blown off, so when closing the blow-off, the operator should note the pressure and by closing the valve slowly, give the pump time to slow down under its own control. Closing the blow-off quickly while the pump is working at high speed will throw excessive pressures and strains on the economizer.

The method of blowing off an economizer should be well understood and carefully followed to avoid serious losses due to breaking

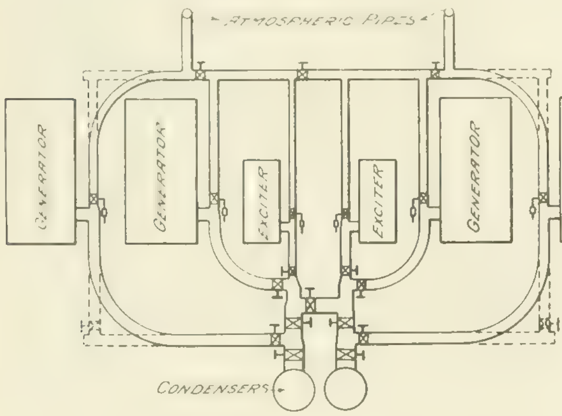


FIG. 48.

economizer tubes or headers. For instance, let it be assumed that the plant has been worked hard and the feed to the economizer is taken from the hot well or small heater, the gas temperature being high and the economizer very warm. Now, if the economizer is blown off under these conditions, there will be a very sudden change of pressure and a great possibility of cracking the economizer tubes. The correct method of operation is to go down the line of boilers and blow them off one by one, allowing the pump to run at a high speed, and by the time the boilers are filled again the economizer will be cooled to such an extent that the incoming water will not subject it to very severe strains and, as the temperature is down, the blow-off can now be opened, allowing the economizer pressure to drop to a low point without making steam. If steam is generated, the condensation of this steam causes water-hammer, which is always productive of trouble wherever it occurs. An economizer can give very good or bad results, being dependent entirely upon its design, system of installation and operation.

The blow-off cisterns should have a large open grating at the top to allow the escape of steam, and if this cistern be close to or in the building, it should be supplied with a very large pipe to carry off the steam. The sewer connection should have a deep water seal to prevent steam from blowing into the sewer. Water, leaving the boilers at 160-lb. pressure, will vaporize 1 lb. out of every 7½ lb. blown off. This makes 3½ cu. ft. of steam for each pound of blow-off water, or 210 times as much volume of steam passing out of

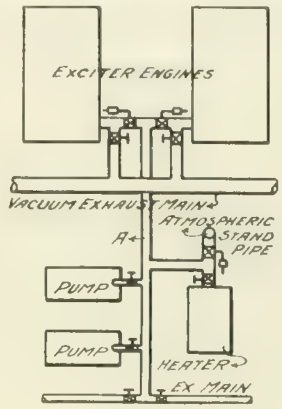


FIG. 49

the top of the blow-off cistern as there is water passing through the sewer. During a blow-off period there will not ordinarily be blown off more than 75 lb. of water per second and 10 lb. of this will be in the form of steam. The atmospheric exhausts for engines are generally arranged with a capacity of about 4 lb. per second per square foot of sectional area. This requires a vent pipe having not less than 2½ sq. ft. cross sectional area for an engine, but since this flow is steady, we can make the pipe of about 1¼ sq. ft. cross sectional area or the diameter of the vent pipe would be approximately 16 in. In case the blow-off cistern is very large, the water in it may then have time to cool and so there will not be as much vapor as just stated. This, however, would help matters only a portion of the time, because, when a second boiler is being blown off, immediately following the first, the blow off will meet water which is of such a temperature that it will not take up any heat without vapor-

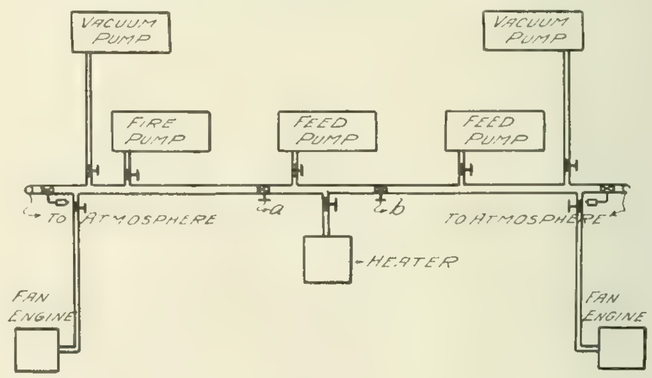


FIG. 50.

izing and then the full amount of vapor will be formed. The chief object in retaining the water in the cistern is to break up the force of the discharge and thus avoid cutting a hole in the cistern by the disintegrating action of the water of high temperature, being directed at one point.

It may be found desirable to provide for taking care of still other drains in preference to discharging them into the sewer, such as the high temperature low-pressure drips from exhaust lines, intermediate service, heater overflow, washout for oil tanks, etc. Since these drains are located at low level, it would hardly be possible to keep them above the floor without their becoming an obstruction in the engine room. These lines should be made of heavy cast iron soil pipe with the joints well calked and laid in and filled around with sand so that expansion and contraction may take place freely without damaging the calked joints.

A mixed system for taking care of these other drips is shown in

Fig. 46; line A takes receiver drips, [illegible] washout. No catch basins are connected to the line [illegible] the question of expansion and contraction would be difficult to arrange for where the lines enter the basins. The line and branches are of iron pipe, calked, and since there would be considerable vapor if any connections were left open, the entire line is made tight and the discharge is dropped into a sump at the bottom of the waste water way. The elbows of this line should be arranged

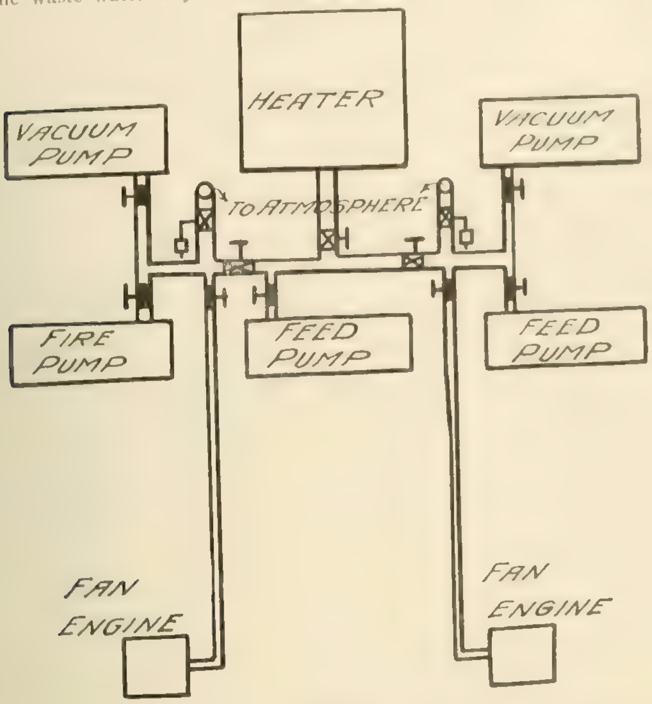


FIG. 51

as shown in Fig. 46, so that they may expand without trouble at the joints or at the floor. Line B is a regular floor drain and may be of sewer tile and arranged to discharge into the waste water way. Line C is of cast iron pipe but, as it is not subjected to very high temperatures, about 170 degrees at the most, the catch basin and drain connections are made into this line. Very little oil passes through this line and a loose joint is not a serious matter. There is no essential reason for duplicating or cross connecting this class of mains, not because they are unimportant, but because they are not under pressure and so can be discharged directly on the engine room floor until any necessary repair is made. Wherever possible, an open gutter should be run alongside of the wall, because such drains can easily be cleaned without interfering in the least with operation. The details of such a gutter will be shown later.

Exhaust Piping.

The next division of the subject which will be taken up is that describing the main engine exhaust lines. In Fig. 10 is shown the general arrangement of the proposed station. The arrangement of the condensers is illustrated by Fig. 22. The problem now in hand is the carrying away of the exhaust steam for 6 engines and 2 condensers, realizing that there must always be in operation 3 large engines, 1 condenser and 1 exciter engine.

An arrangement of the exhaust piping which meets the conditions of the problem is illustrated in Fig. 47. These connections permit the repairing of any portion of the vacuum main or branches without necessitating the shutting down of more than one large unit, and always allowing one exciter engine to be run. The atmospheric exhaust main is shown on the drawing by dotted lines and would not ordinarily be used. The use of one large exhaust main for regular operation of several engines is not as economical in first cost, nor as safe to operate with, as individual atmospheric exhaust lines. A method of laying out a large atmospheric main, which would be accessible for repairs at all times, and which would neither furnish a chance for the engine to lose its vacuum nor injure a man by exhausing onto him, is illustrated in Fig. 48. If the connections were all led into the large main without provision being made for dividing this main into sections, the probabilities are that in case of repairs being necessary on the main branches or atmospheric valves, a shut down would be necessary.

[illegible] station down [illegible] down for several days, if necessary, and the rest of the machinery care for the regular operation, let this idea still remain foremost. Then Fig. 48 is the best piping system for the exhaust mains, and if desired the condensers may be located in the center of the station [illegible] tion of the [illegible] never be used if there is the least possibility of additions ever being made to the station. A better method would be to finish the ends of all lines running lengthwise of the plant with T's having [illegible] by the [illegible]

The next subject to be considered is the exhaust piping for the auxiliary machinery. It is not unusual to find the auxiliaries piped with double connections, so that they may be run either condensing or non-condensing, and exciter engines are also arranged so that they may [illegible] flexible or economical. Consider, for instance, the proposed station: The auxiliaries in this station are the steam pumps, two of which are required to do quite light work, an air pump which uses steam economically and the compound fan engines, which are also economical machines. The heaters taking steam from these auxiliaries will, by taking water from the hot well at about 95°, raise its temperature to 170° or 180°. In this station, in addition to exciting the main generators, the exciter unit would be called upon to furnish current for all the electrical requirements of the station, such as lighting system, circulating pump, motors, air compressor, blast fan for transformers, crane, coal handling machinery and for motor driven tools in the adjacent shop. Thus it is seen that the exciter engine would carry more load and so deliver more exhaust steam than the heater could condense, which would allow much of the steam to waste to atmosphere. This plant will use economizers, and so there will not be much advantage in delivering high temperature water from the heaters to the economizers, because the economizers will raise water more degrees in temperature when

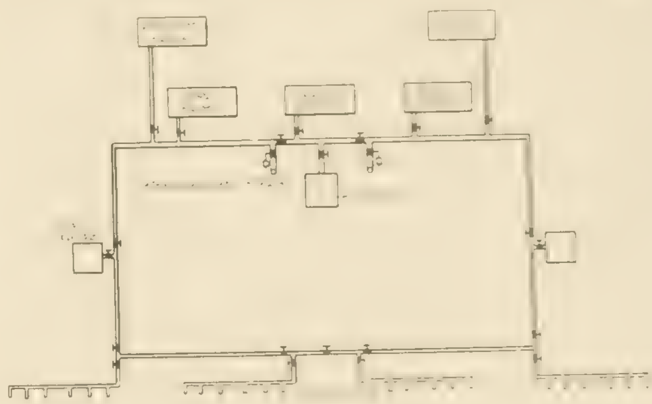


FIG. 52.

receiving low temperature water than when receiving water of high temperature. In other words, the capacity and utility of an economizer diminishes as the temperature of its feed water is increased, and the greater amount of work asked for from the economizer the better paying investment it will be. An active circulation is not provided for in the general design of economizers on account of practical difficulties, and as actual experiment has demonstrated that twice as much heat is delivered to water circulating at the rate of 3 ft. per second as is delivered to it without circulation, it may be seen that the commercial value of an economizer would be increased greatly if the advantages of free circulation were provided for.

If the plant were supplied with economizers it would be an economical plan to deliver all the steam to the heater that it would condense, exhausting such machines as are economical in the use of steam into the condensers and such machines as are wasteful into the heater. A system for connecting certain machines and allowing them to be run in either of the ways just mentioned is

[illegible] tion and should not be used for any lines which are at all times essential for the continued operation of the station. A portion of the line marked A is indispensable, and late at night, when the pumps may be shut down, the exciter engines would be running non-condensing, and this part of the line would then be used by the exciter engines.

Another point to consider, which may be stated as one of the more important details in laying out station systems, is the ability to be able to take apart any valve in the station, not only for repairs needing immediate attention, but for general repairs when the load is light and not over one-half the station capacity is called for.

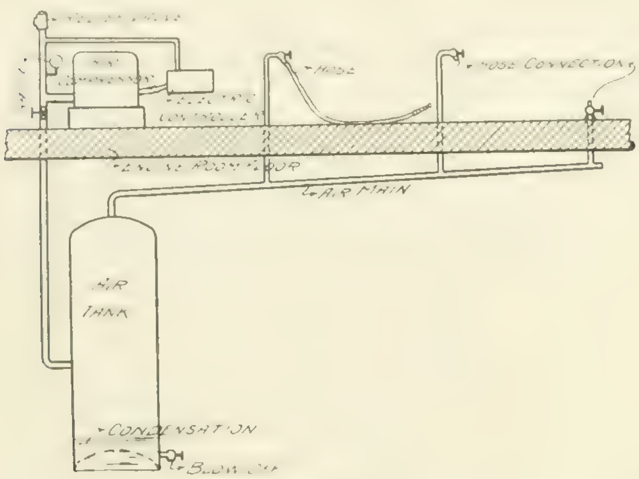


Fig. 53

To be able to shut off one section of the piping is only a partial solution of the problem of designing a correct system; it must be possible to shut off the shut-off itself. Figure 48 shows numerous valves, any one of which can be taken out of the line or have repairs made on it and the continued operation of the other half of the station be possible.

Referring to Fig. 47 it is seen that there are two atmospheric valves opening into one pipe, and if one valve is being repaired there is a constant danger of losing the vacuum and exhaust from the other engine reaching the valve. This is not a good system, because each atmospheric branch should run independently to the atmosphere, or have a valve in it.

There is nothing unusual in the appearance of the connection shown in Fig. 49, such an arrangement being very ordinary. The designer of a piping system must not be contented with laying out a system which looks all right, but he should analyze every requirement and see that his design conforms with an established plan.

On reference to Fig. 49 it may be seen that in order to do any work at all upon the valve shutting off the main from the branches, it will be necessary to shut down the entire auxiliary exhaust main. Such a design is not a system, but is the very limit of crudeness.

The auxiliary exhaust main should therefore be next laid out with a view to making repairs to the pipe line possible and still allow the operation of three-fourths of the entire plant, or permit any valve to be removed and allow the operation of one-half the plant.

It should be understood that if a valve blows a gasket or springs a bad leak between the bonnet and the body, it is yet possible to close the valve and operate three-fourths of the capacity of the plant until such time as the load can be carried by half the machines and the repairs be made.

A list of the machinery which must be piped to the heater and atmosphere comprises 2 dry vacuum pumps, 2 feed pumps, 1 fire pump and 2 fan engines. These machinese are shown in Fig. 50, together with the properly located back pressure valves and atmospheric stand pipes at the ends of the exhaust main. In case of accidents to valves a and b, repairs would be found difficult, because it would be necessary to operate with but one pump. This, however, is possible, and as there is low duty on the shut-off valves, further protection is not justified. It is necessary that the exhaust main should be pitched toward the heater so that all condensation will flow in that direction and it will then be possible to on the steam trap bleeders into the exhaust main, thus saving both the distilled water and the heat units.

The lines may be located in various positions and yet preserve the system shown in Fig. 50. For instance, Fig. 51 shows a different arrangement of the machines, valves, etc., but the general system is unchanged. In Fig. 51, the atmospheric valves are located near the heater so that the air vent of the heater may easily be run into these pipes. The general arrangement of the pipe lines must necessarily adapt itself to local conditions, but the lines should be so run that the original system will be preserved.

The general rearrangement of the auxiliary steam and exhaust mains when laid out on the loop plan is shown in Fig. 52. This plan permits the shutting down of the heater, atmospheric pipe, or any portion of the lines, and yet three-fourths of the plant remains in operation.

Compressed Air System.

Compressed air is now considered essential in the operation of modern power stations and is chiefly used in the cleaning of electrical machinery and apparatus; it is also used for other purposes in the plant because it is available. Compressed air service for cleaning purposes is not vital in the operation of the station, and therefore can be laid out on a single main, systemless plan, but of course when the air system is so designed, there should be no vital system dependent upon air pressure for its operation unless such system has another means of supply.

Ordinarily it is not necessary to use a large air compressor nor large lines, but in order to insure an even pressure, the system should have a storage air tank of fairly large capacity from which, when needed, a relatively large volume of air can be drawn for a short time. The general arrangement of such a system is shown in Fig. 53.

The piping should be arranged so that the compressor, air main and branches will drain rapidly into the air tank. This tank should be provided with a blow-off through which condensation can be disposed of. The compressor, controller, gage, relief and stop valve should be located on the engine room floor, and the tank on the basement floor with the air supply main led off from the top. Hose valves should be placed at the different generators, motors, transformers, switchboards, oil switches, etc., so that 25 ft. of hose will reach any piece of electrical apparatus. If there is an oil room where inflammable stock is kept it is desirable to connect the air main to a can of dry fire extinguishing powder in such a manner that by opening an air valve the pressure from the main will blow this powder forcibly into the room.

(To be continued.)

Trade Name Wanted.

Mr. H. A. Nicholl, general manager of the Indiana Union Traction Co., Anderson, Ind., requests us to announce that this company will pay $25 for the best suggestion for a trade name or apt descriptive phrase for that system that is acceptable. At the present time the company is using the initials of its name, I. U. T., displaying them in the way of a trade mark on its literature, and what is desired is a substitute for the company name, which will be distinctive, convenient, appropriate and easily remembered.

Suggesting the class of names that might be appropriate we can give the examples of names chosen by electric lines as follows: Eastern Ohio Traction Co., the Maple Leaf Route; Muncie, Hartford & Ft. Wayne Ry., Hartford Route; the old Ft. Wayne & Southwestern Traction Co. was known as the Canal Route, a name which would be quite appropriate for its successor, the Ft. Wayne & Wabash Valley, as this road follows the Wabash & Erie canal from Ft. Wayne to Logansport, with a prospect of being continued to Lafayette; the Lackawanna & Wyoming Valley Ry. is named the Laurel Route. The steam railway field offers as good examples of such words and phrases, "Monon," "The Only Way," "Frisco System" and "Overland Route."

This competition is open until Aug. 1, 1905. Suggestions should be forwarded to H. A. Nicholl, general manager, Anderson, Ind.

The Central Pennsylvania Traction Co. opened its amusement park at Paxtang, Pa., May 25th. A new roller coaster erected in the shape of a figure "8" has been installed and new walks and bridges have been built in the park, which has greatly improved since last season.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 1897 have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible] to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V [illegible]. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, [illegible]; single volume, $2.00.]

OVERSTATEMENT OF CARRIER'S OBLIGATION.

Crolly vs. Union Railway Co. (N. Y. Sup.), 92 N. Y. Supp. [illegible]. Feb. 23, 1905.

The judge charged the jury: "So far as the duty of the Union Railway Company to the plaintiff was concerned, I charge you that it was obliged under the law, as a general proposition, to exercise that degree of care which would safely land a passenger at his destination, after it had taken that passenger upon its car." The appellate term of the supreme court of New York holds that this was clearly an overstatement of the carrier's obligation to its passengers constituting reversible error. No such obligation is imposed upon common carriers, viz., to safely land a passenger at his destination. This was virtually an instruction that the defendant railway company was an insurer of its passengers, during transit, irrespective of the circumstances.

WHAT A PERSON CROSSING TRACKS MAY PRESUME AS TO SPEED—SPEED IN EXCESS OF THAT ALLOWED BY ORDINANCE NEGLIGENCE—CARE REQUIRED—LOOKING AND LISTENING SUFFICIENT WITHOUT STOPPING.

Deitring vs. St. Louis Transit Co. (Mo. App.), 85 S. W. Rep. 140. Feb. 7, 1905.

The plaintiff, who was injured in attempting to cross the defendant's tracks, had the right, the St. Louis court of appeals holds, to presume, unless he knew to the contrary, or by the exercise of ordinary care might have known, that the defendant would not operate its street car at a rate of speed exceeding 15 miles an hour, the speed allowed by the city ordinance. The operation of the car at a rate of speed exceeding 15 miles per hour was negligence per se (by itself).

But while the plaintiff had the right to use the thoroughfare, he was charged with the obligation of exercising due care and caution on his part, and with the duty of looking and listening for approaching cars before crossing said tracks, in order to avoid probable collision; and if, upon looking and listening, he discovered an approaching car in such immediate proximity as to threaten his safety, while running at a rate of 15 miles per hour, he would be negligent and inexcusable in going upon the defendant's tracks under those circumstances; or if he discovered an approaching car which he knew, or by the exercise of ordinary care could have known, was running at a high and negligent rate of speed (in excess of 15 miles per hour), so that it would appear dangerous to an ordinarily prudent person in the exercise of due care to attempt to cross the tracks, he would have been negligent and inexcusable in going upon said tracks under those circumstances.

On the other hand, if the plaintiff's position (three feet from the rail), when he looked and listened, was such that when looking at the end of the approaching car he was unable to discern that the car was approaching at a rate of speed exceeding 15 miles per hour, and if it was apparent that the car was then so far distant from him that an ordinarily prudent person of his age and condition, exercising due care, could cross the tracks in safety in front of a car running at a speed of 15 miles per hour without imminent danger of injury, then the plaintiff would be justified in relying upon the defendant's agents to operate the car within the ordinance limit of 15 miles per hour, and in presuming that it was being so operated with due care and caution on their part, and cross the tracks.

Again the court holds that there was no rule of law requiring the plaintiff "to stop and look and listen." He was required to "look and listen," but not to "stop."

INTERSECTING LINE COVERED BY ORDINANCE AS TO SALE OF TICKETS AND GIVING OF TRANSFERS.

Virginia Passenger & Power Co. vs. Commonwealth (Va.), [illegible] S. E. Rep., 995. Mar. 9, 1905.

A company having a line of street railway [illegible] portion of another line extending from a point where the latter intersected with the former to a point in the city limits. A second company owned the balance of the latter line from such point in the city limits to a point in the county, and operated the whole line from the point of intersection to the point in the county, running its cars with the same conductors and motormen continuously through to said point of intersection. The company first mentioned was required by ordinance to sell, between the hours of 6 a. m. and 7 a. m., "labor tickets," at the rate of two for five cents, to be used only between such hours from Monday to Saturday, inclusive, and to give transfer tickets to intersecting lines. The supreme court of appeals of Virginia holds that the second-mentioned line, operated as stated by the company owning the portion thereof beyond the city limits, was such an intersecting line.

MOTORMAN MAY PRESUME DRIVER OF VEHICLE WILL USE HIS SENSES.

Markowitz vs. Metropolitan Street Railway Co. (Mo.), 85 S. W. Rep. 351. Dec. 22, 1904.

Where a motorman saw a wagon when it first came out of an alley, the supreme court of Missouri, division No. 1, says that, whether he noticed how the faces of the occupants, the plaintiff and her driver, were in fact turned, and drew inferences therefrom or not, he saw the wagon and the driver, and the course they were taking, and he had the right to presume that the driver would use his senses. Even though he saw the horse approach close to the track, yet if he still presumed that the driver would exercise the care that a man of ordinary prudence and common sense in his situation would exercise, and stop until the car would pass, this court cannot say with certainty that he was guilty of negligence in acting on that presumption. And even if it could be said that under those circumstances a question at least of negligence arose, which, as a question of fact, ought to have been submitted to the jury, still this court cannot say that it was a question of such gross negligence or reckless or wanton conduct as justified the court in submitting to the jury to say whether or not the plaintiff ought to recover in spite of her own negligence.

CARE REQUIRED AS TO STATION PLATFORMS.

Hart vs. Seattle, Renton & Southern Railway Co. (Wash.), 79 Pac. Rep. 954. Mar. 10, 1905.

"You are instructed," the jury were told in this case, "that the degree of care to be exercised by a common carrier of passengers for hire is the highest degree of care that is consistent with the reasonable and practical operation of its business, in view of the method and means of conveyance employed." "You are instructed," they were further told, "that it is the duty of a carrier of passengers to provide and keep the landing places and platforms used by it for discharging passengers from its vehicles, and all passageways leading to and from such places, in a reasonably safe condition for the purposes intended, and for any violation of its duty in this respect which entails injury upon a passenger, without fault on his part, the carrier will be answerable in damages." The necessity for reasonable care was also repeated in other instructions. The supreme

court of Washington thinks that the instructions, as a whole, made it clear to the jury that it was the trial court's view that not the highest possible degree, but a reasonable degree, of care was required, and the court thinks that the instructions were at least within, and that they certainly did not go beyond, well-recognized rules.

CONSTRUCTION OF ORDINANCE AGAINST CONDUCTORS ALLOWING WOMEN OR CHILDREN TO ENTER OR LEAVE CARS WHILE IN MOTION.

Behen vs. St. Louis Transit Co. (Mo.), 85 S. W. Rep. 346. Dec. 22, [illegible].

With reference to a city ordinance to the effect that conductors of street cars should not allow women or children to enter or leave a car while the same was in motion, the supreme court of Missouri, division No. 1, says that men get on and off the cars while they are going, and the ordinance does not make it the duty of the conductor to attempt to control them in that respect; but it seems to contemplate that women and children are more liable to accidents in attempting such a feat, and that conductors should not allow them to attempt it. The ordinance contemplates interference by the conductor when a woman or a child is indicating an intention to do the dangerous act of boarding or leaving a car while it is in motion. Action indicative of such an intention is essential before the conductor can be expected to know that such intention exists. Just how much restraint a conductor, under this ordinance, would be authorized to exert in case a grown woman should insist on using her own judgment in such emergency, it was unnecessary in this case to say. It did not appear that the conductor was close enough to lay hands on the woman in question to restrain her by force, even if he had had a right to do so; but, when he warned her to wait until the car should come to a stop, her act in disregard of the warning could not be said to have been with his acquiescence or permission.

MEANING OF WORD "INVITATION" AND SUFFICIENCY OF PLEADING.

Kennedy vs. North Jersey Street Railway Co. (N. J. Sup.), 60 Atl. Rep. 40. Feb. 27, 1905.

The averment in a declaration that a car came nearly to a standstill at the instance and request of the plaintiff, who then and there, at the instance and request of the defendant, was then and there invited to become a passenger, the supreme court of New Jersey holds, is a statement of a conclusion drawn by the pleader from inadequate or undisclosed facts, and is bad on demurrer. In a pleading imputing legal liabality, the word "invitation" must be given its legal, and not its colloquial, meaning. In other words, the fair meaning to be given such a declaration as above described is that from the slowing down of the car the plaintiff assumed that he had been accepted as a prospective passenger, and that thenceforth the movements of the car would be regulated with due reference to the existence of such relationship. An essential factor—indeed, the essential factor—in such an invitation is the existence of some state of facts from which the servants of the defendant knew, or ought to have known, that their act of slowing the speed of the car might give rise to the belief that it was for the purpose of permitting the plaintiff to become a passenger. If this be not so, then every diminution of the speed of a moving car from any cause whatsoever inaugurates possible liabilities as to all persons who may make the attempt to board such car while in motion, although the servants of the defendant may be entirely unaware of the necessity of regulating the running of the car with respect to such attempts. If circumstances from which the invitation to the plaintiff is fairly inferable are stated in the pleading, the basis for the legal liability of the defendant is properly laid.

CAUSE OF DERAILMENT FOR JURY AND NOT EXPERT.

Schutz vs. Union Railway Co. of New York City (N. Y.), 73 N. E. Rep. 491. Feb. 15, 1905.

A railroad man of some twenty years' experience with steam and electric railroads was asked, assuming that a car was running at the rate of seven or eight miles an hour on a curve of the degree or radius of a particular curve in question, and assuming that the track at that point was an inch and three-quarters out of gauge, and assuming that the outer forward wheel was worn, and the flange chipped, and that the car left the track at that point, whether he could state with reasonable certainty, from his experience as a railroad man, both in railroad construction and in repairing and in operation, what was the cause of that car leaving the track. The court of appeals of New York holds that it was error to allow this question over objection. It says that a situation was presented which clearly did not fall within the rule rendering expert testimony admissible. A very simple state of facts was laid before the jury, and the question for them to determine was whether the spreading of the track, and the imperfect condition of the front wheel of this car, under conditions already stated, might have resulted in a derailment. There were no facts here peculiarly within the knowledge of men whose experience and study enabled them to speak with authority upon the subject, nor was this witness or a motorman who had been for four years in the employ of different companies to be considered as an expert. In regard to a witness who had 20 years' experience as a shop foreman and railroad man on steam and electric roads, it would have been competent to have asked him, on the state of facts disclosed, as to the tendency of a car leaving the track under those conditions. The question propounded was very different, as it required the witness to state the cause of derailment, which, very clearly, was for the jury to determine.

NOT WITHIN APPARENT DUTY OF MOTORMAN TO EJECT PASSENGER OR TRESPASSER FROM CAR—MOTORMAN NOT "DRIVER."

Drolshagen vs. Union Depot Railroad Co. (Mo.), 85 S. W. Rep. 344. Dec. 22, 1904.

So far as the receiving, carrying and discharging of passengers is controlled by the running, stopping and starting of the car, the business, the supreme court of Missouri, division No. 1, says, is in the care of the motorman. But, in the absence of evidence on the subject, the court is unable to say that a motorman, whose only apparent duty is to operate the machinery that furnishes the motive power for the car, has any authority from his master to eject a person from the car. The court cannot see any connection between the apparent duty of the motorman to operate the machine and the alleged authority to eject passengers or trespassers from the car. If there is such authority in the motorman, its source is independent of his mere duty to operate the machine; it does not flow from that duty. If the motorman should be called on by the conductor to assist in preserving order or ejecting a person from the car, then a different case would be presented, in which the duties of the conductor and his right to call for assistance would be involved. And, even if the motorman acted on his own motion to eject a person whose conduct seemed to render it necessary for the protection of the passengers or the preservation of the peace, a question of authority implied from such an emergency might arise. Nor does the court consider that a motorman is included in the meaning of the term "driver" in the statute enacted in 1855 relative to giving a right of action whenever any person shall die from any injury resulting from or occasioned by the negligence, etc., of "any driver of any stage coach or other public conveyance whilst in charge of the same as driver." It says that the motorman does not come under that clause, because he is not in charge of the car, and he does not occupy towards the corporation and the public the position of the driver of a stage coach or other vehicle of that kind.

POWER OF COURT TO ORDER CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY.

In re Wood (N. Y.), 73 N. E. Rep. 561. Mar. 7, 1905.

The New York statute expressly provides that the general term (now the appellate division) of the supreme court of New York has the power, in its discretion, to order the railroad commissioners to grant a certificate of public convenience and necessity. The court of appeals of New York says that it must be conceded that the statute is exceedingly meager in its provisions as to the practice to be followed, and, doubtless for that reason, most of the proceedings for the review of the actions of the board of railroad commissioners have been by certiorari.

But the court thinks the legislative intent is sufficiently apparent. It was intended, it says, to vest in the general term (now the appellate division) power to review the determination of the railroad commissioners in case they should refuse the certificate of public

convenience and necessity. For the purpose the [illegible] commissioners were required, on the request of the [illegible] company, to certify a copy "of all maps and papers [illegible] office and of the findings of the board. It is true that the statute does not in express terms state that the commissioners shall certify a copy of the testimony taken before them, but the court thinks that the certification of the testimony was implied and intended. The testimony, with the maps and papers on file, together with the findings of the board, furnish a complete record of [illegible] before the commissioners, and enable the appellate division to review the determination made thereon.

It is also true that the statute has not pointed out the precise practice that should be adopted in bringing the case to a hearing before the appellate division, but that court may, by rule or otherwise, specify the time and notice that shall be given to the parties interested upon which it will entertain the application. In this case the evidence was certified by the railroad commissioners, together with all of the maps and papers before them and a copy of the findings. The record was therefore complete, and one upon which the appellate division had the jurisdiction to order the board of railroad commissioners to issue a certificate of public convenience and necessity. Furthermore, the court says that the order herein was a final order in a special proceeding, and that, in the absence of any provisions in the railroad law giving a right to appeal to this court, it was reviewable as a matter of right, under section 190 of the code of civil procedure, so far as the questions of law were concerned.

The question of whether the 10 per cent of the capital stock subscribed for had been paid in in good faith as required by the statute, the court says, was purely one of fact, and, under the provisions of the constitution, its jurisdiction was confined to the review of questions of law; therefore, its examination of the evidence was limited to the determination as to whether there was any evidence that supported the finding.

RIGHTS AFTER DEPOSIT OF CHECK AND FAILURE TO CONSTRUCT LINE IN TIME REQUIRED.

Furth vs. Town of West Seattle (Wash.), 79 Pac. Rep. 936. Mar. 8, 1905.

A franchise ordinance required a certain amount of construction within a year and the deposit of a certified check for $2,000 to insure same, unless such construction should be prevented by any accident, inability to obtain material, etc. The construction required necessitated the crossing of public navigable tide waters controlled by the government, for which it was alleged it was contemplated that the United States authorities would permit the construction or use of a trestle with drawbridges of light construction and low cost, whereas after the passage of the ordinance it was determined and made known by the United States authorities that they required the construction of two very large and extremely costly drawbridges. Wherefore it was contended that the failure to construct and put into operation the line of railway within the year was caused by accident and inability to obtain material within the meaning of the ordinance.

The supreme court of Washington says that it would seem to it that the averments did not relieve the grantee of the franchise from performing his contract under the express provisions of the ordinance. It was for the contractor to put on foot inquiries concerning the cost of the construction of this road and the bridges necessarily connected with it. The information which he here complained of, with reference to the action of the government, could no doubt have been obtained before as well as after the contract had been entered into.

Furthermore, the court says that it is unable to discover any trust character in the check which was deposited for the benefit of the city, or any reason alleged in the complaint for the equitable interference of the court. There must be some force given to the provision in relation to the deposit and the forfeiture of the check. It was a provision for the protection of the city, agreed to by the plaintiff. The property in the check remained in him until the year had expired. Then, if the conditions of the contract had been performed, it was to be returned to him. If not, and no continuance were granted, it was to be forfeited to the city, and, if so, the property in it would certainly belong to the city. It seems to the court that the contract was a simple one, easily understood and easily complied with, and at the expiration of the year, in the absence of the continuance, either the plaintiff had a right to the return of the check, or the city had a right to appropriate it; otherwise the contract in relation to the check amounted to nothing.

Again, the court says that the check, under the terms of the contract, [illegible] ated by the city, and had become indiscriminately commingled with other money belonging to the city, so that the particular money itself could not, in any event, be traced or followed, and therefore there was nothing for an injunction to rightfully operate upon; and, [illegible] It was acting on what it deemed were its rights under the contract, and if it misinterpreted that contract and misconceived its rights it was responsible to the plaintiff in an action at law.

VALIDITY AND CONSTRUCTION OF ACT AUTHORIZING CONSTRUCTION OF TEMPORARY TRESTLE AT RAILROAD CROSSING

Lentell vs. Boston & Worcester Street Railway Co. (Mass.), 73 N. E. Rep. 542. Mar. 3, 1905.

The constitutionality of chapter 163, page 124, of the Massachusetts statutes of 1903, authorizing the defendant to construct a trestle for crossing the Boston & Albany Railroad was attacked on the ground that, although the trestle was in fact and in law an interference with the plaintiff's right of property, an assessment of the damage to the plaintiff's rights in the street, or light, air and access was forbidden by the clause declaring that the construction, maintenance and use of the trestle should be deemed not to be an additional easement or servitude. The supreme judicial court of Massachusetts says that if the trestle did interfere with a right of property which the plaintiff had before the statute was enacted, this clause of the statute was void. But it did not follow that the whole act was thereby rendered invalid. The court thinks that it was the intention of the legislature to declare that the trestle did not interfere with the rights of property of any person, if such a declaration could be made by it; but that, if such a declaration could not be constitutionally made, any person whose property rights were interfered with should have compensation.

Another ground on which the plaintiff contended that the act was unconstitutional was that the person was not ascertained who was to make payment of the compensation found to be due. To construe the act, the court says, it was necessary to have in mind the law then existing as to a street railway constructing its tracks across the location of a steam railroad. It could not build across the railroad location at grade without the consent of the railroad commissioners or of a special commission. It could take land to enable it to cross above or below the tracks of the railroad if it procured the approval of the aldermen if in a city, or of the selectmen if in a town; and it could construct such a crossing on land so taken. Finally, the aldermen of a city or the selectmen of a town were permitted to authorize structures partly or wholly within a public way necessary for carrying the street railway over or under the railroad. From the fact that the defendant railway procured the passage of the act in question, and from the terms of that act, it must be assumed that this railway company found it impracticable to get its tracks across the Boston & Albany location in any of the ways authorized by the revised laws. It was manifest that a separation of grades of the railroad and highway at that point was expected to be made under the policy lately pursued by the commonwealth with respect to grade crossings.

It was under these circumstances that the legislature authorized the defendant railway to complete the construction of its tracks by the erection of the temporary trestle in question, carrying its railway over the Boston & Albany Railroad, on condition that it should be "removed upon the completion of the work of the abolition of the grade crossing of the tracks of said railroad." This permission was granted to the defendant railway for its benefit, and for the benefit of no one else; and, by necessary implication, if anything was to be paid it was to be paid by it. The provision that the compensation should be recovered "in proceedings conducted as provided with respect to laying out of ways in the city" was manifestly inserted to give to the plaintiff and persons similarly situated all the rights which he or they had in the street, which was a public way in the city, and for no other purpose.

ARRESTING MOTORMEN AS A MEANS OF PREVENTING RUNNING OF CARS—EVIDENCE.

[illegible] vs. [illegible] and another (Mich.), [illegible] N. W. Rep. [illegible] Feb. 28, 1905.

[illegible] was for false imprisonment, based upon [illegible] detention of the plaintiff, a motorman, by the police, under directions of the defendants, who were respectively mayor and chief of police of the city of Lansing. The defendants sought to justify their action upon the ground that the condition of the overhead construction of the street railway line was a public nuisance, in that it was a menace to persons using the highway, and that it was the defendants' duty, both by virtue of their office and by reason of the action of the common council, which had declared it a nuisance, to abate the danger by preventing the operation of cars until the wire should be replaced by new.

But if the circumstances shown were such as to justify the abatement of a nuisance, the supreme court of Michigan says that it could have been done by removing the dangerous wires, or by cutting the same off from the power house from whence the current was furnished. The stopping of the cars was not essential to this. If the danger existed only by reason of the running of the cars, cutting the wire would have been an effective method of stopping the cars, or they might have been stopped by taking possession of or disabling them without cutting the feed wire. Either of these methods would have been preferable to the wholesale arrest of the motormen. Counsel cited no case recognizing the method taken of abating a nuisance, or preventing injury to citizens, where the person arrested was not chargeable with a public offense or threatened breach of the peace. The conduct of the defendants was clearly in excess of necessity, and, under the admitted facts, the court could have done no less than to direct a verdict for the plaintiff. The verdict rendered was for $150.

Furthermore, the supreme court thinks it was not error to allow the plaintiff to state that he felt humiliated by the arrest. It was not error to exclude evidence that subsequently he was complimented by his employer for his effort to run the car. Neither was it error to exclude evidence that it was the custom to search prisoners, which custom was not followed in this case. The court was justified in saying that there was no evidence tending to show that the plaintiff resisted an officer, although he took hold of the rope to reverse the trolley after the controller cranks had been taken away from him, and he not only refused to promise not to run cars again, but said that he would run a car every fifteen minutes if given the opportunity, for such were his instructions.

CONSTITUTIONALITY OF LAW REQUIRING SCHOOL CHILDREN TO BE CARRIED FOR HALF FARE.

Commonwealth vs. Interstate Consolidated Street Railway Co. (Mass.), 73 N. E. Rep. 530. Mar. 1, 1905.

The supreme judicial court of Massachusetts here holds constitutional sections 72 of chapter 112 of the revised laws of Massachusetts, which requires street railway companies to carry pupils of the public schools, in their regular course going from their homes to the schools and returning therefrom, at rates not exceeding half the regular fare charged by the company for the transportation of other passengers between the same points. The court says that while the right of the legislature reasonably to regulate rates of fare is well established, it can be exercised only in such a way as will not deprive the company of its property without compensation or without due process of law. Action of a legislature in this particular is subject to the revisory powers of the courts. If the effect of this statute were to compel the defendant to conduct its business at a loss, the court would say unhesitatingly that the law was unconstitutional. But the section places no limitation upon the rates that may be charged generally.

Section 1, chapter 112, of the revised laws, leaves unchanged the provisions of law in force at the time of its enactment which were applicable to the Boston Elevated Railway Company. This company was thereby exempted from these provisions as to pupils of the public schools. It was contended that this made a discrimination, which deprived the defendant of the equal protection of the laws. But the court says that the constitutional principle invoked in this contention does not require that the same laws shall be enacted for all street railway companies in different parts of a state. The situation of the lines of the Boston Elevated Railway Company in the midst of a dense population was so different from that of other lines in the state, and their fitness for use by children in going to and from the public schools might be found by the legislature to be so unlike that of street railways generally in the state, as properly to call for an exemption from the law established for others. The court cannot say that the legislature had no power to make this distinction, founded on differences in conditions.

The most important and difficult question in the case, the court says, was whether there was a constitutional justification for a discrimination between pupils of the public schools and other persons. If this were an absolute and arbitrary selection of a class, independently of good reasons for making a distinction, the provision would be unconstitutional and void. But if the difference is founded on a reasonable distinction in principle, such discrimination does not deny the equal protection of the laws. The education of children throughout the commonwealth is a subject for legislation, which has occupied the thoughts of the lawmakers from early times. The duty of legislatures and magistrates to be diligent in the promotion of education among all the people is specially declared in chapter 5, section 2, of the constitution of the commonwealth. Compulsory attendance of children in the schools is provided for by the laws. Money may be appropriated by cities and towns for conveying pupils to and from the public schools. It cannot be said that the legislature may not concern itself with the transportation of children to the public schools in the interest of popular education, just as it provides such children with books and other necessary articles. So far as this statute merely gives help to these pupils in connection with their acquisition of knowledge in the schools, it is justified. As a police regulation in the interest of education, the law may well require street railway companies to permit these children to ride to school upon their cars, without profit to the companies, provided it can be done without causing them loss. But if such a requirement involves expense, the cost can only be put upon the general taxpayers. It cannot be imposed upon the street railway companies, or upon that part of the public which pays fares to the street railway companies. If, therefore, it plainly appeared that the enforcement of this section would cause expense to street railway corporations, which they must bear themselves, or put upon other classes of passengers in the form of increased fares to make good the loss from carrying school children at half rates, the court would be obliged to hold that there was a taking of property without due process of law, through unconstitutional discrimination.

Therefore the court was brought to the inquiry whether it was possible for the legislature to conclude that this provision would entail no loss upon the street railway companies. Was it not possible for legislators to decide that pupils, in most cases, go to and from the public schools at hours when the cars are not in use by persons going to and from their work, or by many persons; that the pupils generally are of such age and size as not individually to occupy nearly so much space as other passengers; that the difference between full fare and half fare is of such importance to the parents of many of these pupils that the number who would ride at the half rate would be nearly, if not quite, twice as many as at the regular rate; and that for these and other reasons railway companies would suffer no loss from carrying the children at half the regular fare? Unless the court could say as matter of law that such a view would be untenable, it could not hold that the statute was unconstitutional. Nothing less than a certainty that the provision would cause loss to the railway companies, or to some of them, would enable the court to hold that the legislature was powerless to make the requirement. The question was difficult and doubtful. It involved the consideration of facts which primarily were for the lawmaking power. All presumptions are in favor of the validity of legislation. The evidence offered by the defendant had no tendency to show that it would suffer loss by carrying these pupils at half the regular rates. For all that appeared, it would be in better financial condition at the end of a year, if it carried the children in compliance with the statute, than if it did not carry any of them. The court hesitates to say that the lawmakers could not pass the act as one which would put no financial burden upon anybody.

Lastly, the court says that it has come to its notice in former cases that before this statute was passed similar conditions were sometimes imposed by towns in connection with grants of locations, and were accepted with seeming willingness by the railway corporations.

May Meeting of the Ohio Interurban Railway Association.

The May meeting of the Ohio Interurban Railway Association was held at the Hollenden Hotel, Cleveland, May 25th, the meeting being called to order at 10:30 by President Spring. The minutes of the preceding meeting were adopted, as was the report of the treasurer. Eight new members were elected to the association, and a list was distributed giving the names and companies represented by the 115 members of the association who are connected with the management of interurban properties. The transportation committee reported that it was receiving ready response to its efforts and that good progress is being made in the ticket and fare questions. Mr. H. A. Nicholl, Indiana Union Traction Co., was appointed to this committee. The president announced that the Appleyard syndicate has agreed to honor and issue the association's mileage book upon its lines.

Mr. S. F. Cosgrove next described the system offered by the Railways Protective Association of New York for the prevention of a large percentage of fake accident railway damage claims. The scheme of this association, which is under the immediate supervision of Mr. L. E. Drummond, of the Drummond Detective Agency, is to form a mutual association of all electric railways, for which the protective association will act as a claim clearing house. When an accident of any nature occurs on a railway property its history and an accurate description of the claimant will be tabulated and filed with similar records from all the members of the association, so that when the file made up of these descriptions has been kept up for some time it will serve as a reference of much value, because there will be ready for use many descriptions of all classes of accidents and a record and identification charactertistics of those who have made the claims for damages. In this way a railway company can protect itself from bogus claims made by professional fakirs operating in different parts of the country, and perhaps on its own line. The charge for membership in this association is $5 per year.

The first subject for discussion, "The Advantage or Disadvantage of Stub Switches on Single Track Roads at All Points Other than Regular Meeting Points," was opened by Mr. C. N. Wilcoxon, of the Cleveland & Southwestern Traction Co. He felt that the stub switches were advantageous from a maintenance point of view on account of the reduction in the number of switch points which would make for greater safety, and also on account of lessening the first cost and maintenance cost by one-half the number of switch stands.

Mr. W. B. Tarkington stated that on the Detroit, Monroe & Toledo Short Line Ry. they use passing sidings one mile long, with a switch at each end carrying a target light at night. He favored the use of switches that can be run over at full speed and thus always remain set for through operation. On that road the switches with No. 12 frogs are left open, but those having No. 9 frogs are closed and must be operated by hand for the side tracking of the car.

Mr. D. H. Lavenburg stated that the Toledo & Indiana Railway Co. and the Northern Texas Traction Co. use one open and one closed switch for through operation, and when questioned said that he did not recall any accidents which had been caused by a car splitting the switch and taking the siding when it should have continued on the straight track.

Mr. E. P. Roberts stated that the majority of his clients favored the use of spring switches, one of which would remain set for the siding, so that when both cars were on time the passing could be made without stopping, and to aid in this scheme sidings are made long, so that not only is the saving in time effected, but should an on-coming car split the switch the waiting car would be far enough away so that the moving car would have ample space in which to stop before colliding.

Mr. F. W. Coen stated that the Lake Shore Electric Railway Co. has about 50 sidings in its tracks between Toledo and Cleveland, and that with the exception of one or two all are equipped with two spring switches, over which the trains operate at full speed. He could recall but one or two accidents within the last 6 or 8 years that were caused by this arrangement of switches, and further stated that of the other accidents which have happened on this line the use of stub end switches would have prevented but one or two.

Mr. J. W. Brown stated that the West Penn Railways system favors the use of two switches because its line has many heavy grades on which sidings must be placed, and there is continued danger of a waiting car backing off a stub end switch. Also that when the waiting car starts to return to the main track it is necessary to turn the trolley or trouble may be brought about by the trolley wheel leaving the wire and damaging the overhead work as the car backs out onto the main track.

The second subject was "Should Interurban Roads Use Switch Lights on All Switch Stands? If so, Which Would Be the More Economical and Satisfactory—Electric or Oil Lights?" Mr. Tarkington opened the discussion of this topic by stating that the Detroit, Monroe & Toledo Short Line Ry. uses six 16-c. p. lights in series at each siding, two in the telephone booth and two in each target lantern. The experience on this line has been that the oil lights cost more to operate on account of the labor for keeping them supplied with oil, cleaning and picking up and distributing them each day. On this line the lamp circuits are controlled by switches mounted on poles close to the track. These switches are constructed with long iron handles, strongly built so that they may be thrown by the conductor of a passing car without necessitating the car coming to a dead stop and without the loss of time occasioned as when the light control switches are placed in telephone booths.

Mr. H. C. Lang suggested that with the use of electric target lights, when the switch was located on or near a curve it would add to the safety if one of the lights in the switch circuit was mounted on a pole around the curve on the straight track, where it would serve as the pilot light.

Mr. Theodore Stebbins stated that the Appleyard syndicate has tried several different schemes, using five 16-c. p. lights in series, but found that when the lamp current, lamp renewals and loss of time and current by stopping the cars to turn on and off the lights at night and morning are summed the cost is excessive. In order to lessen this cost he uses a special 120-watt, 300-volt lamp designed to burn two in series on the railway circuit. These lamps are left burning continuously, and it is expected that they will effect a saving in the neighborhood of $600 a year over the use of five lights in series, consuming current at the rate of 300 watts. He also stated that one disadvantage in using electric target lights is the trouble occasioned by lightning, but that he is experimenting with reactive coils and lightning arresters, which it is hoped will greatly lessen these burn-outs. Such protective devices are placed at the sidings, where they will also protect waiting cars and the telephone apparatus and where they can be easily cared for.

Mr. Abbott said that a scheme for lighting targets occurred to him, but that to his knowledge it had not been tried in actual service. This scheme would be to use convex mirrors mounted on high switch stands with an ordinary 16-c. p. light placed in front of them, so that its rays would be projected along the line of the track in a much more powerful manner than when the light is enclosed in the lantern behind thick glass lenses. This scheme would also have the added advantage that the unenclosed 16-c. p. lamp would at all times illuminate the flags on the switch stand, so that even though there should be trouble with the mirror and the track be covered with snow the position of the switch could be told at night by the brightly lighted flag or target.

At the opening of the afternoon session resolutions were read and passed by the association expressing its regret at learning of the death of Dr. J. E. Lowes, of Dayton, who was a member of the association and chairman of its legislative committee.

President Spring then spoke of the general agitation throughout the interurban field tending towards an increase in interurban electric railway fares. He stated that many roads have been obliged to increase their rates of fare in order to gain receipts commensurate with the high class of service they offer as compared with the service of parallel steam lines. A resolution formulated by the executive board was read stating that it be the sense of the Ohio Interurban Railway Association that the lowest electric railway passenger fares be at the rate of two cents per mile, with a minimum fare of ten cents. This resolution was unanimously passed after the following discussion had taken place:

Mr. Lavenburg spoke of the Ft. Worth-Dallas line of the Northern Texas Traction Co., which is 90 miles long and parallels a steam railroad. This electric line charges two cents a mile and offers no reduction for a round-trip ticket. A parallel steam railroad, in order to meet the competition, met the two cent rate and also sold mileage books at one cent a mile, but the electric traffic remains satisfactory.

Mr. Lang told of the competition which is being satisfactorily met

is the Western Ohio Railway Co., which parallels a steam road from Lima to Piqua, a distance of 48 miles, stating that although the steam line offered good local and limited service, yet it does not sell to exceed five tickets a day from Lima to Piqua or the intervening towns. He also stated that the Aurora, Elgin & Chicago line is competing with five steam roads operating both local and limited trains on parallel lines. These combined steam roads offer three trains to one of the electric company, the Chicago & Northwestern Ry. alone operating 52 trains a day from Wheaton to Chicago in competition with the electric line for the 25-mile ride. The steam railroad fares are three cents per mile, with commutation and monthly tickets, which are sold at a rate as low as ½ cent a mile. He stated that this electric line raised its rates on March 11th, at which time it began operating to its terminal in the center of the Chicago business district, and although there were many complaints at first, the commuter traffic has increased 300 per cent since then.

The third topic, "Is It Advisable to Charge a Greater Fare from Passengers Paying Cash on the Train than Is Charged for Tickets?" was next discussed. Mr. Brown stated that if a road is equipped with ticket offices at suitable points and the passenger does not have to inconvenience himself to obtain a ticket, it seems just and reasonable that he purchase a ticket before boarding the train. The maintenance of the offices and the printing of tickets form a no small item in the operating expense, and their usefulness as revenue producers lies principally in getting the cash right in over the counter and from the trade which may be attracted by a round-trip rate. Then, where there is competition every time you sell a round-trip ticket you have obtained a guarantee from the passenger to come back over your line; but if the passenger can get on the train and pay the conductor exactly the same fare as he would have had to yield up to the agent for a ticket, it looks like a needless expense to maintain ticket offices. The trouble is in too many cases instead of the passengers paying an excess on the trains as a penalty for not purchasing a ticket, he has to be coaxed to patronize the ticket office by giving him a lower rate than the regular tariff.

Mr. Brown further said that of 23 roads in Ohio giving data on rates of fare, 14 make no difference between a cash fare paid on the train and a single way ticket purchased from agent, 6 roads sell no single trip tickets, and 3 make a reduction to the ticket purchaser of about 12 per cent. Of 8 roads in Indiana, 6 make no reduction to purchasers of single trip tickets, and the 2 do not sell single trip tickets. In the sale of round-trip tickets, 20 of the Ohio roads make a reduction to the ticket purchaser averaging 11.5 per cent, 1 road makes no reduction, and 2 roads do not sell round-trip tickets. Of the 8 Indiana roads, 5 of them make a reduction to the ticket purchaser of about 8 per cent, 1 makes no reduction, 2 do not sell round-trip tickets. On the West Penn Railways tickets are not sold except for use on the city line. The fare averages about 1.7 cents per mile throughout the remainder of the system, the sale of tickets having been abolished after a thorough trial.

Mr. Coen stated that the Lake Shore Electric Railway Co. is endeavoring to bring about as great a reduction in the number of cash fares as is possible, saying that at the present time only 33 per cent of the fares on this line are cash and that it is hoped to lower this percentage.

Mr. Stebbins stated that if tickets were generally used it might be possible for dishonest conductors to collect them and not punch them, then operating jointly with some friendly ticket agent, re-sell the tickets and divide the profits.

Mr. Nicholl stated that the Indiana Union Traction Co. sells no tickets except on the cars, but that it is planning to start a complete ticket service. For return trip tickets this line now charges double the one-way fare less 10 per cent.

Mr. C. O. Scranton, Stark Electric Co., stated that he felt that the ticket service gave a better revenue, and that his company charges two cents a mile for cash fares with a reduction of five cents for tickets. For the convenience of the farmer traffic he is planning the use of a 20-ride ticket made up of five-cent coupons.

The session closed with the announcement of the next regular meeting, which will be held at Cedar Point, near Sandusky, on June 22d, it being the last meeting until October. The ladies are invited to attend the June meeting.

After the adjournment of the meeting at 4 o'clock many of those present took advantage of the invitation of the Roberts & Abbott Co. to witness a practical illustration of smoke consumption at its office, and the invitation of the National Carbon Co. to visit its manufacturing plant.

American Car for Danville.

The type of car illustrated herewith, built by the American Car Co., has lately been placed in operation on the lines of the Danville & Northern Railway Co., which is controlled by the Illinois Traction System. The length over the end panels is 20 ft. 8 in., and the width, 8 ft. 3½ in. The No. 21-E type of truck which is used is claimed by the builders to carry the car body 2 in. lower than any other single-truck. The engraving of the interior shows the transverse seating arrangement and the type of doors used in the ends known as the Browneel Patents Co's. semi-accelerator. The

AMERICAN CAR FOR DANVILLE, ILL.

advantages claimed for this style of door in connection with entrance from one side of platform are the greater facility with which passengers may enter and leave the car, the position being close to the platform step, and the fact that the arrangement prevents in a large measure passengers from standing upon the platforms in such a way as to obstruct the passageway. The seats are of the Brill tilting style with grab handles attached, and the seating arrangement provides for 32 passengers. The sashes are arranged to drop into pockets in the side walls, the openings of the pockets being closed with hinged covers. The interior finish is cherry with birch ceilings tinted a light green, and decorated in gold.

INTERIOR OF CAR.

The general dimensions are as follows: Length over crown pieces, including vestibule sheathing, 30 ft. 1 in.; panel over crown piece, 4 ft. 8½ in.; width over sills, including panels, 8 ft. 11 in.; sweep of posts, 1¾ in.; centers of posts, 2 ft. 5 in.; side sill size, 4 x 7 in.; end sill size, 4 x 7 in.; sill plates, ½ x 7 in.; thickness of corner posts, 3¾ in., and of side posts, 2¾ in.; length of seats, 35 in.; width of aisles, 19 in.; height of steps, 15⅞ in.; height of risers, 14 in. Brill sand boxes, angle iron bumpers, "Dedenda" gongs, steps, and American Car Co's. fare boxes are included in the furnishings. The No. 21-E truck has a wheel base of 8 ft. and 33-in. wheels.

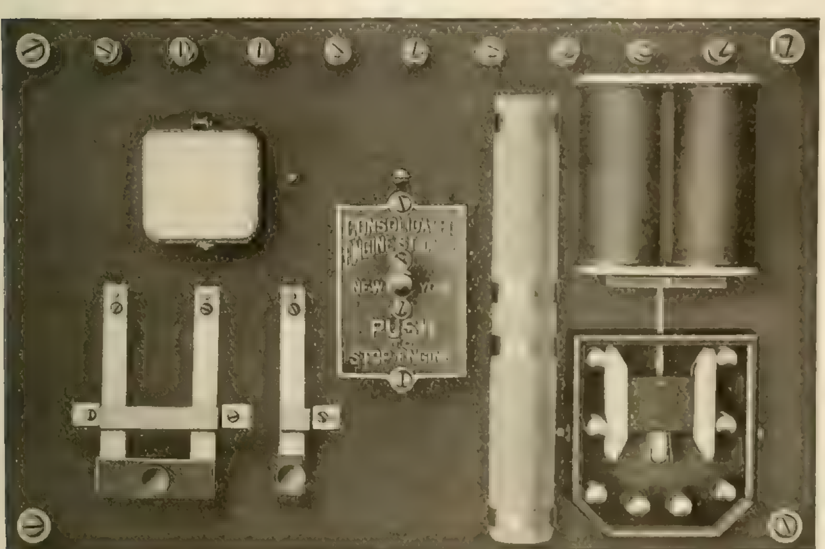
The car barn of the Dayton & Xenia Transit Co. at Trebinos was destroyed by fire May 12th, together with three cars.

Monarch Engine-Stop and Speed Limit System.

The Consolidated Engine Stop Co. has been making [illegible] noteworthy advances in the field of automatic engine-stops and has placed on the market three new devices which have [illegible] additions to the Monarch engine-stop and speed limit system.

To replace the snap switch and push buttons formerly used as a circuit closer, a new automatic push switch has been designed. This is enclosed in a small iron box, 2 x 3 x 1⅛ in., having an attractive cast bronze name plate and the words, "Push to Stop Engine," on the front. The switch is of the push type [illegible] make and break and opens the circuit as soon as the pressure upon the push is relieved. This eliminates all danger of leaving the circuit closed any length of time, and thus prevents deterioration of the batteries.

An entirely new wiring and testing system has been developed, by which the strength of the batteries and the condition of the wires can be determined from a test board located in the engine-room, the chief engineer's office or any place desired. This test board consists of a piece of slate or marble 10 in. square, upon which are mounted two test switches, a buzzer and one of the automatic push switches described above. The circuits may be tested separately, the



TEST BOARD "E" FOR HIGH TENSION CIRCUIT.

double test switch throwing the current through part of the line and the buzzer, the single test switch throwing the current through the engine-stop and the buzzer. The failure of the buzzer shows either that the batteries are getting weak or that the wiring is broken. The buzzer is of high resistance and will fail at least 24 hours before there is insufficient current to trip the engine-stop, giving ample time to renew the batteries. If the test shows a broken wire, the engine-stop system is not crippled, but should an emergency occur, requiring the use of the stop, it can be operated either by the automatic speed limit or any of the push switches, pending repairs to the wires. The advantage of this system will readily be observed, as the condition of the batteries and the wiring can be determined instantly and the engine-stop will always be in commission ready for emergencies.

The test board just described is styled Type "C," and is used in all installations of the Monarch system when battery current only is available; but as the Consolidated Engine-Stop Co. is installing its engine-stops extensively in central stations, railway power plants and isolated power plants, it realized the many advantages of utilizing direct current from a generator, and not be dependent entirely on batteries; and for some time has been experimenting with this end in view, with the result that it now has a new test board Type "E," 10 x 14 in. in size, which contains the entire testing outfit the same as Type "C," and in addition a resistance tube designed to take the direct current from the generator or exciter of 110, 220 or 550 volts; also a solenoid switch.

The switch contacts are drawn up when the solenoid is energized and remain there as long as there is sufficient current to trip the stop. Should the generator current fail for any reason, the contacts of the switch fall by gravity to their lower position, which throws in the battery circuit [illegible] the generator current [illegible] innovation for operating an engine-stop gives a double source of current and makes the Monarch [illegible] continuously under all conditions. The batteries and the wiring are tested on this board in the same manner as the Type "C."

All the parts of these new devices are well finished, and the material and workmanship is of the same high standard that enters into the construction of the Monarch engine-stop and speed limit system.

Tennessee Assessment Bill.

[illegible] Tennessee Legislature [illegible] the more equitable assessment of the interurban railroad and street railroad properties for state, county and municipal taxation, the bill being signed by the governor April 17th. This act gives the state tax-assessors authority to assess all interurban and street railroad properties within the state biennially and at the same time that railroad, telegraph and telephone properties are assessed.

Among the more important provisions of the act are: That every person or corporation owning, leasing or operating such properties shall file with the comptroller of the state, biennially, on or before the first day of April, commencing with the year 1905, a schedule or schedules giving a list of all property [illegible] in the state, in each county and in each municipality, the value of the whole, the capital stock, bonded debt, gross receipts, equipment, power houses and all other real estate. In event of the owner refusing or failing to file such a schedule, the value shall be fixed by the state tax assessors, he shall not be permitted to be heard in opposition, and shall be liable to a penalty of $1,000. In arriving at the valuation of the property, the state tax assessors shall take into consideration the capital stock of the company, the corporate property and franchises, the gross receipts, the expenditures for betterments, improvements and repairs, the market value of the shares and bonds, and all other facts that may throw light upon and show the value of the property, and to ascertain these facts they are invested with power to summon before them any persons and to call for any papers. The road bed, rolling stock, franchises, choses in action and personal property of a railroad having no actual situs shall be known as distributable property and shall be valued separately from the other property; and after ascertaining the total value of such distributable property and deducting from this value the sum of $1,000, the assessors shall divide the remainder by the number of miles of the entire length of the road, and the result will be the value per mile of such distributable property. The assessment for state purposes is then ascertained by multiplying the value per mile of distributable property by the number of miles in the state; and the assessment for county and municipal purposes is obtained by multiplying the value per mile by the number of miles in each county or incorporated city. Transfer stations, car sheds, power houses and real estate are valued separately, as localized property. Provision is then made for a board of equalization, consisting of the governor, treasurer and secretary of state, of which the governor is chairman, to which the assessments and records are delivered; this board is authorized to increase or diminish the valuation placed upon the property by the assessors and to require such additional evidence as will enable it to fix the correct value of the property. The board is required to certify to the valuation fixed by it on or before the third Monday in October, the action taken by it being conclusive and final. If at any time it appears to the satisfaction of the governor that any street railroad is inadequately assessed, or that its property has been omitted from taxation, or any new line has been constructed, he is empowered to convene the board of assessors to make the proper assessment. Provision is also made for the collection of assessments.

Concerted action against the interurban lines entering Columbus, O., is being taken by the steam roads, the Baltimore & Ohio, the Hocking Valley and the Pennsylvania Lines being interested.

Can a Steam Turbine be Started in an Emergency Quicker Than a Reciprocating Engine on the Same Power?*

BY A. S. MANN, SCHENECTADY, N. Y.

If a large steam turbine is cold and at rest how quickly can it be started? Can it be brought up to speed as readily as can a good cross compound engine that is cold all over?

Most station men would have doubts as to the adaptability of the large turbine, say 1,500 kw. or 2,250 h. p., for emergency work. So much has been written about the sensitiveness of a rotating disk to the changes of temperature and the effects of unequal expansion that it is easy to imagine difficulties in the rapid start. The possibilities of an engine with a 62-in. low-pressure cylinder in starting practically cold and coming up to synchronous speed are well understood. A station manager would criticise an engineer who would open his throttle as fast as he dared without wrecking his piping system and let his machine jump into her work. One turn at a time on the trottle is about all that is considered safe, and even then a close watch is kept for groaning valves and cold back bonnets.

Every time the starting valve is moved to increase the steam flow the engine is allowed to take its full increment of speed, due to that particular throttle position before the supply valve is moved a second time. There are ten large oil cups, and frequently more, that must be opened and adjusted before the machine moves at all, besides whatever oiling is to be done about the air pumps and other auxiliary apparatus.

Most engineers would consider 10 minutes as rather a fast start, and 15 minutes as a more usual starting period, including time taken for warming up; in fact, it may not be overstating the case to say that if it were known that an engine-driven plant were to be called upon in emergency for power and it were essential that the briefest possible time were to elapse between the call and the taking of the load, one or more engines would be kept in motion all the time turning slowly and hot all over.

This question makes itself very prominent when the steam station is operated as an auxiliary to a large source of high tension power, which is itself in the construction stage and has a large overload capacity of its own to carry, supplying all sorts of apparatus that use electric power, railway, lighting and power circuits simultaneously.

At such a time all sorts of accidents will happen to the high-tension water-driven plant, most of them due to the necessarily temporary character of many of the electrical connections. It takes months before an intricate system of wiring can be thoroughly relied upon, for it takes months before the temporary work of construction can be replaced.

The station at present under consideration is equipped with three Curtis turbine-driven alternators, 40 cycle, 10,000 volts, each of 1,500 kw. normal capacity. During the summer months the station is operated as an auxiliary to a water-power plant, taking all sudden overloads.

A signal has been arranged, a ¾-in. whistle, so that it can be blown instantly should the power fail. A blast of that whistle means—cut in two turbines and bring the third up to speed. The load will be heavy, and all auxiliary apparatus must be in regular operation.

Each turbine has a surface condenser and there are three or four pumps to be started for each pair of turbines; one circulating pump, one combined hot-well and feed pump, one pressure pump for the step bearings and one dry air pump, all of which are motor driven. The exciter is driven by a steam engine and must be started also, for it supplies current to a portion of the auxiliary apparatus.

The boiler-room has steam up at all times, supplying a system for manufacturing purposes other than power, and slow fires are kept in enough boilers to make steam needed for the normal load. Forced load means forced fires. The boilers have underfeed stokers, equipped with pressure blast, and will respond quickly to a 50-per cent excess call for steam. The operating force for this is about equivalent to a force for an engine-driven plant. Engineers and oilers, however, are busy about the building on construction work, installing new apparatus and taking such work as their regular occupation when the turbines are not running.

At the sound of the whistle the water-tender starts a blower on the extra row of boilers; all blast dampers are opened up and all stokers are allowed to feed at the maximum rate. Each fireman dumps his free ash and bars over his red fire.

The man in charge of the coal and ash conveyor starts the pressure pump for step bearings. One of the turbine men starts the exciter which supplies current to the auxiliaries beside its field current; a second turbine man starts the circulating pump and then his turbine. The hot-well pump and the air pump are started by the oiler. These movements take place simultaneously. The force is organized upon the lines that obtain in a fire station; each man has his specific duty, and after performing it looks to see that there is nothing more for him to do. Only a few seconds elapse between starting the first pump and starting the first turbine.

The turbine throttle is opened as fast as an 8-in. steam valve can be opened without endangering the steam piping system. It is not considered advisable to open the throttle valve as fast as a man's strength will permit; but if nothing unusual occurs in the pipe line, sentiment does not spare the turbine.

One electrician attends to the switchboard and telephone. As soon as the machine approaches speed, the synchronizing system is cut in and the main switches are got ready. One and one-half minutes will do all the work here outlined, including the time taken in mustering the crew from various parts of the building, itself not a trivial matter.

Manipulating an engine regulator so that it shall be at a precise speed and at an exact phase relationship from some other machine, not more than 1-1500 part of a second removed from it, is no matter that can be hurried, and one minute is fast time on such work. But the whole thing, phasing-in and all, has been done in 2½ minutes, including full load on the turbine, which started from a standstill.

This performance has been gone through a great many times, and our record book shows that out of 43 such calls 10 starts were made in 2½ minutes, 18 in 3 minutes and 15 in 3½ minutes.

We have taken the time in a number of instances when all the auxiliaries have been in motion and it only remained to start the turbine and phase it in on the line; the only valves to open in such cases are the throttle and one small oil valve. The two quickest starts have been made in 45 seconds and 70 seconds, respectively, including phasing in. Others range between 70 and 90 seconds. These two quickest starts were made on a turbine which had stood for 24 hours with the throttle valve shut tight though there was a slight leakage past the seat. After the throttle valve is off its seat it is not more than 30 seconds before the turbine is up to speed. A cross compound reciprocating engine of the four valve type, 2,250 h. p. capacity, can be brought up to speed from a standstill in five minutes if it is hot all over. This five minutes is to be compared with the 70 seconds required for the similar turbine operation.

A reciprocating engine, which is turning over slowly with the throttle valve just off its seat or with by-pass open and having all its oil cups open and regulated, can be brought up to speed, say seventy-five turns, in 2½ minutes. This can be compared with the 30 seconds necessary for bringing the turbine up under the same conditions; that is, about one-fifth the time necessary for bringing up the engine.

If the engine is cold all over and has all its oil cups shut tight, all its auxiliaries quiet, 15 minutes is called a rapid start. Starts have been made under such conditions in 12 minutes. When we start a cold turbine, we open up the valve and let her turn, and in two minutes we are ready to bring her up to speed and she will be at speed in 2½ minutes, dividing the engine's time by more than four.

*Read before the American Society of Mechanical Engineers, Scranton, Pa., June, 1905.

London Office of the Peckham Co.

The Peckham Manufacturing Co. has removed its London office from 34 Albemarle St., London, W., to 4 Victoria St., London, S. W. The company's telegraph address is Peckham Hostelery, London, and its telephone number is 70 Westminister.

At the sixth annual commencement of the Thomas S. Clarkson memorial school of technology, Potsdam, N. Y., June 9th, Mr. C J. H. Woodward, assistant engineer of the American Telegraph & Telephone Co., Boston, delivered an address to the graduating class on "The Engineer as an Economist."

A Vacuum Car Cleaning System.

The management of the Central Railroad of New Jersey has recently completed the installation of a system of car cleaning known as the vacuum sweeping system, whereby the dirt and dust is drawn from the car by suction through a pipe. The company has erected a plant in its Jersey City yards, and for a distance of 3600 ft. has laid pipe varying from 2 to 5 in. in diameter, covering in all about three miles. At short intervals this pipe is tapped and from the cocks is run the flexible hose, which may be taken in the car either

CLEANING CARPETS.

by door or window. At the foot of the hose is a metal pipe with a flat triangular end, along the base of which is an opening, and through which the dust and dirt is drawn by the vacuum machine. The operator runs the slot opening over the cushions, carpets, curtains, wood-work, etc., and without any commotion or dust raising, every loose particle or germ is carried away, everything being left

CLEANING CAR SEATS.

clean and wholesole. The dust thus removed, before reaching the "drawing-in" machine, passes through two dust separators, the first of which clears the air of 90 per cent of the grit, dust and germs; the second separator or cylinder draws the air through water in which corrosive sublimate is used, and completes the purification. The vacuum system, while reducing disease liabilities to a minimum, at the same time reduces the cost of cleaning and time consumed and two cars can be thoroughly cleaned under the new system at the same expense of time and money as is usually consumed in cleaning one.

The system and machinery are the invention of Dr. David T. Kenney, of 72 Trinity Place, New York City. We are indebted to Mr. C. M. Burt, general passenger agent Central Railroad of New Jersey, for the information, and the illustrations herewith.

Postel & Linn.

A new consulting engineering company has recently been organized by Mr. Fred J. Postel and Mr. H. R. Linn, of Chicago, and offices have been established in suite 1404, Fisher Building, Chicago. The firm is prepared to act in the capacity of consulting engineers for both mechanical and electrical engineering, and will make a specialty of heat, light and power plants and interurban electric railways, particularly with reference to power plants, overhead construction and car design and equipment. The experience of both these gentlemen particularly well fits them for this line of work, being graduates of the University of Illinois, Mr. Linn with the degree of mechanical engineer, and Mr. Postel with the degree of electrical engineer. For the past seven years Mr. Linn has been general foreman of the car department of the Lake Shore & Michigan Southern R. R., in charge of the designing and building of its rolling stock. Mr. Postel has been associated with the engineering firm of Charles G. Armstrong & Co. for the past six years, during which time he was in charge of the engineering work in connection with the construction of the power plant of the La Salle St. Station, the central power station of the Illinois Central R. R., Chicago, and the light, heat and power plant of the Consumers' Electric Co., Bloomington, Ill.

Interurban Service Between Chicago and Kankakee.

The Illinois Central Railroad Co. placed in effect May 14, 1905, an interurban train service between Flossmoor and Kankakee, Ill., and connecting with suburban trains to and from Chicago and Flossmoor. This service comprises four trains each way daily, including Sunday, the run being made from Randolph St. station, Chicago, to Kankakee, a distance of 55.88 miles, in 2 hours 20 minutes. Through passenger trains on the Illinois Central make no stops between Kankakee and 63rd St. station, Chicago; local trains only made seven stops between Kankakee and Flossmoor, while the new interurban trains make 26 stops between Kankakee and Flossmoor and stop at all suburban stations within the city limits of Chicago. Of the 26 stops shown on the time card 7 are ticket stations, or the regular stations that have been along this line for years, while the rest are nothing more or less than road crossings, large trees and fence corners.

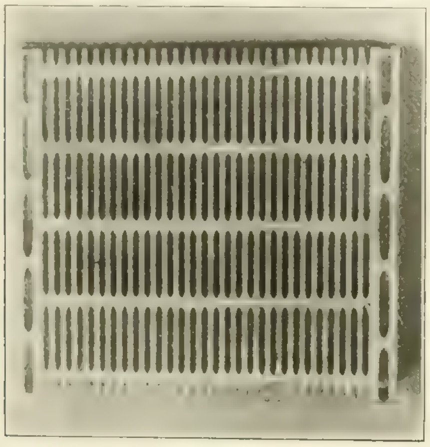
Tickets for these trains are sold at very low rates; the one-way rate between Kankakee and Randolph St., Chicago, is 90 cents, and the round-trip rate is $1.45, while the old rate and the rate which now applies on regular trains is much higher. The one-way rate between Kankakee and Chicago is $1.70 and the round-trip rate, good for two days, is $2.25, except that on Saturdays a week-end ticket, good returning Monday, is sold at the round-trip rate of $1.70. The rates between stations on interurban trains are based approximately on 2 cents per mile one way, and 1½ cents per mile round trip, no fare, however, being less than 5 cents one way and 10 cents round trip. Tickets can be purchased at stations where there are agents and of the conductors on the trains. Tickets for interurban trains or through tickets for interurban and suburban trains will only be honored on such trains and will not be good for passage on regular trains; while all classes of interline tickets, local tickets, mileage tickets, excursion and commutation tickets sold for local and through trains will be honored on interurban trains. The single trip tickets for interurban trains are good only on date of sale and the round-trip tickets are good for going passage on date of sale and returning the following day. The rates for children on interurban trains will be half fare, with a minimum of 5 cents one way and 10 cents round trip; while for continuous passage on suburban and interurban trains the fare for children will be as stated with the regular suburban rate added. No stop-overs are allowed on one-way or round-trip tickets and no baggage is checked for or carried on these trains.

Bijur Storage Battery.

The art of internal welding as discovered and perfected into a commercial process by Mr. Joseph Bijur has made possible the construction of storage battery plates on a scientific basis, unhampered by the limitations of the former crude methods of fabricating the metal.

In the construction of this new Bijur type of battery plate improved methods for the chemical treatment of the plates and new machinery for their construction have been developed, which not only give a more advantageous form to the active material, but also permit the automatic production of active parts in a form which heretofore could not be made at a commercial cost.

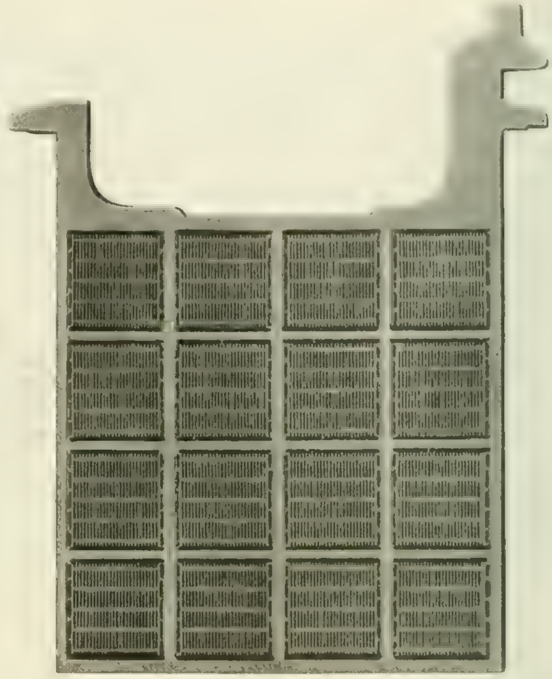
This new type of "high duty" battery for regulation, reserve capacity and operation economy is a product of the General Storage Battery Co., whose sales office is at 42 Broadway, New York City, and its manufacturing plant at Boonton, N. J.



GRILL UNFORMED.

The detailed design of the battery plates is shown in the accompanying illustrations. The basis of the Bijur battery is a minute cell of metallic lead, in which the active material grows, locking itself in as it expands, but being so disposed that openings for the circulation of electrolyte and escape of gases are provided, while the plate readily accommodates itself to the changes of volume occurring with charge and discharge. These cells are a part of the grating or "grill" made of pure lead squirted under pressure, which is enclosed in a frame of strong inoxidizable lead alloy containing a small percentage of refined antimony. This grill consists of vertical and horizontal strips and vertical ribs which form the oxide cells. As no central web is used, the plate is open through and through for a free circulation of the electrolyte. By the use of internal welding the grill is firmly held on both sides by the heavier alloy frame and a perfect chemical union made between grill and active lead. The small strips are perfectly free to expand in every direction throughout the life of the plate. No solder, flux or foreign material of any kind is used in the welding process. This scheme of construction, with a comparatively thin layer of oxide of the proper structure and thickness as determined by experience, and with the oxide in close contact with the grill and entirely open to circulation of the electrolyte, frees the Bijur "high-duty" plates from the ordinary causes of storage battery deterioration.

This new type of plate construction is credited with the following desirable features: The oxide is so supported that it cannot fall down, yet does not owe its retention to a filling up of the original interval left for it—a method which leaves no room for further expansion, as active lead is converted into the more bulky peroxide. At the same time the oxide is freely bathed by the electrolyte, insuring good acid diffusion with consequent absence of undesirable local concentration. The active lead parts are of uniform cross section and wear evenly. Expansion of the grill is provided for, and can occur without any tendency to distort the plates. Equal action of all parts of each grill and all parts of each plate is assured in an electrolyte of uniform acid density. The character of the oxide is such as to yield the highest results in capacity per gram of oxide. It is also of such character that its adherence to the lead from which it was grown is natural, and very great. Chemical union between active portions and frame is assured, avoiding contact losses and possible insulation of active parts by sulphation. There are no loose parts to become detached and fall out. Free escape of gases, large contact surface and locking in of active material favor high efficiency and enable the battery to work normally well at high rates of charge and discharge. The space occupied by the plate is utilized to the greatest advantage, hence while the reserve lead



BIJUR STORAGE BATTERY PLATE.

thickness is uniform and about 10 per cent heavier than in batteries of the old types, the capacity, unit for unit, is increased 20 per cent. The Bijur plates interchange almost exactly with all present standard sizes.

The General Storage Battery Co. owns basic patents covering the methods and machinery used in the manufacture of Bijur batteries, the plates and batteries themselves and the boosters, automatic switches, special appliances, regulating and distribution systems used in connection with these products.

New Features on a Cabinet Planer.

Every operator of a planer knows how much valuable time and labor is lost by having to remove the cutter head from the planer, chisel out the old metal from the boxes, put in the babbitting mandrel, fitting the caps over it, re-babbitting, taking the caps off again, replacing the cylinder, and then scraping the bearings again and again to insure a perfect fit. And then when the caps are screwed down how often is it necessary to hammer the bearings until the cylinder will turn round without sticking.

It was to get rid of all this trouble that the J. A. Fay & Egan Co., Cincinnati, O., recently invented its patent sectional clamp bearings for the journals. This device is composed of two sets of thin babbitt metal plates, five to each set, whose edges rest diagonally upon the journals and exert no pressure downward except that produced by their own weight. These plates are clamped into position by clamp bolts, which may be loosened at any moment there is occasion to take up any wear on the edges of the plates in contact with the journal. The cylinder never has to be removed from the planer, and there is no occasion for re-babbitting.

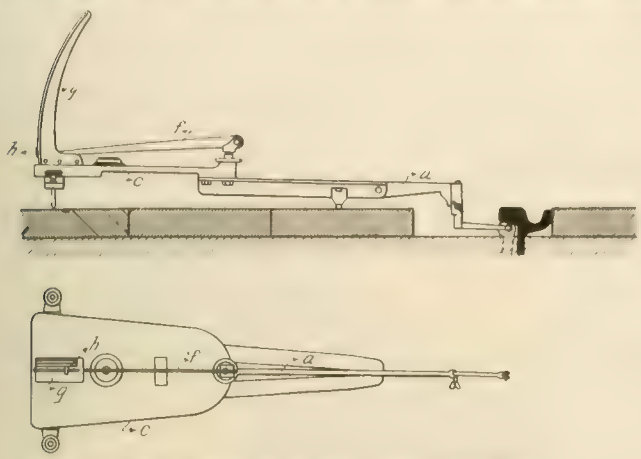
The above company's No. 156 new cabinet smoothing planer contains this excellent feature, and a new patent solid or sectional feed roll, a table moving on inclines operated by two parallel screws mounted on ball bearings, all run on shafts insteads of studs, and chip breakers which rise with the circle of the knives.

A Device for Measuring the Deflection of Track Rails.

BY DR. ALFRED GRADENWITZ.

The many close investigations which are now being made of the rapidity of wear and the relative stability of track work call for special measuring devices of which the accompanying illustration depicts a useful form.

The essential parts of this device, other than the main frame work or foot plate C, are the interconnected first and second class



DEVICE FOR MEASURING TRACK RAIL DEFLECTION.

levers A and F, respectively, and the scale G with its telltale marker H. One end of the lever A is fitted with a small roller which is designed to rest snugly against the underside of the head of the rail whose deflection it is wished to measure. The end of this lever on the opposite side of the fulcrum from the roller is in contact with a vertical strut which conveys any movement in lever A to the underside of lever F at a point close to its fulcrum. It is seen that by this arrangement any slight vertical movement of the contact roller at the end of lever A is conveyed to lever F, and by reason of the varied lengths of the lever arms, such movement is greatly magnified and proportionate deflections of the rail are thus read on the enlarged scale G which is built as a portion of the arc of a circle whose radius is the lever arm F.

When such deflections are made and the pointer moved upward on the scale the telltale marker H is also raised but withheld at its highest point by a simple mechanical device. As may be seen in the illustration an adjustment is provided for insuring the proper contact of the roller bearing with the head of the rail. And one end of the main frame of the device is supported on simple lifting screws so that when the contact roller has been adjusted the frame may be raised or lowered until the index points to zero on the scale and thus interpolation of results be made unnecessary.

The scale and proportions of the levers are so arranged that they indicate the deflection of the rail to 1-10 mm., hence it is seen that a deflection of 1-20 mm. may be read with a high degree of accuracy. The apparatus is free from any springs, its operation being effected wholly by the weight of its various parts. This device is adapted for general use and requires but little disturbance of the pavement adjacent to the rail. [illegible] writer is indebted to [illegible] the inventor of this device.

Government Control of Electrical Development in Ontario.

[illegible]

The provincial government of Ontario has taken steps to retain the right to transmit electric [illegible] power to the municipalities. This action, recommended by the railway committee on legislation, foreshadows an advanced policy for the development of water resources in the interest of municipalities. Public ownership of public utilities seems to be the object.

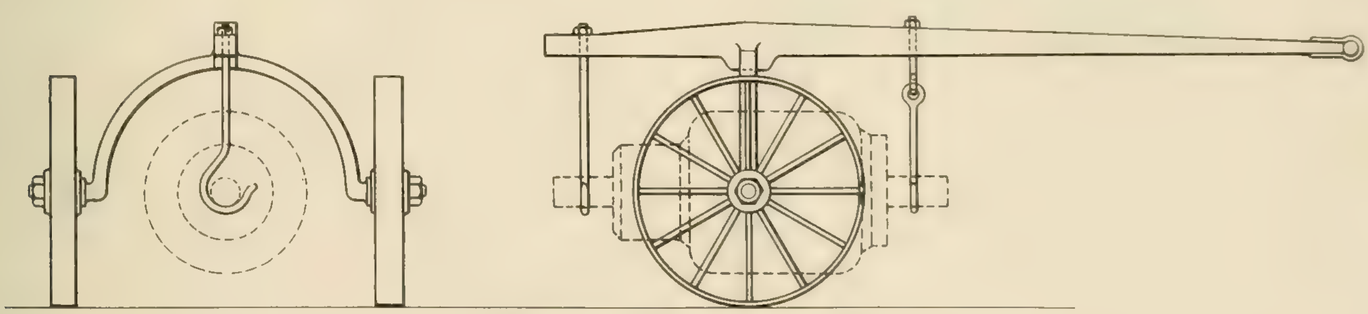
The occasion for the move came when the deferred bill granting an extension of time to the Ontario electric line was brought up for consideration. The road is to run from Toronto to Cornwall. On behalf of the company it was said that it had to buy a private highway, and that the work would certainly be pushed forward if an extension was granted. After discussion, the time was extended, but an amendment was carried curtailing the powers of branch lines, which cannot hereafter be built without the consent of the government, and must not go out of the county in which they are begun, and must not extend beyond 30 miles in length. Heretofore there was very little limit to powers in this regard.

Another amendment which is under consideration provides that the government shall at all times have the right to enter upon the right of way of the said company and dig up land, erect thereon all the necessary poles or lay all necessary conduits, and erect, put down, or construct all cables, wires and poles for the transmission of electrical power from any point in the province to the works and plant of any municipality, for distribution of such power within the limits thereto.

In 5 or 10 years all steam roads, it is believed, will use electricity, and therefore a similar clause will be in all new charters and in all renewals.

Convenient Armature Buggy.

The accompanying sketch illustrates a convenient armature buggy designed by Mr. G. E. Miller, master mechanic of the Union Electric Co., Dubuque, Ia. This consists of an arched bar terminating in journals on which are mounted the wheels, the radius of the arch being great enough to let the buggy run over any of the armatures used. To the top of the arch is fastened rigidly a long bar which is the longitudinal member of the buggy. For supporting the armature, there are two rods depending from the straight bar, each having a hook at the lower end. One of these rods is rigidly fastened to the long bar, while the other is attached to an eye bolt and is free to swing. The long bar has at one end cross handles for convenience in manipulating.



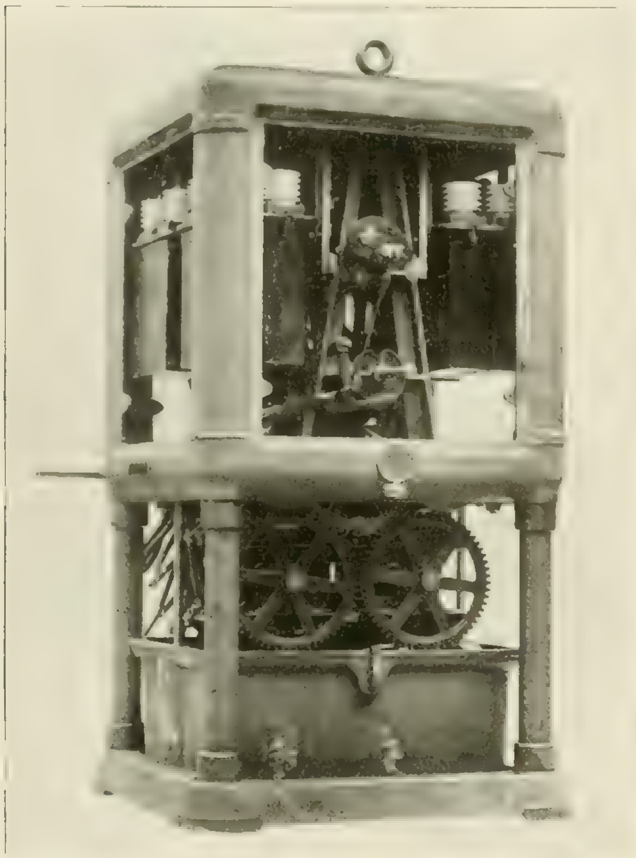
UNION ELECTRIC CO. ARMATURE BUGGY.

The Toledo, Port Clinton & Lakeside Railway Co. has recently purchased a fast steam yacht to be run between Port Clinton and Put-in-Bay in connection with its electric cars, giving a schedule of 2½ hours between Toledo and the islands. The boat is 92 ft. long, 16½ ft. beam, steel hull, and is registered for 125 passengers. Three trips a day will be made between Port Clinton and the islands, a distance [illegible]

Auto-Starter for a 1,400-H. P. Induction Motor.

Owing to the heavy current drawn from the line at the time of starting induction motors and the attendant drop in the voltage leads of the supply circuit, it is necessary to provide some means of furnishing a low voltage to the motor until a fair speed has been attained. The type of auto-starter used for this purpose consists of an oil-immersed switch or switches of the drum type used in conjunction with two auto transformers so connected as to apply gradually increasing voltages to the terminals of the motor. The advantages of a gradual development of torque manifest themselves both in the motor and in the line regulation.

The Westinghouse Electric & Manufacturing Co. build oil-immersed auto-starters for use with all sizes of constant speed induction motors from 5 to 2,000 h. p., suitable for various voltages, frequencies, and two and three phase. The accompanying illustration shows an auto-starter designed for the control of a 1,400-h. p.,



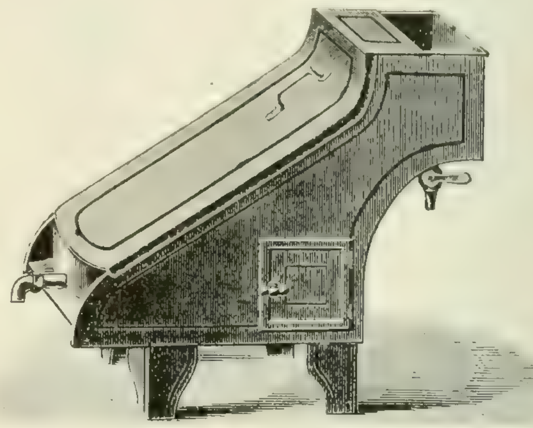
AUTO-STARTER WITH OIL TANK LOWERED AND COVER REMOVED.

2,200-volt motor. In this picture the regulating wheel and the enclosing panels are removed so that a better view may be had of the interior. For the same purpose the oil tank is also shown in its lowered position. This controller, known as Type 197, has eight starting and one running points, and when increasing the voltage from a low starting pressure to the full line potential the motor circuit is not opened as the successive points are passed, because transition resistances are inserted between the different notches. This feature does away with destructive arcing and prevents fluctuations in the line voltage due to starting the motor. The necessary reductions in voltage for starting are obtained by two auto-transformers mounted outside the case in connection with the preventative resistances. This type of controller is equipped with two automatic line circuit breakers.

By the first turn of the hand-wheel, the two non-automatic breakers which relieve the drum switches from breaking the heavy arcs are closed, and the motor is connected to the first point of each auto-transformer, both direct and through the preventative resistances. The next step connects the motor through another set of resistances to the next higher voltage, disconnects the motor from the lower voltage and finally short-circuits the resistances on the higher step. This is continued with each of the eight steps until the motor is connected to the full line voltage. The successive steps are indicated on a numbered dial below the hand-wheel on the front of the frame. An overload on the motor or a slight backward turn of the hand-wheel will cause the main line circuit breakers to open and the word "off" to replace the word "on" upon the shutter just above the hand-wheel. In either case it is necessary to return the wheel to the starting position before the circuit breakers can be closed. The tripping coils are so connected that only a part of the turns are in circuit when starting. Thus the capacity for heavy starting currents is increased and a greater protection when running is assured. This apparatus is intended only for starting, and therefore cannot be used for varying the running speeds of the motor.

Process for Cleaning Machine Oil.*

In large manufacturing establishments the machine oil used in running engines, dynamos, motors, and machinery of every descrip-



APPARATUS FOR CLEANING OIL.

tion forms a very considerable part of the annual expense account. In order to reduce this item to a minimum, a Berlin firm has placed an apparatus on the market which promises to find a ready introduction.

Fig. 2 shows its internal workings. The oil which has already been used is introduced into a settling chamber at the top, from

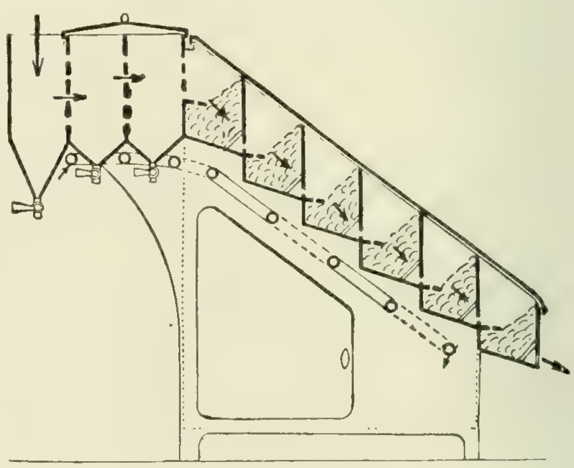


FIG. 2.—SECTIONAL VIEW.

which the liquid passes, as the arrows indicate, through two other settling chambers, at the bottom of each of which is a faucet for the removal of the sediments, and thence through a series of filtering chambers situated on an inclined plane, from the last of which it may be removed in a condition for use.

The Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co. has established a general freight service on its lines, handling freight in carlots. Special equipment has been placed in the service, the first train hauled consisting of four cars of brick of 40 tons each.

*From United States Commercial Agent Harris, Eibenstock, Germany.

June Meeting of the Indiana Electric Railway Association.

The June meeting of the Indiana Electric Railway Association was held at the Indianapolis Traction & Terminal building, the meeting being called to order at 10:30 o'clock, June 8th, with Mr. J. W. Chipman, vice-president, in the chair. The subject for discussion was train dispatching and papers were read by Mr. O. P. Spilman, chief dispatcher, Indianapolis & Northwestern Traction Co., and Mr. W. L. Pearson, Indianapolis & Eastern Railway Co. At the conclusion of the papers there was a brief discussion of a number of points of practice in handling trains.

A circular from Dr. J. M. Hurty, chairman of the Indiana State Board of Health, was read. This circular gave a statement of the requirements for the cleaning and disinfection of steam and electric cars which the board had under consideration and all companies operating in the state were invited to send representatives to a meeting of the Board of Health June 12th. On motion, the association appointed H. A. Nicholl, W. G. Irwin and A. A. Anderson a committee to attend this meeting on behalf of the Indiana Electric Railway Association.

The meeting then adjourned. The next meeting will be held Oct. 12, 1905.

In the afternoon delegates were the guests of the Indianapolis & Martinsville Rapid Transit Co. for a trip over the "Scenic Route," a special car leaving the union station at one o'clock, under the personal direction of Mr. Paul H. White.

Train Dispatching.

BY O. P. SPILMAN, CHIEF DISPATCHER INDIANAPOLIS & NORTHWESTERN TRACTION CO.

I shall try to give you, with the aid of a few blanks and forms, and in as few words and as plain a manner as possible, my views as to the dispatching of trains upon electric roads.

I have been in communication with a number of roads with a view of ascertaining what, if any, system was in use, and the most practicable, and find that as yet it is a kind of go-as-you-please affair. No two roads communicated with follow the same system, and some have none at all. I think it will be conceded by all that the safety of persons and property, as well as a return to those who have invested in these enterprises, makes this branch of the service one of vast importance. For, it is upon its reputation for safety, carefulness and the regularity with which its trains are run, that a road must stand before and be judged by the public.

I feel that it is wholly unnecessary for me to occupy your time in calling attention to the growth of interurban service, the increase in traffic, the expensive equipment and the speed at which local, as well as limited, trains are run in order to successfully compete with the steam roads, this being a matter you are all fully conversant with, and shall confine myself as closely as possible to dispatching.

In the dispatching of trains upon electric, as well as upon steam roads, there are three fundamental principles to be taken into consideration. First, and above all others, is Safety—not only to persons, but to property. No other consideration should be brought to bear with the element of safety in question. Safety—first, last, and all the time. Next comes Dispatch, the prompt handling of trains, giving them all possible dispatch commensurate with safety. This, the patrons of the road have a right to expect and demand. Next, Economy. While I place this last, it is of great importance. There should be economy in the number of trains run, but not to the detriment of the service nor to dispatch and safety.

Interurban roads, being yet practically in their infancy, have not the advantage of old experienced men that steam roads have. On a steam road a man must serve an apprenticeship, sometimes for years, as brakeman or fireman before he is thought competent to fill the position of conductor or be given charge of an engine. On an electric line a man without any previous knowledge may in a short time qualify for service upon either the front or rear end of a train. Great care should therefore be exercised in the selection of men, and, as a thorough knowledge of trainmen is a great help to the dispatcher, I think it should devolve upon the chief dispatcher to conduct examinations of all applicants so far as such examination pert[illegible] [illegible] ing of trains [illegible] railroad men [illegible] and right [illegible] the service taking opposite sides. When such questions come up with us, or when, on account of trouble on the line, wires down and trains late, a train crew is undecided just what their rights are, or what they should do under certain circumstances, I make a memorandum of each question or case and bring it before the men now in the service and embody it in the examination of all new men in order that all may have the same understanding.

Trainmen's especial attention should be called to the words, "Time Card," "Regular," and "Extra," as a thorough understanding of their meaning [illegible] thing in a book of rules. A "Time Card" is a general law governing the movement of all regular trains. Every train shown on the time card is a "Regular" train. An "Extra" train is one not shown on nor having any time card rights, and is inferior to any train of whatsoever class that appears on the time card. You will readily see how the three words or terms are interwoven and their importance as a factor in the safe handling of trains. Another point we lay particular stress on is that a train is not due to meet any particular car or crew, but a train of a certain number. When the line gets in trouble and there is no communication with the dispatcher, and a train is met at a siding, the crew must stop and ask what the train number is. They must not take it for granted that because it is the regular crew they have been meeting for weeks, that it is the train they are due to meet there.

Steam road dispatchers have an advantage over those on electric roads in that they do not have to depend upon the equipment of a train going into a terminal to make another train out in a few minutes, and are thus enabled to adhere more closely to the rule that "when a train is late, run it late, and keep all others on time." Unless a late train has enough lay-over time at the terminal to enable it to get out on time, you will have it late on its return trip, and it may be necessary to fill in the run from some point where you have an available car and crew, and you must either run the late train through or unload the passengers to be picked up by a following train. In either case additional expense is incurred. If in the first place the train is not too late, and you can give it a little advantage at meeting points over opposing trains, and divide the delay between three or four trains, each of which may be able to make up a little time, you will soon have them all on time. If you run the train late or annul it, you will hear loud complaints from your country patrons, especially if the weather be inclement.

Until some better means of communication for the transmition of train orders than the present telephone system is found, I strongly favor making all trains on the time card of the same class. If you have superior and inferior trains, when an inferior train gets late and there is trouble on the telephone line, nothing but superior trains will move and it will take but a short time to demoralize your schedule. If all trains are of one class, they can all go to their scheduled meeting point, and you can thus take care of your local business. This plan works equally well or better when there is no telephone trouble, for if it is desired to give an important train the advantage over one of minor importance it can be done with little trouble by special order.

I do not know of a better way to further express my views upon the subject than to acquaint you with the system in use upon the Northwestern for your consideration, discussion and criticism, with the end in view that we may benefit thereby, for the best is none too good. With a train sheet showing 82 regular and a large number of extra trains daily we use the standard system of dispatching as adopted by the American Railway Association, and with such slight modifications as make it applicable to interurban service, find that it fills all requirements. The main principles of this system are, "That all orders must be in as few words and as plain meaning as possible." "In giving one train a right over another, the train from which the right is taken must first be given the order." "The words meet and pass are to be construed in their literal sense, an order to meet a train meaning just what it says, and an order to

[illegible]

We do not run cars, but trains, defining a train as "a motor car, properly equipped, with or without additional cars," and use the word "car" and the number as an identification, the same as an engine on a steam road.

In connection with this system of dispatching we use a block signal system, not to run trains by nor to give them any authority to proceed, even if the block shows clear, unless the train has a time card right to do so, but as an additional safety precaution against a dispatcher giving a lap order, or a train crew reading an order wrong or running by a meeting point. A train finding a red block against it at other than a meeting point is required to stop and call up the dispatcher. Should the telephone line be in trouble, so it is impossible to get the dispatcher, the train waits seven minutes, and then if no opposing train appears in view proceeds upon its time card rights. "Safely and oft with mickle care to the crystal spring the pitcher they bear, but it is broken at last on its way or there." It is not the ninety and nine cases where a train can run by a red block in safety, but the one lone instance where the "pitcher" might be broken that we wish to guard against. We try to impress upon our men the importance of the rule that "a fixed signal imperfectly displayed, or the absence of a signal where one is usually shown, must be regarded as a danger signal."

Train orders are received by the conductor and copied in manifold. After he repeats the order to the dispatcher, and receives "complete" and the time, he hands one copy to the motorman, who reads it to him to make sure they both understand it alike. Should the telephone fail before the "complete" is received, the order is of no effect and must not be acted upon. An order is in effect until fulfilled, superseded or annulled. An exact copy of each order issued is kept by the dispatcher in a book provided for that purpose. Our trains being all of the same class, scheduled meeting points are definite; a train, however late, has a perfect right to go to such meeting point against an opposing train unless the meeting point is changed by a special order. We, however, provide for this by requiring a train to report to the dispatcher when it becomes five minutes late, and at once when it is found scheduled time cannot be made. A train arriving at a meeting point and not finding the expected train there or in sight, must report to the dispatcher at once.

(The forms used for train orders have at the top the name of the company and a blank for the number of the order; then follows the address "To Conductor and Motorman, Train No. —, Car No. —, At ————." Leaving space for the body of the order, the lower portion of the form is ruled for four columns, headed "Conductor," "Motorman," "Complete" and "Time," in which the dispatcher enters these notations as the orders are delivered. In giving the orders cited by the author, we reproduce only the address and body. All are, of course, signed.—Ed.)

When is becomes necessary to change a scheduled meeting, we use this form:

TRAIN ORDER 14.

Train 23, Car 46, City Limits:

Train 23, car 46, and train 24, car 27, will meet at Lawrence.

This is a definite meeting point, and unless the order is superseded or annulled each train has a right to go there indefinitely late.

If it is decided to change this meeting point, we use this form:

TRAIN ORDER 15.

Train 23, Car 46, Ingalls:

Train 23, car 46, and train 24, car 27, will meet at Wheelers instead of Lawrence.

Or if it is found that the late train is making up time and it is desired to let them go to their scheduled meeting point, we simply annul the order in this manner:

TRAIN ORDER 16.

Train 23, Car 46, and Train 24, Car 27, Ingalls:

Train order 14 is annulled.

In either of these cases the principle of first giving the order to the train from which the right is taken must be observed.

In the majority of cases of collision, whether upon steam or electric roads, you will find an "extra" train one of the factors. Therefore, too much care cannot be exercised in their movement, and the crew must ever bear in mind that it has no rights except such as are conferred by the dispatcher and that they must keep entirely out of the way of regular trains. If the extra train to be run is of little importance and no especial time is required, an order as follows will suffice:

TRAIN ORDER 17.

Extra East, Car 107, Smiths:

Car 107 will run extra Smiths to Browns.

If the train is an important one and if specified time is expected to be made, give the following order:

TRAIN ORDER 18.

Extra East, Car 58, at LaFayette:

Car 58 will run extra LaFayette to Indianapolis, and will meet train 17, car 54, at East Mulberry; train 105, car 46, at Martz; train 19, car 40, at Whites; train 21, car 30, at Eldridge; meet train 177, car 48, and pass train 18, car 34, at Townsend. O. P. S.

This practically makes of your extra a regular train with definite meeting points. This order is an exact copy of the one used for the special train of this association, March 9th, LaFayette to Indianapolis, and did not disarrange our regular schedule a minute.

If the extra is of still greater importance and it is desired to give it the right of track over all other trains, it can be done in this manner:

TRAIN ORDER 19.

Extra East, Car 58, LaFayette:

Car 58 will run extra LaFayette to Indianapolis on the following schedule, with right of track over all trains: LaFayette, 3:20 p. m.; East Mulberry, 4:07; Martz, 4:14; Whites, 4:35; Eldridge, 4:59; Townsend, 5:13; Indianapolis, 5:35 p. m.

Every train on the road in any way concerned by this movement must have a copy of this order.

We give a work train the following order:

TRAIN ORDER 20.

Work Extra, Car 100, Power House:

Car 100 will work extra June 8th between Power House and Greenwood.

The working limits should be confined as much as practicable, to be changed as desired; or you can add "until ————," if it is desired to confine the train to a certain hour.

Where trains are run in sections you can use the form shown in No. 21 or No. 22:

TRAIN ORDER 21.

Train 23, Car 46, and Car 103, Irwin:

Train 23, car 46, will carry signals Irwin to Chipmans for car 103.

TRAIN ORDER 22.

Cars 26, 40, 109 and 57, Chipmans:

Car 26 will run as first, car 40 as second, car 109 as third, and car 57 as fourth sections of train 23, Chipmans to Irwin.

A great deal more might be said on other forms, such as time orders, giving an extra train until a certain time to make a siding for another train or a work train time against a passenger train that is late, but they are very seldom used, and for all ordinary occasions those already shown will suffice.

All departments of the Public Service Corporation, with the exception of that of Col. Edwin W. Hine, assistant to the president, and that of John P. Feeney, superintendent of the claims department, were removed from Jersey City to Newark on June 15th. The idea of consolidating the various departments under one roof is in the interest of economy and efficiency. Under the old arrangement the departments were scattered.

Train Dispatching as Handled on the Indianapolis & Eastern Ry.

BY W. L. PEARSON

The dispatcher's office is furnished with a train sheet and train order book, which is adapted to all requirements. All train crews are furnished with train order blanks, also time table [illegible] regular trains operated. Passing points are marked with heavy black face type, also train number of all trains passed at each passing point.

All train crews report at terminals for orders, and compare their time with the Western Union clock at the dispatcher's office. Train crews reporting on schedule time are given their time card rights and will meet trains as per time table. Train crews reporting late are given orders, which are written down by the conductor on a form provided for the purpose, and the order is then repeated to the dispatcher, but is not in force until his "correct" has been received. Conductors then read and deliver the order to motormen, who turn them in at the dispatcher's office at the end of the run. The dispatcher then compares the orders with his copies in the order book, and, if correct, the orders are destroyed; otherwise they will be held for investigation.

Copies of orders in the order book are retained and all order books are filed at the superintendent's office.

Train crews are allowed but one minute grace at passing points, and must meet trains within one minute of schedule passing time, or report before train from opposite direction is due at regular passing point. Under these conditions, the dispatcher never has to say, "Can you see them coming?" or "Call again in a minute or two," but knows exactly what order to give when he hears from a train crew. And in the writer's opinion this is the best and safest way to operate.

Train crews who have become late and are running on train orders must maintain running time or report in time to advance trains from opposite direction.

All cars are provided with a portable telephone, and we have a "drop" provided for connection every half mile. Each train is listed on the train sheet and has a column by itself, and in case trains are late, a record is kept on the train sheet as well as in the order book. For instance, a train has an order to pass a certain train at a certain switch. It is marked in that train's column opposite that switch, "Pass No. 101," or whatever train it may be. And if a crew has an order to report at a certain point, it is marked on the train sheet in the same manner as that just mentioned. The object of this is that dispatcher may always have a record of his orders before his eyes, and also, that he can leave the desk at any time, and another man take his place without any complications whatever.

In case a regular train becomes late and is being followed by a limited train, and the limited train passes around the regular train at other than a regular passing point, the regular train notifies dispatcher at once, so that he may know that the limited train is ahead, and is making schedule time; and trains may be operated in opposite directions accordingly.

All trainmen are under the immediate instruction of chief dispatcher in the absence of the superintendent.

All second class trains, including freight, construction, work and line cars, are run as extras and display signals accordingly. Such trains have no rights except those given by the dispatcher, and must be in the "clear" four minutes before arriving time of all first class trains. In case telephone line is out of service, east bound trains have right of way over west bound trains five minutes after schedule passing time.

All conductors are supplied with a tin box containing all necessary signals. Each conductor must have this box on his train at all times when on duty.

Green flags by day and green lights by night are known as caution signals and all trains must be under full control while passing over a section of track where said signals are displayed. Green signals are also used on front of trains running in two or more sections, and denote that second section of such train is entitled to same rights as first.

[illegible] passing a train [illegible] with one long and two [illegible] there is another section [illegible] in the siding [illegible] whistle, which signifies that the train in the siding is aware that the train on the main line is running in two sections.

Red flag by day and red [illegible] signal and when [illegible] passed until the [illegible] signal removed.

A book of instructions, covering all the points mentioned, is furnished each of the employes of the company.

Washburn Automatic Couplers.

A coupler designed to meet M. C. B. [illegible] accompanying illustration. For [illegible] been in use in steam railroad service, and therefore has received a thorough test. In adapting it for electric railway service, all of the high grade steam railroad features have been retained as much as possible, changing the details wherever necessary to suit the needs of electric railway service, and, it is stated, adding some features which make it an improvement on the M. C. B. type. A description of the more prominent features of this coupler, which is manufactured by Edwin C. Washburn, Minneapolis, Minn., may be interesting.

WASHBURN AUTOMATIC COUPLER.

There are only four parts to the complete device. These parts have large wearing surfaces, and the design is such that the largest amount of wear falls upon those parts that are cheapest to replace. The coupler has a knuckle opener and a positive lock set so that one movement of the operating lever or chain unlocks the coupler, throws open a knuckle and sets the lock ready for recoupling. The design is such that it is entirely unnecessary for a person operating the coupler to touch it with the hands. When it is desired to unlock the coupler, as in the case of two cars standing together, it is only necessary to raise the lock until it catches on the tail knuckle and then release it, when it will fall into the lock set position. This is accomplished by but one movement of the operating lever or chain. The lugs on the knuckles and the walls at the top and bottom of the coupler come into close contact when the coupling is made, and thus insure a rigid joint. The parts operate automatically at the first impact, thus the jar of bumping cars together more than once is done away with, as is also the necessity of an employe going between the cars to make couplings.

The shank is made to take only one connecting bar and that between tail pieces, but it can be furnished with rear arrangement to suit the user's requirement, and so designed that the lock may be operated from the top, as in the illustration, or from the bottom so that it will not interfere with the platform.

The building [illegible] Purdue University, LaFayette, Ind., which has recently been built and equipped, is described and illustrated in an attractive pamphlet issued by the university.

High-Speed Cars for the Coeur d'Alene & Spokane Ry.

Four handsome interurban cars, built by the J. G. Brill Co., have recently been delivered to the Coeur d'Alene & Spokane Ry. Two of the new cars are combination passenger, smoking and baggage motor cars, and the other two are trailers. They are mounted on the Brill No. 27-E-2 trucks designed for high speed.

MOTOR CAR FOR COEUR D'ALENE & SPOKANE RY.

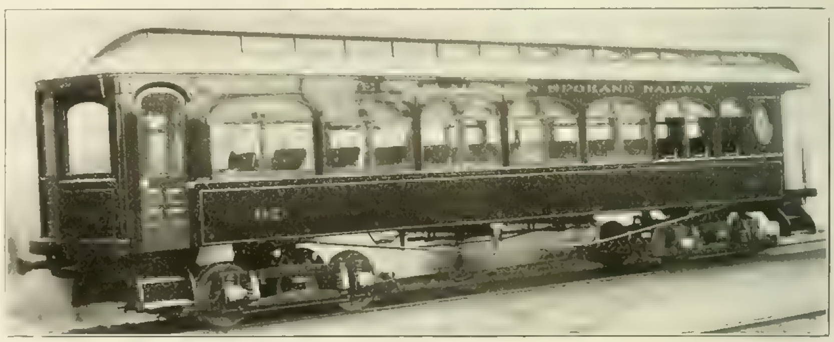
The combination cars are 51 ft. over the crown pieces, and 8 ft. 8 in. wide. While the semi-convertible window system is applicable to the arched top twin window arrangement, only part of it is used in this case; that is, the lower sash when raised is partly contained in the side roof, the bottom of the lower sash being equally as high as the bottom of the small stationary upper sash. The seats in the smoking and passenger compartments are of spring cane, while the baggage compartment has a seat of cherry slats on each side. The sliding doors of the baggage compartment on each side of the car are 40 in. wide, and the door in the partition between the baggage compartment and the motorman's compartment is 24 in. wide. In the center of the car is a small toilet compartment.

The trailers are 48 ft. 9 in. over the crown pieces and 8 ft. 8 in. wide. The window system is the same as in the cars above described. Entrances are provided at both ends. The seats are upholstered in plush, and are arranged to accommodate 52 passengers. Motors may be placed on the trucks at any time, in which case these cars may serve as motor cars.

The bronze rail that drops to guard and hold open the vestibule doors closing the step openings also acts as a hand rail and is similar to those used on Pullman cars. The bottom framing is unusually substantial, and consists of double side sills, the outer 4 x 8⅜ in. and the inner 2 x 6 in., with a 15 x ⅜-in. steel plate sandwiched between. The four center sills are composed of 6-in. I-beams with yellow pine fillers. The truss rods under the side sills are 1½ in. in diameter and the needle beams are double trussed. The floors are double and have ⅛ in. of felt between. The interiors are pleasingly finished in golden oak.

INTERIOR OF TRAIL CAR.

The cars will be operated on the company's interurban line of about 35 miles connecting Coeur d'Alene and Spokane, Wash. The road traverses the valley of the Spokane River, which has its source in the Coeur d'Alene Lake, in which vicinity is the richest mining district in the state. Spokane is the nearest large commercial center. The business of the company is steadily growing, and new equipment has frequently been added, all of which has been furnished by the American Car Co. and the J. G. Brill Co.



TRAIL CAR, COEUR D'ALENE & SPOKANE RY.

The general dimensions of the motor cars are as follows: Length over end panels, 46 ft. 1¾ in.; over bumpers, 52 ft.; length of passenger compartment, 22 ft. 8 in.; smoking compartment, 10 ft. 8 in.; baggage compartment, 8 ft. 4½ in.; from end panel over crown piece, 4 ft. 11 in.; thickness of corner posts, 3¾ in.; of side posts, 3¼ in.; side sill size, 4 x 8¾ in.; end sill size, 6 x 8 in.; sill plates, 12 x ⅜ in.; weight of car and trucks, without electrical equipment, 49,600 lb. The trailers are 38 ft. 10 in. over the end panels and 49 ft. 9 in. over bumpers. Other dimensions are the same as for the motor cars. The No. 27-E-2 trucks have a wheel base of 6 ft. 6 in. and 33-in. wheels. Four 75-h. p. motors are used per car.

Chicago Litigation.

Two suits were brought to determine the validity and scope of the 99-year act; one was brought by the receivers of the Union Traction Co. and the West Chicago Street R. R. against the city and the street railway companies affected, and the other by the receivers of the Union Traction Co. and the North Chicago Street R. R. against

the city and the railway companies affected. Judge [illegible] decree in the former case was rendered March 8th, [illegible] the latter May 8th. An appeal has been taken to the [illegible] Supreme Court by the receivers in both of these [illegible] appeals have also been taken by the city in both [illegible] the North Chicago City Railway Co. in the North Side case, and by the Chicago West Division Railway Co. in the West Side case.

After entering the decree in these two cases, the injunction against the city was dissolved as regards the streets held not to be included in the 99-year act.

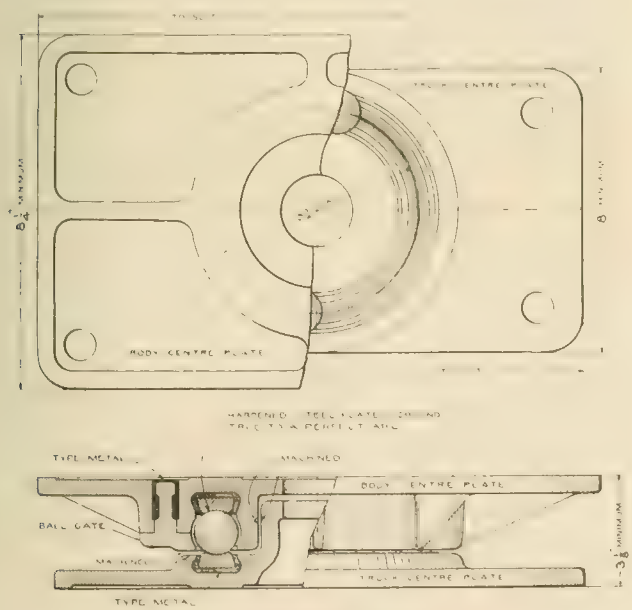
There are now pending in the state courts three suits, which by mutual agreement will be heard together Sept. 18, 1905, by Judge DePuy, of the Cook Superior Court. The first of these three cases is that known as the Harrison "Coup No. 1," in which it is the contention of the city that under the original franchise granted in 1859 the city had the right to purchase the Chicago City Ry. at the end of the franchise term, 25 years, and that the 99-year act of 1865 was unconstitutional because impairing a contract then existing between the city and the Chicago City Ry. The other two cases are quo warranto proceedings brought by the attorney general on the relations of the city against the Union Traction Co. and the Chicago City Ry., respectively.

There have been many rumors and newspaper reports as to offers to buy or to sell Chicago street railway properties, but nothing definite has been done.

Ball Bearings for Center and Side Bearings.

Some of the reasons that have been advanced for advising the use of anti-friction center and side bearings are that by thus reducing the turning moment necessary for revolving a truck about its center bearing, the wear of the flanges in passing curves and special work is reduced and a saving effected in the repaid cost of the track work, wheels, trucks, car body and equipment. A lessening of the grinding effect of flanges on special work is of course accompanied by a decrease in the train resistance and a reduction in the amount of power used.

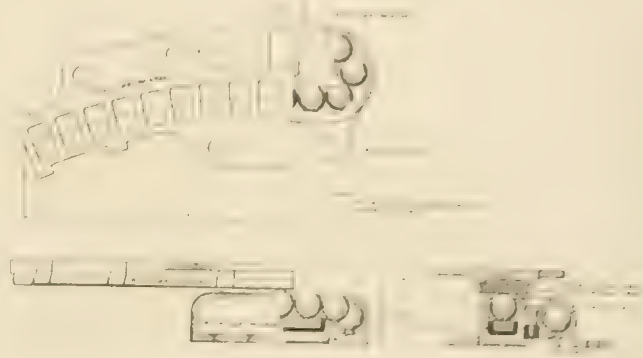
The Baltimore bearings, made by the Baltimore Railway Specialty Co., Baltimore, Md., are designed so that the fraction resistance attendant to the revolving of the truck about the center bearing is small. The use of steel balls in these bearings in place of steel rollers is said to increase the life of the bearing, because of the tendency for the rollers to be worn flat by the continued slight lateral motion of the car body, relative to the truck. The accompanying illustrations show the construction of the types of bearings designed particularly for electric car use. This type of bearing is made for all classes of railway equipments, the general design being the same with the details changed to suit the particular type of rolling stock.



ROLLER CENTER BEARING.

[illegible] the center bearing [illegible] from the center are circular ball races in which are securely keyed grooved ball race plates [illegible] has been subjected to a special treatment to obtain the requisite degree of hardness for successfully carrying the 18 steel balls interposed between the race plates to support the weight of the car. A retaining ring for the balls is keyed into the body center plate by type metal, which after having been poured into the key opening, expands in cooling, thus securely fastening the ring.

The truck side bearing designed for electric rolling stock is also illustrated. It [illegible]



ROLLER SIDE BEARING.

described for the center bearing have been incorporated in the design of this side bearing.

Both of these types of bearings have the balls suspended in the body member so that dirt cannot clog or interfere in any way with their rolling action. There are 18 balls always in service in a center bearing and never less than 3 balls in service in a side bearing. Each ball before being assembled must successfully pass a rigid compression test. From the results of experiments with this type of center bearing it is stated that with a load of 70,000 lb. on the center plates the application of 70 to 90 lb. force at the end of a 35-in. lever arm is sufficient to turn the plates.

The T. H. Symington Co. is the selling agent for the "Baltimore" bearings. The Chicago office of this company is Suite 315, Railway Exchange Building.

A. S. R. A. Committee Meetings.

Meetings of the Executive Committee of the American Street Railway Association and of the Reorganization Committee were held at the Bellevue-Stratford Hotel, Philadelphia, June 12th and 13th. Those in attendance were: W. Caryl Ely, president; John I. Beggs, second vice-president; T. C. Penington, secretary and treasurer; John J. Stanley, C. G. Goodrich and W. E. Harrington, of the American Street Railway Association; W. G. Ross, president Street Railway Accountants' Association; H. H. Adams, first vice-president American Railway Mechanical and Electrical Association; W. H. Renaud, jr., Association of Street Railway Claim Agents; and members of the executive committee of the American Street Railway Manufacturers' Association.

It was voted that the name of the A. S. R. A. be changed to the American Street and Interurban Railway Association, and that the Accountants', the Mechanical and Electrical, and the Claim Agents' associations be affiliated with it. The Manufacturers' association is to work in harmony with the Street and Interurban Association and to have charge of the exhibits and entertainments at the conventions.

The convention will be held the week of September 25th; Mechanical and Electrical association and Claim Agents, Monday and Tuesday; A. S. R. A., Wednesday and Thursday; Accountants', Thursday, Friday and Saturday. The meeting and exhibit halls will be at the Philadelphia Commercial Museums, which can be reached by 15-minute car ride from the Bellevue-Stratford, the headquarters hotel. Some 35,000 sq. ft. exhibit space is available.

Personal.

MR. FREDERICK H. [illegible] has been appointed [illegible] [illegible] the New Orleans [illegible].

MR. W. J. TERWILLIGER has been appointed superintendent of the Columbia & Montour Electric Railway Co., Bloomsburg, Pa., vice Mr. David G. Hackett, deceased.

MR. PETER SMITH, president of the Peter Smith Heater Co., who is making an extended business trip through the middle west, was a caller at the office of the "Review," May 23rd.

MR. M. J. LOFTUS, superintendent of the Columbus, Grove City & Southwestern Railway Co., has resigned to become superintendent of the Dayton, Springfield & Urbana Traction Co.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. entertained the delegates to the International Railway Congress at luncheon on Tuesday, May 16th, at the works, East Pittsburg.

CORY, MEREDITH & ALLEN, consulting engineers, announce the removal of their offices, June 1st, to suite 910-11-12-13 Union Trust Building, corner of Market and Montgomery Sts., San Francisco.

MR. W. P. CULVER, formerly with the Cleveland Motor Car Co., is now the eastern representative of the Diamond Chain & Manufacturing Co., of Indianapolis, Ind., and will have headquarters in New York.

MR. [illegible] RICHARDS has been appointed superintendent of the Taunton & Pawtucket Street Railway Co., Attleboro, Mass., having resigned as assistant superintendent of the Boston & Worcester Street Railway Co.

MR. ROBERT P. LEAVITT has been appointed general mechanical superintendent of the Albany & Hudson Railroad Co., in addition to his former duties as electrical superintendent of both railway and lighting departments.

MR. L. E. SMITH, of Worcester, Mass., formerly with the Boston & Worcester Street Railway Co., has been appointed assistant to Mr. Fred S. Smith, superintendent of the Taunton & Buzzard's Bay Street Ry., and assumed his duties May 10th.

MR. GEORGE W. ROUNDS has been appointed superintendent of the Houghton County Street Railway Co., vice Mr. J. S. Bleeker, promoted to the management of the Blue Hill Street Railway Co., Boston, Mass., another Stone & Webster property.

MR. FRED J. J. SLOAT has been appointed general manager of the Cincinnati Northern Traction Co., which controls the Cincinnati, Dayton & Toledo Traction Co. Announcement has also been made of the appointment of Mr. W. H. McAllister, of the Cincinnati Traction Co., as comptroller.

MR. J. S. M. GOODLOE, certified public accountant, who has for several years represented in Columbus, O., the firm of Patterson, Teele & Dennis, on May 1st withdrew from that firm and has organized the firm of Goodloe & Kennedy, with headquarters at 900-905 New Hayden Building, Columbus, O.

MR. S. R. DUNBAR, who until recently was purchasing agent for the Indiana Union Traction Co., has been appointed passenger agent of the company with headquarters at Anderson, Ind. This is a new department created by the present management and all passenger traffic matters will be handled by Mr. Dunbar.

MR. HENRY PERCY BRADFORD, of the Underground Electric Railways Co. of London and the Metropolitan District Ry., and director of Societe des Tramways et Voies Ferries du Nord, Lille, France, was a recent caller at the office of the "Review," while on an extended trip throughout the United States.

MR. WILLIAM K. VANDERBILT, JR., is to represent the New York Central R. R. in the management of its electric railway properties and it is stated will become a director and vice-president of the Utica & Mohawk Valley Railway Co. and the Syracuse Rapid Transit Co., and has taken up the matter of converting the West Shore between Utica and Syracuse for electrical operation.

MR. GEORGE GIBBS has been appointed chief engineer of electric traction of the Pennsylvania, New York & Long Island and the Pennsylvania, New Jersey & New York, the subsidiary corporations of the Pennsylvania R. R. under which the tunnels under New York and the North and East rivers are being built. He was formerly vice-president of Westinghouse, Church, Kerr & Co.

AT A MEETING OF THE BOARD OF DIRECTORS of the Westinghouse Electric & Manufacturing Co., held in New York May 30th, Mr. E. M. Herr was elected first vice-president and chief executive under the president. The advent of heavy electric traction and the adoption of electricity by main line railways render the services of a man skilled not only in manufacture, but also conversant with railroad operations, especially desirable at this time. There are few men who are more widely known among railroad managers and in whom more confidence is reposed than in Mr. Herr. He was locomotive superintendent of the Northern Pacific railway for a number of years, and previous to that had many years' experience in various positions on important railways in the west. For the last seven years he has been vice-president and general manager of the Westinghouse Air Brake Co.

MR. H. J. SLIFER has recently become associated with J. G. White & Co., New York City, as steam railway expert. Mr. Slifer was born in 1859 and graduated from the Polytechnic College of Pennsylvania in 1880 with the degree of mining engineer, since which time he has constantly been engaged in railway work. Mr. Slifer's experience has included engineering work on the Mexican National Ry., the Pennsylvania R. R., the Milwaukee, Lake Shore & Western R. R. and the Chicago & Northwestern R. R., being appointed superintendent of the Iowa Division of the latter road in 1899. In 1902 he resigned to accept the position of general superintendent of the Chicago, Rock Island & Pacific R. R., in charge of operation. His experience in engineering, operating and maintenance matters qualifies him well for the position he now holds, in which capacity he will be in responsible charge of matters relating to the company's steam railway undertakings.

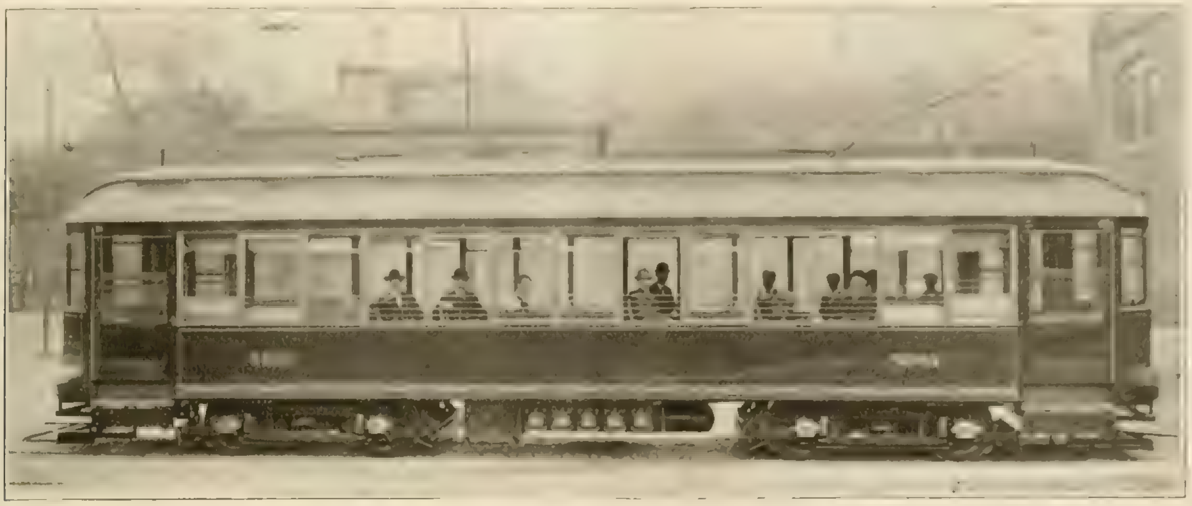
MR. C. N. WILCOXON, who recently succeeded Mr. H. A. Nicholl as general superintendent of the Cleveland & Southwestern Traction Co., resigned his position of superintendent of the Western Ohio Railway Co., with which system he had been connected for some four years. Previous to taking up railroad work Mr. Wilcoxon was for a number of years engaged in water and gas works construction and management. For six years he was general manager of the Muncie Natural Gas Co., one of the largest natural gas corporations in Indiana; together with his father, he built the third Bell telephone exchange in Indiana, the number of the old Blake transmitter and a set of instruments installed in his residence at that time being No. 2228. Mr. Wilcoxon then entered the service of steam railroads and later resigned to enter the service of the Citizens Traction Co., of Muncie, Ind., after which he became associated with the Decatur Traction & Light Co., Decatur, Ill., resigning a position of general manager of this company to go with the Western Ohio Railway Co. Under Mr. Wilcoxon's management the Western Ohio developed into one of the best high speed interurban lines in the country and his experience in both steam and electric railway practice well fits him for the heavier duties as general manager of 140 miles of electric railways comprising the Cleveland & Southwestern system.

C. N. WILCOXON.

MR. ALBERT S. CRANE has recently become associated with J. G. White & Co. as chief hydraulic engineer. Mr. Crane was born in 1867 and graduated from Cornell University in 1891, since which he has been actively engaged in hydraulic work. From 1891 to 1895 he was employed on sewer and water works construction in Newton, Mass.; for a period of four months he was engaged in designing the details of the Fortress Monroe sewerage system, after which he became assistant engineer of the department of city works of Brooklyn. From 1898 to 1901 Mr. Crane was engaged on the developments of the Michigan & Lake Superior Power Co. at Sault Ste. Marie in the capacity of assistant chief engineer, when he was appointed chief engineer of the Lake Superior Power Co. Since 1902 he had been engaged as principal assistant engineer of the Sanitary District of Chicago, in charge of the design and construction of the 30,000-h. p. water power plant of the Chicago Drainage Canal.

Steel Car for East Boston Tunnel Service.

The Boston Elevated Railway Co. has recently [illegible] at its Bartlett St. shops a car of somewhat novel design and [illegible] tion intended for use in the East Boston Tunnel [illegible] and the streets connecting therewith. The car is of a [illegible] type so that it may be used advantageously in either summer or winter, and is intended to provide a maximum carrying capacity, with quick and easy ingress and egress of passengers and having its entrances closed while in motion with a view to the prevention of accidents. Strictly speaking, the car has no platforms, the floor



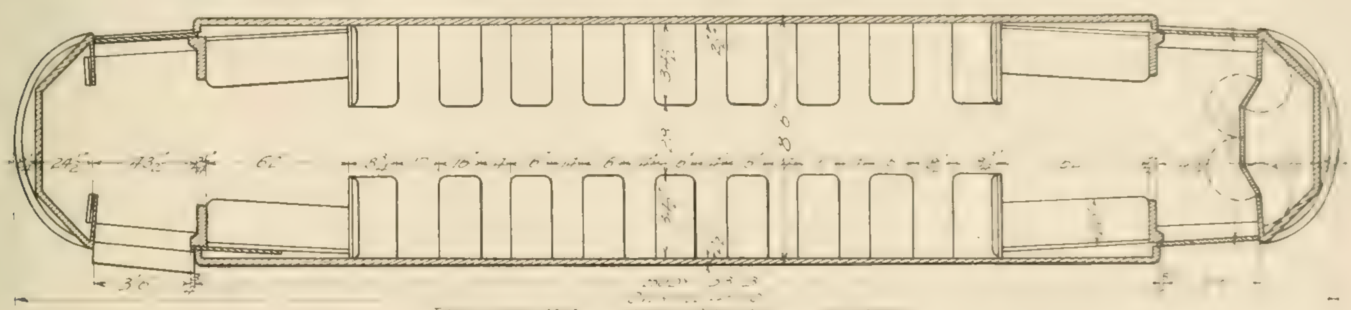
CAR FOR EAST BOSTON TUNNEL SERVICE.

of the car being continuous and at the same level to its extreme ends, and the car is closed by sliding doors in the side with no full bulkhead separation between the platform portion and the body of the car.

Attention has been paid to securing the greatest possible width of aisle and, in construction, to attain the lightest possible weight consistent with necessary strength.

The general dimensions of the car are as follows: Length of body, 33 ft. 3 in.; length over all, 45 ft. 10¼ in.; width over all, 8 ft. 6 in.; height from bottom of sill to top of roof, 9 ft. 8 in.; height from rail to top of roof, 12 ft. 3½ in.

As the car was to be used in the tunnel, it was desired to make it fireproof, or as nearly so as practically necessary. To this end the bottom framing is composed largely of steel angles and I-beams. The side sills are made of three angles hot riveted to-



FLOOR PLAN OF CAR.

gether in such form as to allow the window sashes to drop into the pocket to the bottom of and outside of the sill.

The cross sills consist of I-beams riveted to side sills with steel knees, and having oak fillers on either side.

The end sills are made up of two steel plates 6 x 1 in. and 6 x ¾ in., formed to practically the same lines as the bolster, in an inverted position.

The extension of car beyond the main end sills, there being no drop platforms, is supported by two pairs of 3-in. I-beams, with oak fillers, running under top and resting on casting on bottom member of end sills, and extending back to the bolster and to [illegible] the anchor casting on the outer end.

The floor is of hardwood painted with fire-proof paint, the under side lined with asbestos and further protected with heavy sheet tin thoroughly painted on both sides.

The body framing consists of 12 T-iron posts on each side, running straight up from sill to roof plate and interlocked at the window stool. [illegible] plate running the entire length of car and riveted to the posts.

There is a soft steel truss, 3½ x ¾ in., supported at the posts directly over the bolsters by a block gained into the posts, the lower ends passing through the side sill and provided with anchor castings and take-up nuts.

The sides of the car, from sill to windows, are built in with longitudinal sheathing ¾-in. thick, and covered with ⅛-in. steel plates riveted to the window stool and bolted to the side posts.

The roof is of the steam car type, the top covered with 8-oz. duck, painted and sanded.

The conspicuous features of the design are the side end doors and folding step operated by compressed air. The doors are 3 ft. 6 in. wide and will admit two persons side by side directly into the car, there being practically no platforms. The motorman's cab is so arranged with folding doors as to make a separate compartment while in use, or may be folded out of the way, leaving the space open.

A pocket, lined with sheet iron and asbestos, is provided in the cab over the motorman's head, and contains all switches, fuses, etc., mounted on slate panels.

The maximum [illegible] only 2½ in. thick, thus with 8 ft. 6 in. over all there is an inside width of 8 ft. 1 in., which admits of cross seats 34½ in. long and a 28-in. aisle.

The sashes are of channel bronze and are divided into two parts, the top sash being 9 x 28 in. and may be raised its full height; the

[illegible] 33 x 28 in. [illegible] flush with the [illegible] window stool, which is but $27\frac{1}{2}$ in. from the floor. This is accomplished by the novel side sill construction which, with the car siding, forms a pocket into which the sash may drop.

The window runs are provided with an automatic cover which comes into place and prevents the dropping of articles into sash pocket when sashes are raised.

There are 14 reversible transverse, 4 fixed transverse, and 4 longitudinal seats, giving a seating capacity for 52 persons with ample knee room, and a floor space of 12 ft. from end of car to cross seat.

The interior of the car is lined with sheet aluminum, the headlining being finished its natural color and the standing finish painted a rich olive shade, decorated in gold. The car is illuminated with six 5-light circuits and provided with illuminated signs.

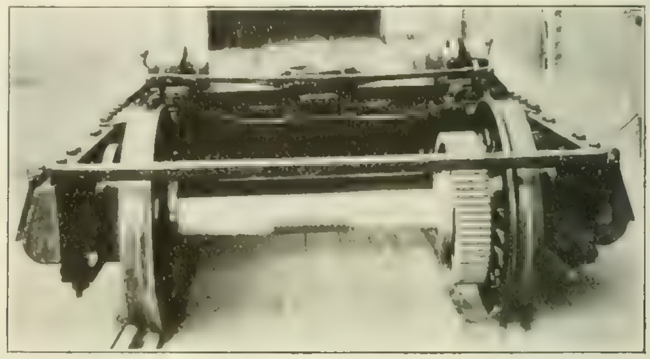
INTERIOR EAST BOSTON TUNNEL CAR

The electrical equipment consists of four G. E.-74 motors having a rated capacity of 65 h. p., and Sprague-General Electric control similar to that installed on the later elevated car equipment of the company. The 15 contractors, with interlocks and auxiliary rheostat, are arranged in one iron box beneath the car, the cover of which is arranged very conveniently for inspection and adjustment of contractors and interlocks. The reverser, which is also beneath the car, is well protected by an iron box which also contains switches for cutting out the several motors; all wiring is run in iron pipe conduit and great care taken to eliminate all possibility of fire. One important feature of the control equipment is the automatic relay throttle which governs the acceleration of car; another is the train line cutout switch by means of which the motorman can open the train line circuits on each car. It is intended to use this car as a motor car of a train of two cars of like size, the train to be driven either end forward, the second car being without motors. The tunnel contains long grades of 5 per cent and less and at present affords no opportunity for looping cars at the terminal. The motors are mounted on Brill 27-E-1 trucks having 33-in. steel tired wheels and $4\frac{1}{2}$-in. axles.

New Type of Trucks for Gasoline-Electric Motor Car.

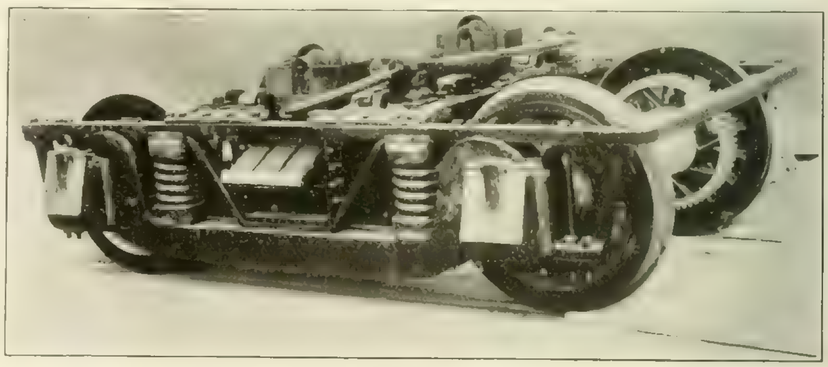
The American Locomotive Co. has recently completed for the Delaware & Hudson Co., the trucks shown in the accompanying illustrations. This type of truck is designed to carry the body and equipment of a gasoline-electric motor car. The truck weighs 15,000 lb. and is made to carry a load of 50,000 lb. at the centering pin. There will be two G. E.-69 motors mounted in the truck. The specifications for the construction of this type of truck call for a frame of wrought iron $2 \times 3\frac{1}{2}$ in. in section, forged in one piece and dropped down 4 in. at one end to clear the draw gear. The boxes are cast iron, similar to M. C. B. standard boxes and are fitted with malleable iron lids and dust guards of wood. Lead lined plastic bronze bearings made by the Ajax Metal Co. are used. These are designed to fit interchangeably with M. C. B., $5\frac{1}{2} \times 10$-in. wedges. Taylor steel-tired plate wheels, 36 in. in diameter, are used, mounted upon axles of open hearth steel. The gears are mounted on the hubs of two of the wheels. The diameter of the axles at the points where they carry the motors is $6\frac{1}{2}$ in. and the motor bearings are 12 in. long. A forged pedestal is used, made of $5 \times 1\frac{1}{2}$-in. bar iron and secured to the frame by 1-in. taper turned bolts.

The equalizers built of 6-in. iron and placed on top of the boxes are designed with thimbles between them and bolts through the equalizers to prevent spreading. There are four double coiled springs between the frames and the equalizers. These springs were made by the National Steel Spring Co., and the two triple elliptic springs were made by the American Locomotive Co. The



END VIEW OF TRUCK.

bolster is of the "built up" type with roller bearings on the top of the bolster spaced 58 in. between centers. The swing links are of cast steel with pins of cold rolled steel $2\frac{1}{4}$ in. in diameter, fastened to the castings by tapered pins. Bolted to the swing link transoms and riveted to the truck frame transom supports are the cross-channels, $12 \times 1\frac{1}{8} \times \frac{1}{2}$ in., with chafing plates to protect the channels from motor wear and with safety straps to prevent the



AMERICAN LOCOMOTIVE CO. TRUCK FOR D. & H. CO.

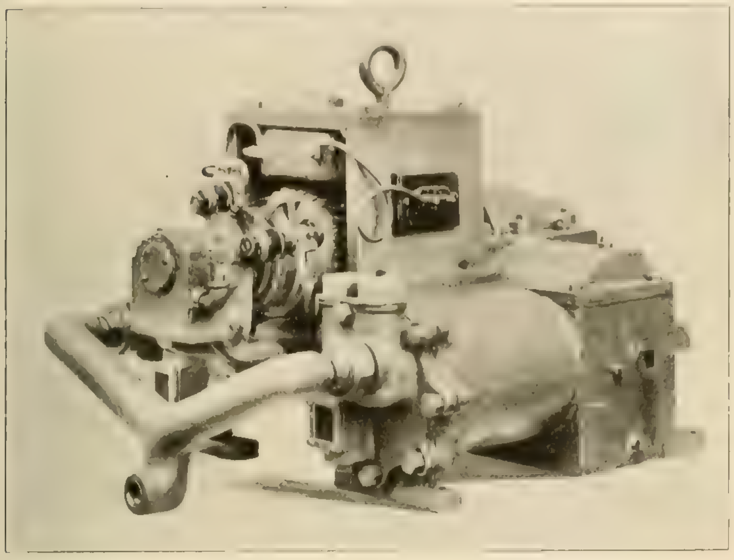
motors from raising. The brakes are inside hung with vertical brake levers and T head hangers. These hangers have bearings and caps at their upper ends to prevent the brakes from chattering. The brake heads are of malleable iron of the M. C. B. Christie type, and the brake shoes are of cast iron, flanged to interchange with the Lappin shoes now used by the Delaware & Hudson Co.

Advantages of Clay Cattle Guards.

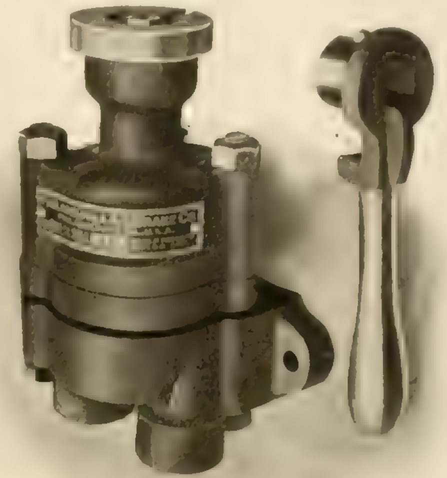
An interesting fact in connection with the use of vitrified clay cattle guards, such as the "Climax" stock guard, on third-rail surface construction is the fact, that these guards always present an insulating platform on which a workman may stand and feel free to work with his bare hands on the third-rail cable terminal or the connecting bond between the third-rail and the cable. They are also found useful in case of disorder to the third-rail or its insulators, because the individual pieces of the cattle guard may quickly be taken from their place on the track and used for blocking up or bracing the rail at times who no other suitable material is at the command of a track inspector.

Philadelphia Air Brake.

The present general use of air brake equipment on electric cars proves that it is hardly necessary for any further argument as to the advisability of using them. The fact that air brakes have reduced the accident cost is admitted and it is also known that the use of air brakes reduces the cost of operation, particularly through the use of less power, notwithstanding the fact that some power is used by the independent motor compressor. With hand brakes, when running, it is customary for the motorman to take up the



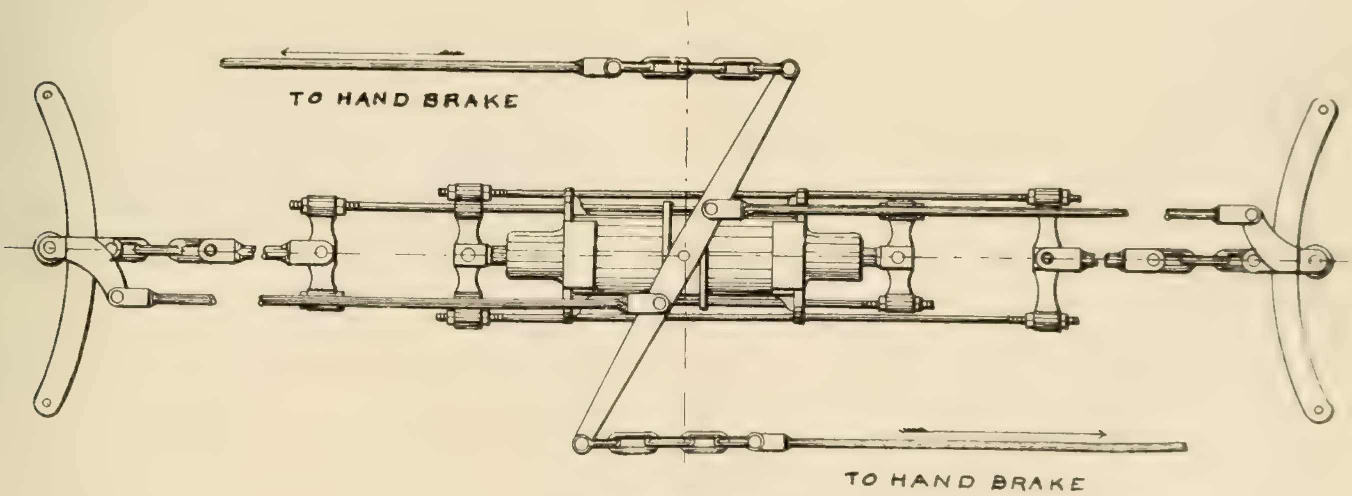
MOTOR COMPRESSOR.



ENGINEER'S VALVE.

slack of the brake chain, which leaves the shoes in partial contact with the wheels. This adds to the wear and tear on the mechanism of the car and increases the amount of current drawn from the line by the car motors. The Philadelphia Air Brake Co. states in offering its type of brake that it does not advertise any radical changes from the style of brakes now upon the market, but has endeavored to improve upon present design in different ways which have been suggested by long experience and numerous tests.

One of the accompanying illustrations shows the independent motor-driven air compressor used in the brake equipment. This unit consists of a series-wound multi-polar motor connected to a



DUPLEX JAM CYLINDER.

steel crank shaft by an improved high speed worm and gear. This gear is placed in the center of the crank shaft which operates two single acting plunger pistons through connecting rods. The arrangement of the pumps and motor is such that all moving parts are working in the same compartment which is kept partly filled with oil and is completely enclosed. All the air valves are exactly alike and are located with a view to ease of inspection. It is stated that the worm gear greatly reduces the noise of transmission and that the three bearing design of the armature shaft greatly lessens the danger from bending. All [illegible] are provided with oil rings. The motor driven compressor is arranged to be placed either inside the car or suspended under the floor of the car. In the latter case, a dust proof box is provided and is so arranged that the entire motor may be removed through the bottom of the box by the removal of four bolts or any part of the motor can be inspected through doors in the sides. The assembly of this compressor is such that it may readily be taken apart for the inspection or repair of any of its details.

The automatic cut-off for controlling the motor compressor is simple in design and has but two moving parts, the diaphragm operating the magnet contact and the magnet armature operating the motor switch, which supplies current to the compressor. This cut-off works by gravity in such a manner that the closing of the motor switch is positive under any conditions and not dependent upon a magnet or spring. In event of an accident to the cut-off the compressor is left running and can be regulated by the use of the hand switch on the platform, thus insuring full air pressure at all times.

The engineer's valve for controlling the air is built in a compact manner. When the handle is removed the valve presents a smooth flat top, making it impossible to operate same with any device other than the proper handle. The exhaust muffler is contained in the valve, thus requiring but two lines of pipe through the platform.

An accompanying illustration shows the duplex jam cylinder. By this arrangement of the double end cylinder with one end connected to each end of the car, all the equalizing between the two trucks is accomplished by the use of compressed air instead of a compli-

cated system of levers. The cylinder is placed exactly in the center of the car, allowing a straight pull to each truck and the hand brake lever is attached to the top of the jam cylinder casting entirely independent of the air brake rods. It is thus seen that this arrangement makes practically three independent brakes—two air brakes and one hand brake.

The Philadelphia Air Brake Co. has had its brakes successfully installed for two years and now has its equipments on nine electric railways, among which are the Public Service Corporation of New Jersey; West Chester Street Ry.; Hartford, Manchester & Rockwell Tramway Co.; Danville & Sunbury Railway Co., and Camden & Trenton Street Ry. An active campaign in the west is proposed and arrangements have been made for opening an office in Chicago, a more detailed announcement concerning which will be made later.

The Bumps.

This amusement device, which is patented by E. C. Boyce, 302 Broadway, New York, originally consisted of a smooth slide about 50 ft. in length with polished maple bumps of different sizes, placed at regular intervals on its surface. These bumps serve to change the direction of the slider and to give him a series of quick bumps which would land him at the bottom on a soft pad or cushion in a more or less reckless and excited condition. This year in constructing the bumps, in addition to the main slide, three others have been added, as may be seen in the illustration. One a straight

THE BUMPS

and narrow chute, constructed of slippery basket work material, and gives the slider an excellent speed; the second, producing a sensation of alternate falling and rising until the bottom is reached, by a succession of general inclines; and the third, which perhaps is the most exciting of all, consists of a narrow chute with sharp and sudden turns occurring at the most unexpected places. In has proved to be an exceptionally attractive amusement device for summer parks and its low cost of construction, maintenance and operation appeals to the prospective purchaser.

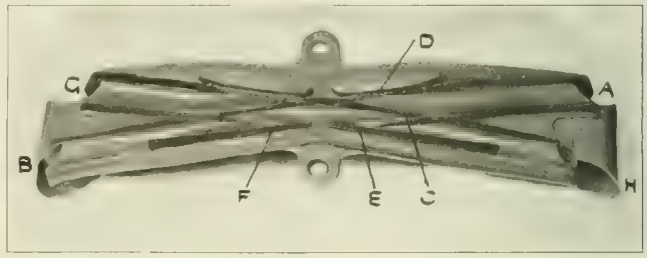
Improved Overhead Crossing.

Crossings and frogs are a necessary evil on overhead tramway work, and the erratic behavior of the trolley at these points is often the principal cause of trouble. The smaller the angle of the crossing the greater is the liability of the trolley to take the wrong wire.

If combined with a narrow angle crossing the trolley wire is a side running one and there is a certain amount of overhang on the trolley wire, this trouble is still further intensified. When a trolley is advancing through a crossing on to a trailing frog, there is considerably more liability of damage to the overhead gear than when it is traveling in the reverse direction. Should the trolley take the wrong wire under these conditions, the mechanical frog that it would meet on this wire presents a most effective trap and serious damage to the trolley head and overhead gear frequently ensues.

On the Burton-on-Trent (England) Corporation Tramways narrow angle crossings, about 16 degrees, are used with a certain amount of overhang on the trolley due to the cars not running centrally with the trolley wire round the junctions. Damage to trolleys and overhead gear had been of frequent occurrence, and after numerous experiments to better matters, an improved design of crossing was brought out by the general manager, Mr. P. J. Pringle, and this has been the means of reducing the troubles to a negligible amount.

The crossing is shown in the illustration herewith, and in designing this, an attempt has been made to get in practice a continuous through rail without any complicated gear or mechanism to effect it. If we presume a trolley wheel passing from A to B there is always a possibility of it fouling the point C of the center diamond and being thrown off the crossing. That part of the crossing marked D acts as a guard rail and prevents this occurrence and practically gives the equivalent of a continuous rail to the passage of the trolley wheel at this point. On the trolley wheel



BURTON-ON-TRENT OVERHEAD CROSSING

still further advancing, the hard phosphor bronze spring piece E is quite lightly sprung to one side, and then the flange of the trolley wheel meets the phosphor bronze spring piece F, guarding it from any possibility of taking the wrong wire. On the trolley advancing from C to H the same cycle of actions takes place.

If a trolley head is taken in the hand and applied to this crossing, no amount of side pressure or speed in passing across will permit of the trolley taking the wrong rail or being thrown off.

All the crossings on the Burton-on-Trent Corporation Tramways have been equipped with this pattern for the last eight months and have proved most effective. The spring pieces are made a good length, about 7 in., and are quite flexible, so that the amount of wear on these due to the trolley wheel springing them open is exceedingly small and they will have a considerable life. The replacement of them when necessary is arranged to be quite a simple matter.

The British Insulated & Helsby Cables Co. has taken up the manufacture of this crossing.

Derrah Trolley Trips.

Mr. R. H. Derrah, general passenger agent, Boston & Northern and Old Colony Street Railway companies, has devoted a great deal of attention to giving the newspapers of the territory served by these lines every opportunity to learn about the attractive features of these trolley roads. Three excursions were given over the Boston & Northern lines, the last one being on May 28th, when some 30 newspaper men, representing nearly all the newspapers between Boston and Salem, Mass., were Mr. Derrah's guests. A commodious observation car was provided for the occasion, and left Boston at 9 o'clock in the morning. Mr. Derrah and the division superintendents accompanied the party, and the points of interest which abound in this territory were pointed out by the host, who also told many interesting stories of historic interest and the days of witchcraft. Dinner was served at the Franklin House, Lawrence, a few impromptu speeches following. These trips, of which there were three over the Boston & Northern and two over the Old Colony system, have proved most interesting, and have become known as the "Derrah Trolley Trips," as their success is due to Mr. Derrah's charm as a host.

It is announced that the recently opened station of the Indianapolis & Northwestern Traction Co., at Crawfordsville, Ind., is to be followed with like new stations at LaFayette, Lebanon and Frankfort. This is both a freight and passenger station.

Recent Tests of Automatic Sprinkler Protection for Electric Railway Properties.

At a joint meeting of the car barn and automatic sprinkler committees of the National Fire Protection Association, held in Boston, March 28-29, 1905, the developments and results of tests for car barn fire protection were discussed. It is stated that in the opinion of the committees, there was not at that time enough data on the subject so that the committees felt justified in making regulations and specifications for the installation of automatic sprinkler systems in car barns. It was thought advisable to ascertain the effectiveness of ceiling protection alone; of aisle protection alone; of aisle protection in connection with ceiling protection, and to obtain these facts by a series of actual burning tests in a modern typical car house. With this point in view, the committee proceeded to obtain additional conclusions, and five burning tests were held in the Miles Ave. car house of the Cleveland Electric Railway Co., April 24th, in the presence of four members of the car barn committee and many others directly interested in the results of the tests.

The Miles Ave. car house is a single story building with a floor area 96 x 456 ft. It has 12-in. brick walls between pilasters spaced 16 ft. from center to center, with large windows between the pilasters and one large door at the north end, while the south end is entirely open. The roof is of gravel and composition on wood sheathing, about one-half supported by wooden trusses and the other half supported by wooden posts, spaced 16 ft. center to center in three rows. The floors are of earth and cinders. In the north section which has the wood trusses, the average height between floor and roof is 29 ft. 6 in. and in the rest of the barn the height averages 22 ft. 6 in. In this barn the tracks have a slight grade toward the south end and two of the tracks pass directly through the building; two tracks have switch and crossovers inside of the building, but all have tangent tracks at the south end for a distance of 50 ft. from the building. The barn has a total storage capacity for 80 cars.

TEST FIRE IN PROGRESS

There are two water supplies, city mains and gravity tanks, both automatic, and an auxiliary supply by means of steamer connections. The city supply pipe, 6 in. in diameter, is connected to a 16-in. street main which connection feeds to the 8-in. feeder of the underground sprinkler piping. The measured city pressure at the base of the sprinkler riser at the time of the test was 18 lb. Two 35,000-gallon tanks for the auxiliary supply are mounted on steel towers with the bottom of the tanks 78 ft. above the ground. For the use of the steamers, there is a Siamese connection near the northeast corner of the barn. An 8-in. cast iron pipe which is parallel with and about 40 ft. from the east side of the building has 8-in. connections from each gravity tank and 8-in. branches to the sprinkler system. Each two 6-in. sprinkler systems are provided with one post indicator valve, located 40 ft. east of the building.

In addition to the regular ceiling equipment of automatic sprinklers there is at least one line of sprinklers over each aisle between [illegible] Aisle sprinklers are spaced 6 ft. apart, and not counting the repair [illegible] sprinklers exposed to one fire. These are fed by eight 6-in. dry pipe systems with Grinnell air and alarm valves. The greatest [illegible] Extinguisher Co., of Providence, R. I., which is now equipping with similar systems other buildings of the Cleveland Electric Railway Co.

[illegible] panying illustrations. The results and details of the tests were

TEST CAR

recorded by eight men. The first car burned had ceiling sprinkler protection only and was located about 55 ft. from the south end of the building with four others exposing it; one adjoining on the same track, one east 6 ft. from the car side and two west 12 and 19 in. from the car side. There were two rows of aisle sprinklers between the second named exposure and one row of aisle sprinklers between the last named exposure. With the car openings except in front and rear closed, a fire of light combustibles and kerosene was started in the car. This fire gained great headway, opening the ceiling sprinklers, but before any quenching effect was determined the aisle lines were turned on and the effect of the latter was almost instantaneous in controlling the fire. The ceiling sprinklers were not given a severe test in this fire although 14 heads opened just prior to the turning into service of the aisle sprinklers. The fire did not communicate to the other cars or to the building and it was seen that the aisle sprinklers when turned on performed excellent and effective service and reached the heart of the fire. About 25 per cent of the combustible material of the car body was consumed.

The arrangement of the cars for the second test was similar to that of the first and the interior of the car was set on fire in the same manner with the end windows and doors open. The fire was allowed to burn itself out under the protection of the ceiling sprinklers alone, which apparatus extinguished the fire after about 85 per cent of the combustible material of the car body had been consumed. Four ceiling sprinklers opened and held the fire in check to the one car with some serious damage to one adjacent car, which had had its exposed windows purposely knocked out during the early progress of the fire. A wood post 14 in. east of the car was slightly blistered and the roof boards and rafters were slightly scorched.

The third car burned was located about 112 ft. from the south entrance of the building and exposed to three other cars as in the previous test, and being protected by the ceiling sprinklers only. The fire in this car was very severe and flames poured out on all sides, opening 29 ceiling sprinklers which checked the fire and confined it to the burning car with a slight damage to an exposed post and the two neighboring cars. The ceiling sprinklers which opened were confined to a more compact area than in any other test. About 80 per cent of the combustible material of the car was consumed.

The fourth car burned was placed about 55 ft. from the south entrance of the building and with three cars exposed and arranged about the same as in the earlier fires. This car burned under aisle sprinkler protection only—at the car transom level and 32 in. from

the transoms. The fire was about the same extent as in the preceding test and five aisle sprinklers opened, controlling the fire without communication or damage to the adjoining cars, roof or building parts. Prompt and effective interior service from aisle sprinklers was illustrated in this fire, although aisle sprinklers were at a disadvantageous location from a point of quantity distribution into the car. This experiment was successful, in that the fire did not communicate to other property, and was controlled with about 20 per cent or less of combustible material of car body being consumed.

The fifth car burned was located about 80 ft. from the south entrance of the building with the adjacent cars arranged in about the same manner as in the previous tests. This car was under aisle sprinkler protection only, with the sprinklers opposite the car windows. Several transom lights were broken and the end doors and windows were open. A metal-clad board 9 in. wide was placed over the aisle sprinkler line on the west side of the cars at a height of 10 in. above the sprinkler line. The regular sprinklers in the aisle lines on the east side of the car were replaced by sprinklers having a metal hood 4 in. in diameter, placed 2 in. above the deflector. The function of these hoods and board was to bank the heat, and thus acting as heat accumulators make the aisle sprinklers respond more quickly. The fire was started under the same conditions used in other tests. One sprinkler opened near the southwest corner of the car which so effectually quenched the fire that it was decided to replace the sprinkler and rekindle the fire; after doing this the water was again turned on, and the sprinkler just put in was opened and again held the fire in check. Two heads on the line on east side of car were opened by hand, in order to determine to what extent, if any, the hood might interfere or assist in water distribution, also to what extent they might act as individual shield to fuses, from other sprinkler sprays. The fire experiment was successful in that the fire did not communicate to the ceiling or adjoining cars, and illustrated the excellent and effective interior distribution from aisle sprinklers when placed opposite the windows. About 25 per cent of combustible material of car was consumed, but had not the fire been rekindled the combustible material burned would have been less than 10 per cent.

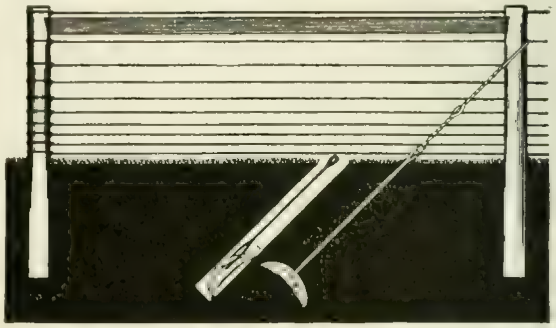
The committee on car barns summing up the observations of these tests, stated that in this class of property it is essential to arrange such protection as may hold and control a fire within any one car in which that fire might originate. Basing its arguments on 14 reported experiments, the committee recommended that not a greater number of sprinkler heads be provided for the horizontal flat surface in a car house than would be required under the same surface in any other building to be protected, stating that good engineering would ask for a line of five or six sprinklers as the necessary protection under a solid surface, say 8½ x 42 ft., the size of an average city car. The experiments indicated to the members of the committee that while ordinary car house operation practice does not warrant the placing of sprinkler lines opposite the car windows, nevertheless, as satisfactory results can always be obtained by placing sprinkler lines on either side of the cars with sprinkler deflectors opposite the transom lights and having heads not over 8 ft. apart on the line with the sprinkler lines not over 16 in. from the car, preferably not over 6 in., exception to this being made at division or side bearing brick walls, if these are within 3 ft. of the car. These final burning tests were of an extreme nature, barring the absence of draught which was not obtainable. The car to car exposure, while serious in each case, would have been more so in modern and recently finished cars.

The Amesbury Trolley Wheel.

The Climax Ignitor Co., Amesbury, Mass., which is the manufacturer of the Amesbury trolley wheel, reports that this product is meeting with hearty approval of railway companies which have it in service. As an instance of how this wheel is regarded, Mr. E. P. Shaw, jr., general superintendent of the Boston & Worcester Street Railway Co., under date of May 15, 1905, wrote to prominent street railway officials as follows: "The Climax Ignitor Co., of Amesbury, Mass., is manufacturing what we believe is one of the best trolley wheels on the market. We have had them in use on our road for several weeks on the main line, and we get more mileage out of them than any other makes we have used. We find that the bushings outwear the wheels and upon the terms at which we are able to buy them, the maker taking back the old wheels, our cost for trolley wheels has been reduced."

Miller Anchor for Fence Posts.

There is scarcely an electric railway extending beyond city limits that is not obliged to construct and maintain some fencing. A properly built fence requires but little maintenance during the life of the posts, but unless the type of construction is such that the wire is kept taut throughout its length, there will be many repairs needed. It is necessary that corner posts be rigidly anchored and that at all breaks in the line of the fence, such as gates, cattle passes, highway crossings, etc., the end posts be braced against the dead-end pull of the wire. There are many methods of accomplishing these results in a more or less permanent way. The



ANCHOR APPLIED TO SECOND POST.

accompanying illustration shows a satisfactory method of using a Miller guy anchor for taking up the strain at a gate or similar break in the line of fencing. As is shown, a 4 x 4-in. strut is set between the end and second posts. To hold the second post in place when carrying the push of the first post through the strut, a guy anchor is planted in the way shown, and by means of twisted wire between the eye of the anchor and the top of the second post, the dead end pull of the wire fencing is transferred to the securely buried anchor.

The type of anchor recommended for this and the many similar arrangements for guying is known as the Miller No. 2 anchor. It is said that when placed, this anchor, size 6 x 13 in., will remain firm under a load that will break the rod at a strain of about 9,800 lb. The Miller Anchor Co., Norwalk, O., which manufactures these anchors, states that the time saved in installing this type of construction will offset the cost of the anchors and as the anchors remain permanently placed the dead ending of the fence is accomplished in such a way that the wire does not sag nor the posts pull up. The cost of these anchors is 80 cents each, and an auger with adjustable blades for rapidly boring the holes in which the anchors are to be installed, is sold for $3.

Exhibits at the Lewis & Clark Exposition.

Among the exhibits in the Electricity Building at the Lewis & Clark Exposition, which was opened at Portland, Ore., June 1st., are those of John A. Roeblings' Sons Co., which has a display of wire for all purposes, showing round and special shapes, insulated wire and stranded cables; the Westinghouse Electric & Manufacturing Co., with a large exhibit of general electrical apparatus; the General Electric Co., having an extensive exhibit of apparatus for all purposes; the D. & W. Fuse Co., whose western sales agency has a display of fuses, Deltabeston wire and other well known products of this company; the Duff Manufacturing Co., Pittsburg, Pa., with an exhibit of jacks for all purposes.

The Portland Consolidated Railway Co. made every preparation for handling from 40,000 to 50,000 people per day without inconvenience and in preparing for the exposition spent some $200,000 for new equipment and alterations. The fair grounds are reached by four of the company's lines and ½-minute service is maintained between the business district and the fair grounds, 125 cars being used in this service.

Ohmer Register Contracts.

In the April "Review" was published an extensive list of railway companies that had just closed contracts with the Ohmer Fare Register Co., of Dayton, O. The contracts enumerated included an order from the Portland Consolidated Railway Co., of Portland Ore., for nearly 300 additional machines, and other orders and renewals from about fifty different companies. Since that publication, the Ohmer company has received a large number of other renewals, and has closed contracts for equipping all the cars of the Oakland Transit Consolidated, of Oakland, Cal. This company has been using Ohmer registers for two years, and now proposes to put in service on its various branches over 250 of the Ohmer machines mounted for registering three fares. It will also use a number of the Ohmer machines mounted for recording four different classifications of fares. Other companies which have just closed contracts with the Ohmer company include the Sacramento Electric, Gas & Railway Co., Sacramento, Cal.; Pueblo & Suburban Traction & Lighting Co., Pueblo, Col.; Indian Territory Traction Co., South McAlester, I. T.; Kokomo, Marion & Western Traction Co., Kokomo, Ind.; Indiana Northern Traction Co., La Fontaine, Ind.; Atlantic Shore Line Ry., Kennebunkport, Me.; Grand Rapids, Grand Haven & Muskegon Railway Co., Grand Rapids, Mich.; Norfolk & Southern Railroad Co., Norfolk, Va.; Puget Sound Electric Railway Co., Tacoma, Wash.; Winnebago Traction Co., Oshkosh, Wis.; Syracuse & South Bay Railway Co., Syracuse, N. Y. Besides these companies additional orders have been received from the Fort Wayne & Wabash Valley Traction Co., Fort Wayne, Ind.; Illinois Valley Railway Co., La Salle, Ill.; Lorain Street Railway Co., Lorain, O.; Louisville Railway Co., Louisville, Ky.; Virginia Passenger & Power Co., Richmond, Va.; Los Angeles-Pacific Railway Co., Los Angeles, Cal.; Asheville Electric Co., Asheville, N. C.; Evansville & Princeton Traction Co., Princeton, Ind.; Seattle, Renton & Southern Railway Co., Seattle, Wash. The Ohmer company has been running a night force in its factory for several weeks and will be compelled to do so for a portion of the summer at least.

Lewiston & Southeastern Electric Railway Co., Ltd.

While Idaho is one of the largest states of the Union, and has greater diversity of natural products than any other state, it probably has the least mileage of railroads. About the time this state was opened to railroad transportation the two transcontinental lines which pass through it apportioned out the territory between themselves, and seemed to have a mutual understanding that neither should invade the other's territory, and that they would all combine to keep out any new developments which they did not fully control. This has greatly retarded the wonderful resources of this great commonwealth. One of the richest sections in the United States is embraced in the Camas and Nez Perce Prairies, which prairies are situated in Idaho and Nez Perce counties and which lie from 60 to 80 miles southeast of Lewiston. This rich section has for the past 15 or 20 years been disputed territory between the Northern Pacific on one side and the Oregon Railway & Navigation Co. on the other. It was decided that the business would not pay for both to build a line through this section, and neither would permit the other to build alone. Therefore, this section has remained as disputed territory, and without any means of transportation whatever, except the old freight wagon and stage coach.

About two years ago Colonel Judson Spofford and associates organized the Lewiston & Southeastern Electric Railway Co. with the purpose of building a railroad from Lewiston, by Lake Waha and Westlake, to Grangeville, a distance of 85 miles, with a branch line from Westlake, via Ilo and Dublin, to Nez Perce City, a distance of 25 miles. This proposition was and still is strongly opposed by the great transcontinental lines. About six weeks ago both the transcontinental lines threatened to invade this territory by putting in numerous corps of engineers, and lines were run in all directions from these prairies. All at once, and without any warning whatever, these various engineer corps were withdrawn, and the general impression given out that neither of the transcontinental lines would build. The people all through this section were so much enraged from this action that they held a mass meeting at Lewiston, and others were held at Westlake, Cottonwood, Grangeville, Nez Perce and many other places, and they resolved that they would by public

[illegible] Spofford [illegible] the Lewiston & Southeastern Electric Ry. enterprise. [illegible] Colonel Spofford brought capitalists from New York and [illegible] to Lewiston, and made arrangements with them to furnish the $3,000,000 necessary to build the road.

Then the Northern Pacific Co. evidently became alarmed, and one afternoon a large force of engineers appeared and went into camp on the right of way of the Lewiston & Southeastern Electric Ry., near a canyon at the mouth of Tammany Creek. Colonel Spofford foresaw their intentions to occupy with ties and rails this important canyon at the mouth of Tammany Creek, and when the engineers got up in the morning they were surprised to find that the Lewiston & Southeastern company had a force of men at work in this canyon. After looking on for a day or two, the Northern Pacific engineers withdrew to other sections. While Colonel Spofford was not quite ready to let a regular contract on this section of the work, the force is still at work in and holding this canyon.

The population of the entire section is giving its hearty support to the electric line, and the people are becoming highly incensed at the movements of the Northern Pacific to try to block their hopes of an efficient transportation line, for which they have waited so long. It is now well assured that the Lewiston & Southeastern company will commence construction all along the line as soon as terminal facilities and rights of way are secured in the city of Lewiston, which will probably be in the next 10 days. This is but another instance of the determination of the powerful transcontinental lines to crush all opposition within their self-constituted inherited territory, but so far they seem to have been outwitted in this territory.

Basic Patent for Micanite Sustained.

The Mica Insulator Co., through Messrs. Kenyon & Kenyon, its solicitors, brought suit in equity in the United States Court for the District of New Jersey against the Union Mica Co., a New Jersey corporation, and John M. Lay. After submission of full proofs and arguments on both sides, Hon. George Gray, of Delaware, U. S. Circuit Judge, has just filed an opinion holding that the Union Mica Co. and John M. Lay have infringed upon the rights of the Mica Insulator Co., under the Dyer United States Patent No. 483,646, and that this patent introduced a new and valuable raw material to the art. The complete opinion of Judge Gray follows, and will prove interesting to the electrical trade. The following extracts are quoted from Judge Gray's opinion:

"The expert testimony on both sides show that a substantially new material has, by the process of the patent in suit, been supplied to the electrical art." * * * "The trade name 'Micanite,' given to this material by the patentee, has established for itself a recognized place in the electrical art."

"The (Dyer) process has so completely solved the difficulties in the way of economically and efficiently utilizing mica."

"The process is thus characterized by a product unique and admittedly of the greatest utility."

"I have no difficulty in finding that the process of the Dyer patent in suit is unanticipated, and that it involves patentable invention."

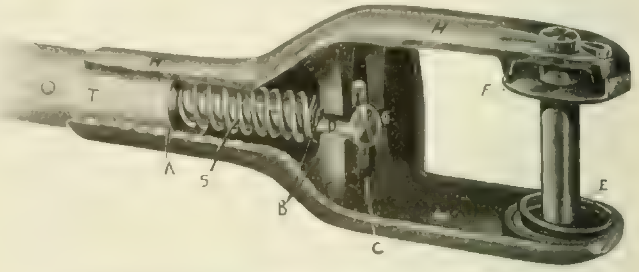
"I am satisfied that the defendant company has been guilty of the infringement of claims 1 and 2 of the Dyer patent, as charged in the bill."

The Mica Insulator Co. advises dealers and users of mica insulating material to avoid purchasing mica products made in substantially the way "Micanite" is made. The patent has been sustained after long and expensive litigation and the Mica Insulator Co. proposes to enforce its rights under the Dyer patent against all infringers, and against all who aid and abet unauthorized manufacturers to infringe, by purchasing the product of the infringement. The Dyer patent covers broadly the only process by which a material having the valuable characteristics of "Micanite" or a mica product capable of being molded can be made.

The passenger department of the Old Colony and Boston & Northern Street Railway companies has recently issued five attractive folders, descriptive of trolley trips over the lines of these companies. Besides time tables, general information for passengers regarding special cars, etc., and a map of the systems, these folders contain short descriptive articles of the trips and place of interest along the route.

Bayonet Detachable Harp.

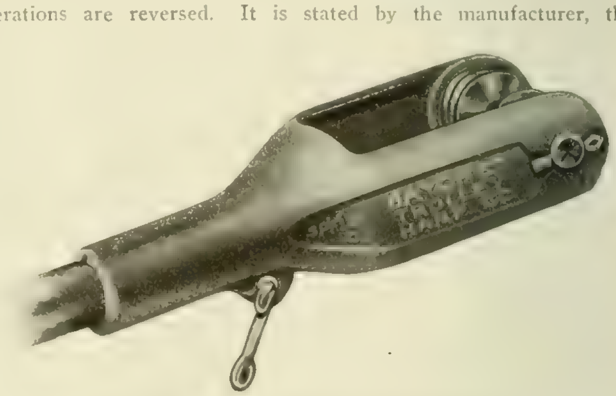
The accompanying illustration shows a new and unique design of trolley harp that should meet with much favor on account of its simplicity and ease of changing. The essential parts of the device, as shown in the sectional view, are the head H, and the stem D. This head fits snugly over the pole, the lap in the running position is about 1 inch. The stem is designed with a diameter which will fit into the trolley pole and allow the two to be firmly riveted together, the shoulder at A being flush with the end of the pole. The protruding portion of the stem D is of a smaller diameter, and about it is coiled a strong lock spring S, one end of which rests



PARTIAL SECTION OF DETACHABLE TROLLEY HARP

against the shoulder at the end of the pole and the other end rests against the slotted bosses at the upper end of the sleeve. These bosses have a central aperture of the same diameter as the reduced extension of the stem D and also have a locking recess C. At right angles to the slot G, a locking pin with its axis perpendicular to the stem completes the details of the harp.

To remove the harp it is simply necessary to compress the retaining spring, meanwhile turning the head through an angle of 90°, by which operations the retaining pin will be raised from its seat and placed in position so that it will pass through the slots and allow the head with its wheel to be removed. To replace the head these operations are reversed. It is stated by the manufacturer, the


THE BAYONET DETACHABLE TROLLEY HARP

Bayonet Trolley Harp Co., Springfield, O., that only 10 seconds of time is required to remove a harp that may contain a damaged trolley wheel and replace the harp by another.

Among the other advantageous details of this device are the protected centering spring E, seated in a groove around the axle, and the contact washer F, with its extended lip making close contact with the end of the head and so arranged that when the wheel and washer are in position the spring is completely protected from all injury.

This design of harp is fitted with a new scheme for attaching the trolley rope, which together with the detachable harp assure a very quick change of trolley wheels in case of accident.

Talaquega Park, an amusement property located on the electric road between Taunton and Pawtucket, Mass., which was conducted for the past few years by an amusement company, was sold at public auction May 20th to Edwin R. McDuff, of Pawtucket, who bought for John McLaughlin, of Cumberland, R. I. The property was purchased for $7,000, which is but a small portion of its value, having cost about $50,000 to build a few years ago. The future of the property is undetermined.

STREET RAILWAY REVIEW

Vol. XV | JULY 15, 1905 | No. 7

Brunots Island Power Station of the Pittsburg Railways Co.

Immediately after the consolidation of the electric railways of Pittsburg by the Philadelphia Co. in 1902 it became apparent that more power capacity would be needed in the near future, and among the first work of the engineering department was that of designing a new station. The site chosen was Brunots Island, about 101 acres in area, which lies in the Ohio River two miles south of the junction of the Allegheny and Monongahela. The whole island, which is 5,000 ft. long with a maximum width of 1,800 ft., was purchased by the Philadelphia Co. Access to the island is by means of a ferry and also the bridge of the Ohio Connecting R. R.

BRUNOTS ISLAND POWER STATION OF THE PITTSBURG RAILWAYS CO.—PROVIDENCE ENGINES AND 15,000-K.W. WESTINGHOUSE [illegible]

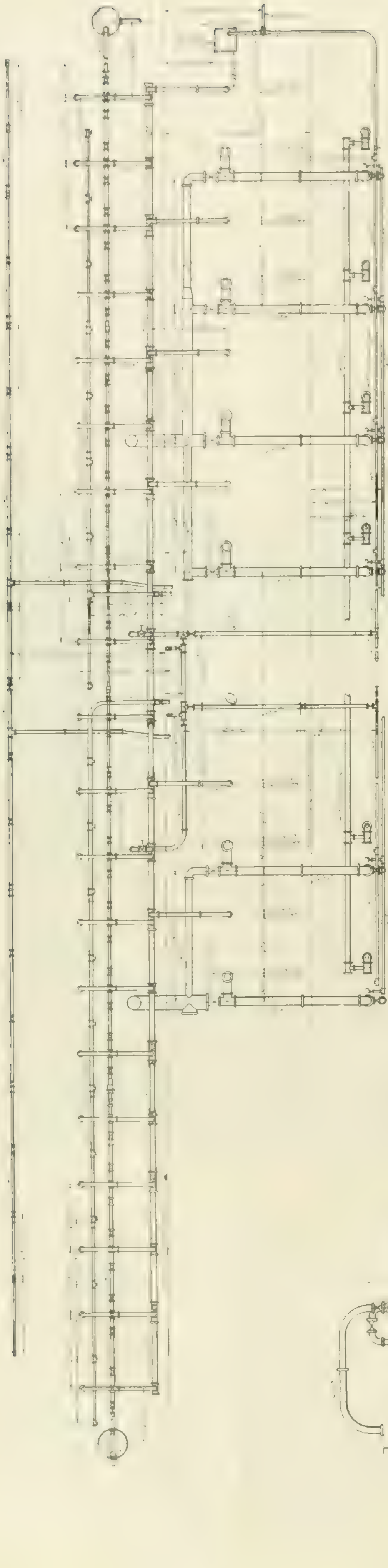
Work on the new station was begun Oct. 13, 1902, and Oct. 12, 1904, the generators were first turned over. The station began supplying current regularly in November, 1904.

In the "Review" for April, 1903, we published the foundation drawings for this station and gave data as to the equipment that had been decided upon. Placing the foundations was a work requiring a great deal of time. The river level varies greatly, and to ensure always having a supply of water for condensing purposes the level of the basement of the power station had to be placed low, and was fixed at only 5 ft. above pool level of the river, which is about 8 ft. above low water mark, giving a lift of only 13 ft. to the condensers under the most unfavorable conditions. The station walls are relied upon to protect the plant against damage from floods, and therefore especial attention had to be given to making the building foundations [illegible]

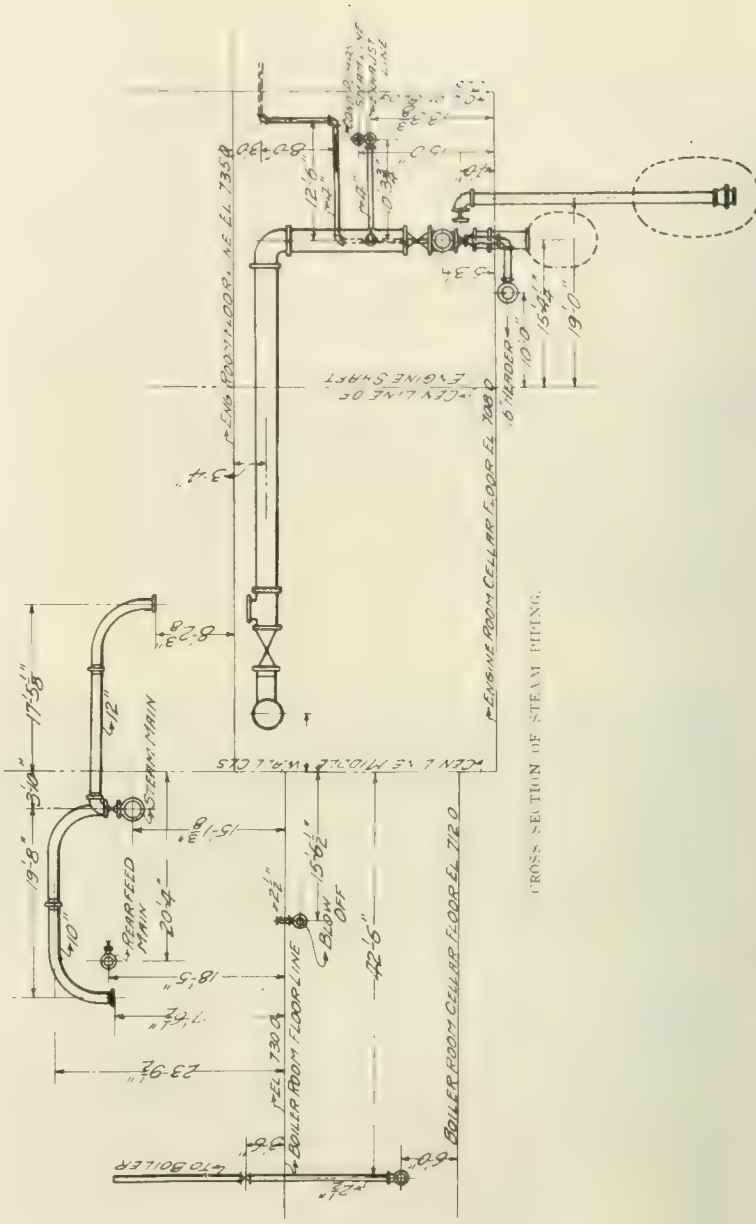
The general layout of the [illegible] drawing, which gives the relative [illegible] storage yards, wire viaducts, water intakes, railroad sidings and the steam railroad bridge, which for the present serves to carry the electric feed wires across the river. The width of the island at the point where the railroad crosses is about 1,250 ft., and parallel to the railroad structure there has been built a side track on trestle work which is 1,050 ft. long, and a second one parallel to the south side of the power station, which, with the connecting curve, is about 750 ft. long. The tracks on these sidings are [illegible] above the ground and 80 ft. above the river; the trestles are of 12x12-in. posts, four to a bent, with the bents 14 ft. 8 in. between centers.

Provision had to be made for taking coal from barges in the river as well as from cars delivered by rail. The design for the coal handling installation has not been definitely determined, but a crane with clamshell bucket will probably be used for unloading from barges, and cars drawn by electric locomotives for transferring to the storage piles.

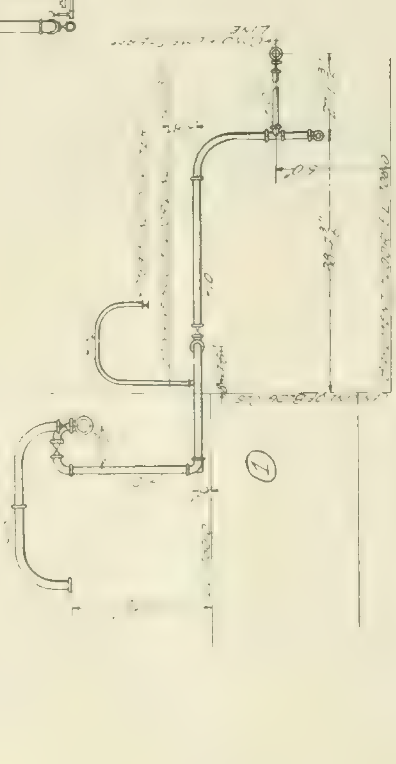
The building is of brick with stone trimmings, with the roof of expanded metal and concrete, laid on steel purlines and covered with Warren-Ehret patent gravel roofing. The foundations for building and machinery are of cement concrete and are carried down to a gravel bottom; the concrete used is of the proportion of 1 part cement, 2½ parts sand and 5 parts broken stone. The building is



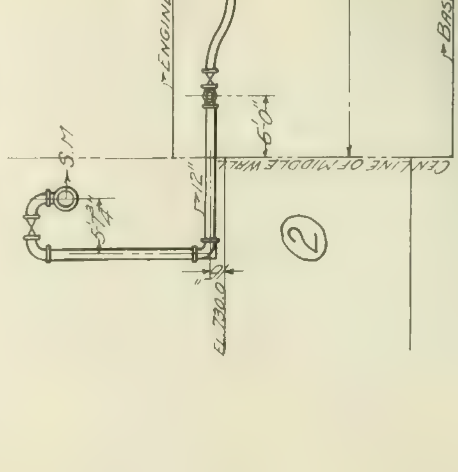
PLAN VIEW OF STEAM PIPING.



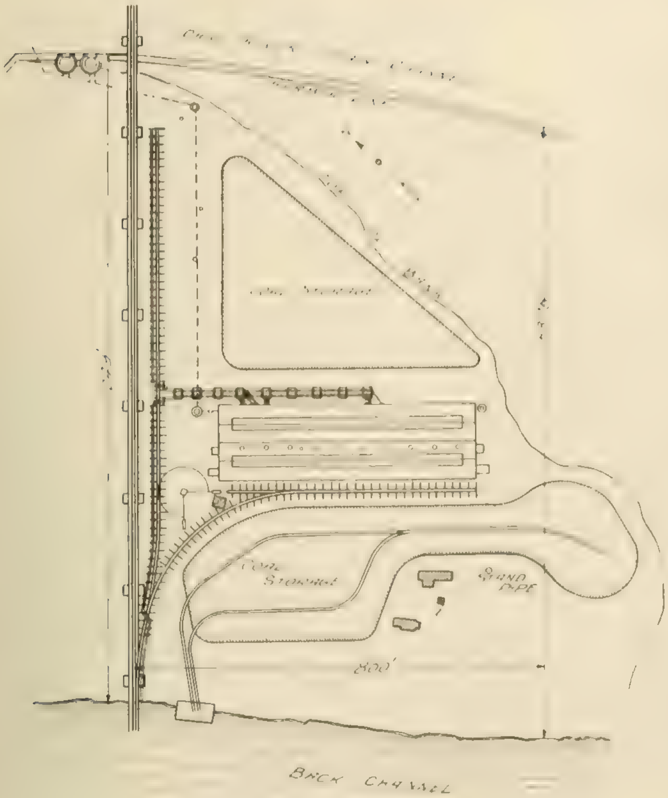
CROSS SECTION OF STEAM PIPING.



PIPING TO EXCITER AND CONDENSER PUMPS.



PIPING TO CONDENSER PUMPS.



GENERAL PLAN OF STATION

486 ft. 4 in. long between the centers of end columns and 141 ft. wide between centers of columns, the boiler and engine rooms each being 70 ft. 6 in. wide.

The station is designed on the unit system, and is ultimately to contain nine 1,500 kw. units, with a battery of two boilers for each

The main generating units now installed and in operation comprise:

Three [illegible] each direct connected to a horizontal cross-compound Rice & Sargent [illegible];

Two 1,500-kw. Westinghouse 2,200-volt two-phase alternators, each direct connected to an engine similar to those for the direct-current units.

For exciters there are two 75-kw. 250-volt machines driven by tandem compound engines [illegible].

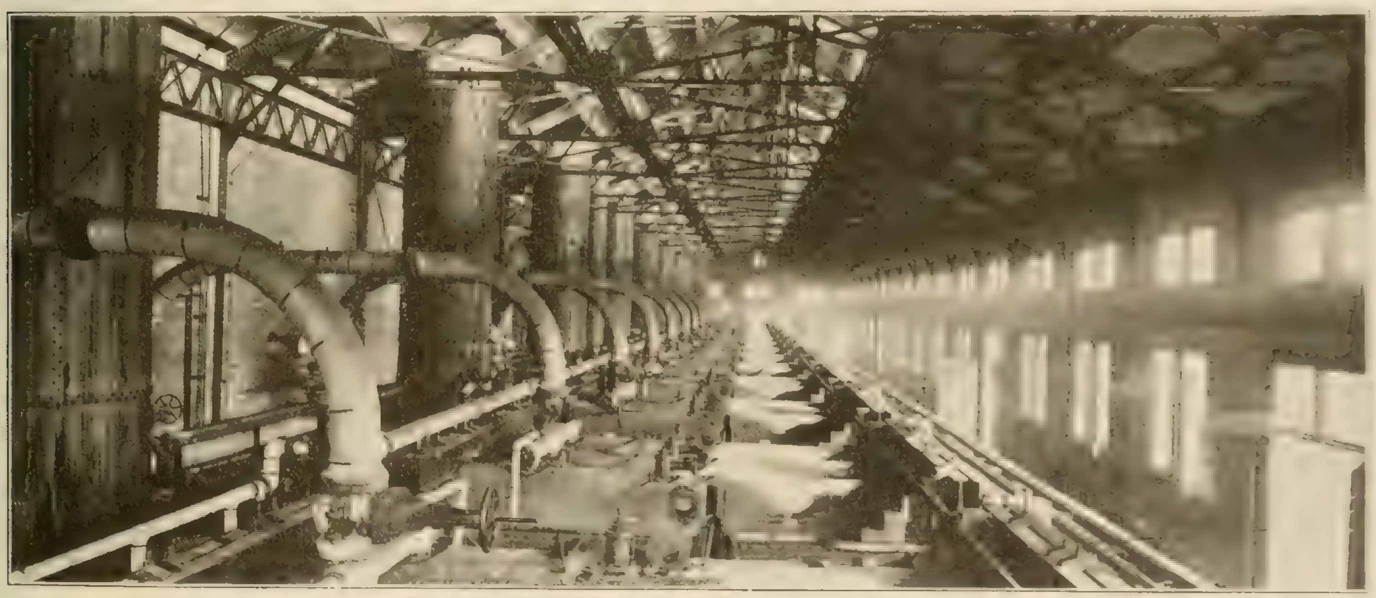
The builder of all five of the main engines was the Providence Engineering Works, successor to the Providence Steam Engine Co., of Providence, R. I. All the engines have the Rice & Sargent valve gear. The valves are operated by direct motion from the eccentrics without the medium of wrist plates, there being separate eccentrics for the admission valves and for the exhaust valves of each cylinder. The point of cut-off is determined by a rod from the governor which actuates a yoke, operating by means of rollers on a curved lever attached to the cut-off toe. The range of cut-off is from zero to ¾ stroke.

For each main unit there is a Blake vertical twin jet condenser with pumps 16 and 44 by 24 in. The vacuum obtained in service is 28 in.

In the boiler room there are 20 Babcock & Wilcox boilers of 500 h. p. each, arranged in batteries of two and equipped with Murphy stokers. The working pressure is 150 lb. per sq. in. For each battery of boilers a separate steel stack 7 ft. in diameter and 130 ft. high above the grates is provided.

The feed pumps are four in number, and were built by Epping & Carpenter. The feed is heated by two 5,000-h. p. National Pipe Bending Co.'s vertical heaters.

A steel coal bunker extending the entire length of the boiler room has a capacity of 1,800 tons. The section of this is indicated in the cross-section of the station; it will be noted that the slope of the bottom is such that chutes placed at the same angle will clear the boiler fronts and deliver to the stokers. The bunker is supported on a single row of steel columns. Ashes are dumped into hoppers under the grates and are removed by cars operated over a track in the boiler room basement.

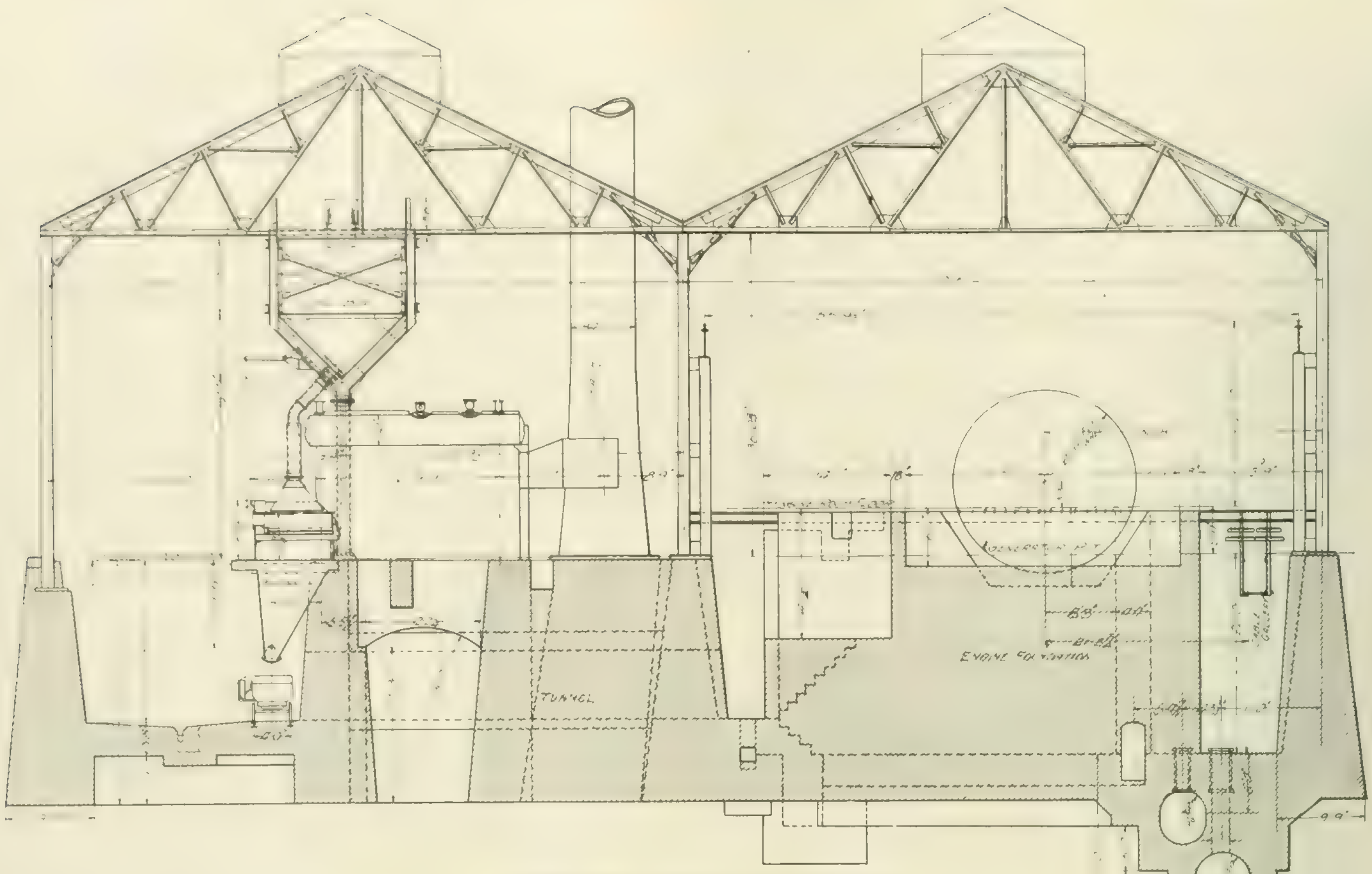


GENERAL VIEW ABOVE BOILERS—BRUNOTS ISLAND STATION

engine; each battery of boilers is served by a separate stack 130 ft. high. Beginning at the bridge end of the building, there will eventually be four direct current units, then the auxiliary steam apparatus occupying the same space as an engine and its generator, and then five 1,500-h. p. alternating current units. For each unit a tunnel is provided for communication between the boiler and engine basement.

At the west end of both the boiler and engine rooms space has been partitioned off for a superintendent's office, a storeroom, a toilet room and a locker room for the men.

Water for house service, and also available for emergency, is taken from two 10-in. artesian wells 60 ft. deep. The two pumps for this service are electric driven, and were furnished by the Knowles Steam Pump Works; the motors are Westinghouse. Each pump has cylinders 9⅜ and 6¾ by 24 in., and at 28½ r. p. m. has a capacity of 200 gallons per minute; the motor speed is 1,200 r. p. m. A storage tank of steel, 12 ft. in diameter and 63 ft. 3 in. high, is located 250 ft. from the station on the line of the east wall, and is set on a solid block of concrete 15 ft. deep, 16 ft. in diameter at the top and 20 ft. in diameter at the bottom.

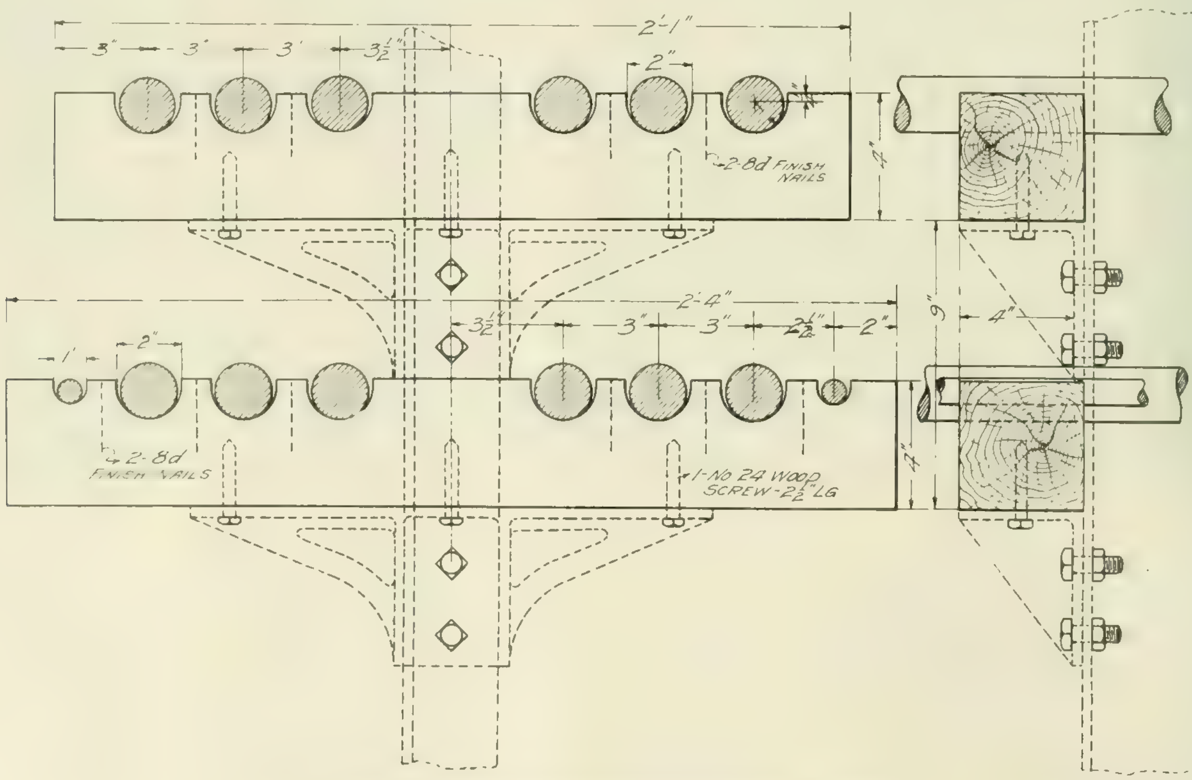


CROSS-SECTION BRUNOTS ISLAND STATION.

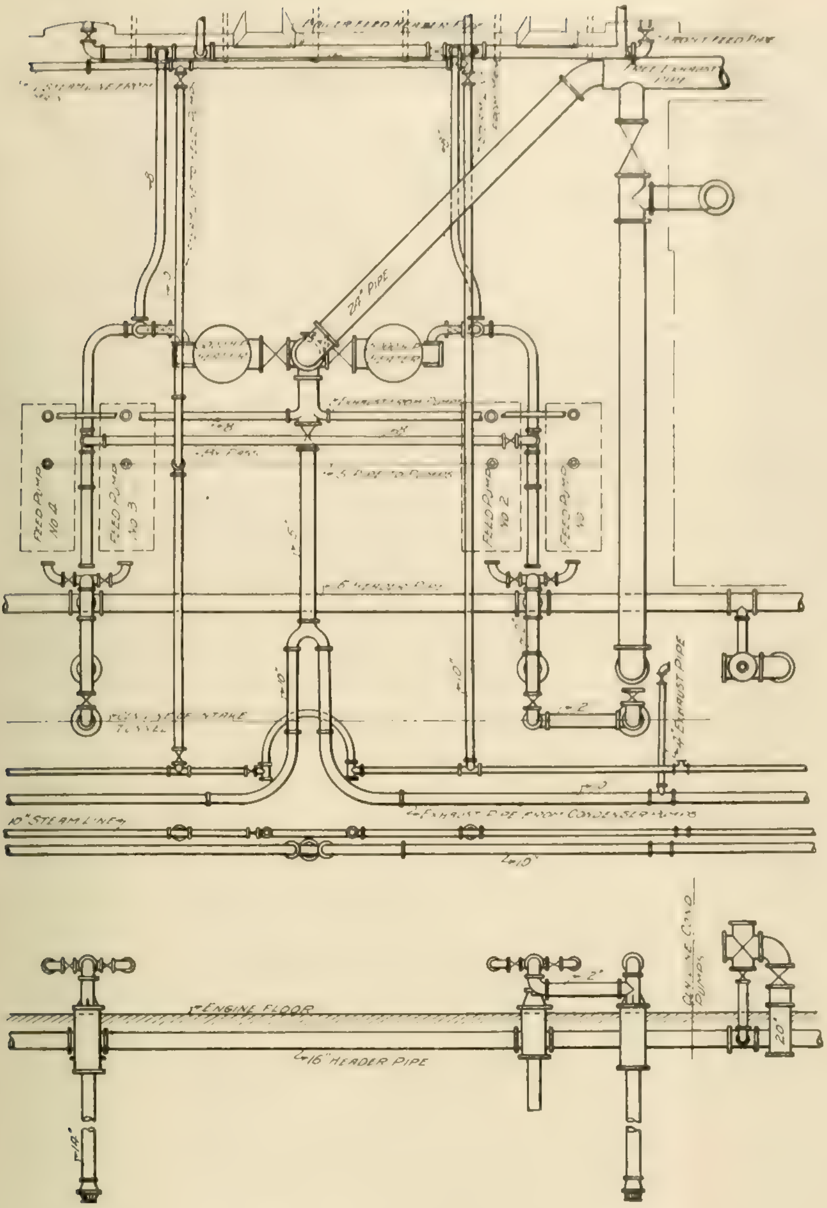
Water is delivered to the tank through a 6-in. standpipe, which serves to regulate the pressure on the service system, the overflow from the standpipe going into the tank. A 10-in overflow pipe from the tank is also provided.

Within the station the service water main is 8 in. in diameter with 2½-in. branches to the bearings of each engine, 2½-in. branches to each condenser and 2½-in branches to the feed pumps. Water for the engine bearings is taken regularly, the other connections being for emergency use only.

The general layout of the steam piping is shown in one of the line drawings. The main header is 18 in. in diameter, of extra heavy



DETAILS OF BRACKETS AND CROSS ARMS FOR CABLE GALLERY.



PIPING TO HEATERS AND PUMPS

wrought iron and is in the boiler room. This header is in four sections, each about 95 ft. long, which are connected by expansion bends of 14-in. pipe. Five boilers are connected to each section of the header, the leads being 10 in. in diameter. The engine leads are 12 in. in diameter, and from the middle sections of the main header are two 10-in. pipes to supply the exciter engines and condenser pump steam main.

The exhaust connections from the main engines are a 26-in. pipe to the condenser and a 24-in. connection to an atmospheric exhaust pipe. Two atmospheric exhaust pipes are provided, one 40 in. in diameter for four main units and the heaters, and one 48 in. in diameter for five large units.

Two boiler feed mains are provided, one at the front and one at the rear of the boilers. The pumps and heaters are placed in the engine room opposite the fifth battery of boilers, giving four 1,500-h. p. units on one side and five 1,500-h. p. units on the other, when the generators provided for are installed. The front feed main at the pumps is 8 in., reducing to 4 in. at the ends of the lines; the rear feed main is 8 in. at the pumps, reducing to 5 in. for the end boilers.

The condenser piping is shown in the drawings. All the steam piping is drained to an automatically operating pump which delivers to the feed main.

The valves in the plant were manufactured by the Pittsburg Valve & Construction Co., of Pittsburg.

There are separate switchboards for the two kinds of current gen- [illegible] direct current [illegible] the [illegible] bays [illegible]

[illegible] are carried in a gallery suspended from the engine [illegible] the building wall. The floor of the cable gallery is [illegible] bolted to the floor beams and spaced 3 ft between centers. Cast iron brackets bolted to the vertical angles at suitable heights carry 4x4-in. yellow pine cross arms [illegible] cross arms are shown in detail in one of the drawings. The cable gallery is reached from the engine room by steps located at each generating unit and from the basement by two flights of stairs.

Cables from the two switchboards leave the building through terra cotta ducts, 4½ x 4½ in. in size, built into the walls. The ducts for alternating current cables are in the bays 8, 9 and 10, and those for direct current cables in bays 17, 18 and 19, near the west end of the building. From the points of exit from the station to the siding trestle all cables are carried on the wooden frame indicated in the general plan. As previously mentioned, the trestles of the railroad sidings serve to carry the cables while on the company's property; the cables are taken across the river on the railroad bridge.

The principal contractors on this plant were the Pittsburg Valve, Foundry & Construction Co., which furnished all the valves and piping and erected the piping; the Expanded Metal Fireproofing Co., which put in the floors and roof; the American Bridge Co., which had the contract for structural work; the Dravo Constructing Co., which built foundations for building and machinery; the A. & S. Wilson Co., which constructed the building, and Keding & Ridge, who were contractors for the waterworks.

Chicago Traction Litigation.

July 5th Judge Mack, of the Cook Circuit Court, rendered his decision in the so-called Townsend cases brought to attack the validity of the amended leases of the North and West Side roads to the Chicago Union Traction Co. These were two cases brought by minority stock holders of the North Chicago Street Railroad Co., and another case by minority stockholders of the West Chicago City Railway Co. against the Chicago Union Traction Co. to declare void the leases between the various underlying companies of the Union Traction Co.

Judge Mack's decision was on every point in favor of the Chicago Union Traction Co., holding that the leases were valid and that the directors that were elected in July, 1903, were properly elected and that the Chicago Union Traction Co. had a right to be beneficially interested in the 32,000 shares of stock held in trust by the Illinois Trust and Savings Bank under the lease, and had a right to control a vote of that stock. In every way it was a sweeping decision in favor of the Union Traction Co. and a complete defeat of the claims of the underlying stockholders who brought the suit.

An official trial of new motor cars for handling freight trains has recently taken place on the Gruyere lines. Trains of 120 tons were satisfactorily hauled at a speed of 40 km. per hour. The preliminaries are being completed for the construction of several city and interurban lines throughout the country.

Recent statistics show that in Austria there is now an electric trackage of 170.5 km., of which 155.8 km. are operated by the overhead trolley and 15 km. by the underground conduit system. The rolling stock comprises 945 motor cars and 725 trailers. During the second half of the year 1903 there were 80,510,879 passengers carried; there [illegible] slight accidents, caused chiefly by the carelessness of passengers getting on or off moving cars.

Twenty-third Annual Convention of the Street Railway Association of the State of New York, Lake George, June 27-28, 1905.

The 1905 meeting of the Street Railway Association of the State of New York was held at the New Fort William Henry Hotel, Lake George, N. Y., June 27th and 28th. This convention was a successful one, and much credit is due to the retiring officers of the association for their successful arrangement and management of an instructive program and pleasant entertainment. This meeting will be remembered as one of the best, from all points of view, that the New York State Association has held.

There were approximately 200 members, supply men and guests present, and splendid facilities for the accommodation of all were furnished by the management of the beautifully located New Fort William Henry Hotel. The large number of lady guests made the meeting exceptionally enjoyable from a social standpoint. Through the courtesy of the Hudson Valley Railway Co. several pleasing trips for the entertainment of the guests were offered and much appreciated.

During the afternoon of the first day of the convention, special cars were provided for a trolley party, which trip was made over the Hudson Valley lines extending north and south from Lake George and terminating on the north at Warrensburgh. A large number of guests enjoyed this trolley ride over the scenic route through the foot hills of the Adirondack Mountains and over ground made memorable by early history. A magnificent display of fire-works was given from the dock directly in front of the broad piazza of the hotel. The evening of the first day of the convention was enjoyably spent by many of the guests in dancing in the hotel parlors. The entertainments of the second day included a steamer ride to the Sagamore Hotel, where a luncheon was served and a return ride, affording opportunity for viewing the beauties of Lake George. At the conclusion of the association meeting a banquet was served to nearly 300 guests in the large dining hall of the hotel. Hon. W. Caryl Ely presided as toastmaster, introducing in a pleasing way the several distinguished speakers who made entertaining and instructive remarks. At the conclusion of the banquet many of the members and guests departed for their homes on a special train provided by the Delaware & Hudson Co.

Much credit is due to the committee on exhibits, consisting of B. B. Nostrand, jr., chairman; Fred V. Green, Maj. H. C. Evans and Henry R. Ransom, for its businesslike and satisfactory method of handling the arrangements for the exhibits offered by the manufacturers.

The sessions of the association were held in the assembly room of the hotel. President C. Loomis Allen, of Utica, called the first session to order at 10:45 Tuesday morning. Upon motion the roll call was omitted. The report of the 22nd annual convention was read by Secretary W. W. Cole, of Elmira, and approved. The report of the executive committee was next read by Secretary Cole and approved by the Association. The minutes of the executive committee meetings held during the past year were read and adopted, as was the secretary-treasurer's report. Next followed

Address of the President

BY C LOOMIS ALLEN.

At the last annual meeting of this association the executive committee was, by unanimous vote, empowered to change the time of the next annual meeting and was also authorized to select a suitable place. In accordance with this authority the executive committee selected Fort William Henry Hotel, Lake George, and Tuesday and Wednesday, June 27th and 28th, were the dates chosen as the time for the holding of the 23rd annual meeting of this association. The change in the dates seemed to be necessary to meet all existing conditions. The American Street Railway Association has desired, for many years, to hold its annual meeting in September, and it was believed by your executive committee unwise to hold the New York State convention the same month. Furthermore, to obtain a suitable location where the delegates, guests and supplymen would find suitable and roomy quarters underneath the same roof, it was necessary to hold the convention at a time when some of the large summer resorts were open. There is much that might be said in favor of changing the date of the meeting from fall to spring, the most forceful argument being that there would be more time for the preparation of papers to be read at the annual meeting and better preparation for the discussion of them prior to July 1st, than after that date.

Our fiscal year, which is about to close, has been one of commercial prosperity, as well as one of advancement in the science of transportation. The best energy and brains of our country are engaged in solving difficult transportation problems, and this is evidenced by the inauguration of quick and convenient rapid transit service in New York City, on Oct. 27, 1904, upon which date the subway system of the Interborough company was opened to passenger traffic. The rapid transit facilities offered by the subway, in the territory which it serves, are unparalleled in the transportation world.

Our brethren of the steam railway field, who for many years thought electricity impractical and not feasible as a motive power, are not only considering it favorably, with a view to recovering the local traffic, which was decreasing where the public was better served by electric traction, but are adopting electricity at the large terminals for the purpose of handling not only local traffic but the heavy limited trains as well, at these points. At the last annual dinner of the Transportation Club in New York City, so eminent an authority as Hon. Chauncey M. Depew stated that within ten years the usefulness of the steam locomotive would be over.

Experiments that are being conducted on the New York Central's experimental track, immediately west of Schenectady, have demonstrated that the electric locomotive is not only capable of performing the service now being handled by the steam locomotive, but that the same service can be performed at considerably less cost. It is hardly necessary for me to state that it is impossible for one to foretell the advancement and improvements which will be made in transportation facilities in the next decade, due to the adoption of electricity as a motive power, but the street railways who have experimented and fostered the development of electric traction can justly claim a portion of the credit from the success achieved in electric traction due to the development which is sure to follow.

The New York Legislature, after a session lasting 125 days, adjourned without passing any measures adverse to street railway interests. The only measure becoming a law that might be considered burdensome to street railways is the act which increases the Board of Railroad Commissioners from three to five members. The only criticisms that might be made to this measure are the increased cost to the railroads of maintaining this commission, together with the fact that this tribunal might be, by reason of increased numbers, unwieldy and difficult to obtain determination of questions submitted.

There are two things that I desire to bring to the attention of this association and to urge careful consideration, and I hope affirmative action upon the part of the association. The first is the revision of Article 4 of Chapter 39 of the General Laws, known as the Railroad Law. The railroad law as enacted did not contemplate conditions as existing now. The demands of the public for increased transportation facilities, and the construction made necessary to give better facilities in transportation, have created conditions not contemplated by the railroad law as it stands today. There are many legal provisions that are required by railroads in order that better facilities can be afforded the public. There are

many provisions that the public require to satisfy public demand that are not today incorporated in the railroad law, and I believe that this association should be foresighted enough and in favor of advancement to urge upon our legislature the advisability of revising this act.

The other matter which I wish to bring to the attention of the Association is the question of municipal ownership. For many years municipal ownership of public utilities has been agitated by certain classes. Discussion and agitation has steadily increased until today it is a subject of much discussion by writers in the daily press, the editors of our conservative magazines and by the professors in our universities and institutions of learning. It is becoming so important to many minds that it is believed that it will be one of the important issues in our next national election. In the early part of the winter it was my pleasure to attend a banquet where a fair-minded lawyer, of considerable repute, in responding to the toast of municipal ownership, without in any way making an expression of his opinion, occupied the time allotted for his toast in reading extracts from the published reports of Glasgow, Leeds, Plymouth and Huddersfield. This agitation and discussion are rapidly educating the public to the idea that municipal ownership is the only way of getting cheaper fares and better transportation facilities, and also to the idea that the municipality owning and operating its public utilities, will, from the moneys derived from the net revenues of operating its public utilities, reduce the burden of taxation to a very considerable extent.

It seems to me that the public utilities, and street railway interests in particular, are derelict in their duty in failing to keep pace with the trend of public sentiment in this matter. We all know that there can be no successful street railway manager unless that manager first considers the demand and needs of the public, and we know that the successful policy of a transportation corporation is one that, first of all, is ever particular to consider and care for the needs of the public. It is a fact, with possibly few exceptions, that the men engaged in street railway operation in the United States know less of real facts concerning the question of municipal ownership than many of the citizens that patronize street railways believe they know. We, of all others, should be the first to know, in minutest detail, the facts, figures, conditions and results of municipally operated street railways. I have read with great interest all the articles upon municipal ownership that it has been possible to obtain, but have been forced to the conclusion that these articles were prejudiced either in favor of or against municipal ownership. It is not a prejudiced statement of facts that street railway men desire. It is a true statement of conditions and facts that is needed before forming our opinions as to whether municipal ownership is the best thing under our conditions and under our institutions. There are in this state some ninety street surface railways in operation under a common legislative act. We are reporting to and are amenable to the same authorities and our interests and conditions to a certain extent are similar. It seems to me that no better expenditure of money could be made by this association than to, at this convention, authorize the executive committee of this association to employ experts who will make a study of municipal ownership of street railways and furnish reports to the members of the association, in such detail as we would expect to obtain from experts when examining a property with a view to purchasing its securities. Your executive committee has considered this question at two meetings and has embodied in its report a recommendation which I hope will be discussed and favorably considered before the adjournment of this meeting.

By referring to the program it will be seen that the sessions of this convention will be devoted to the reading of papers upon interesting subjects followed by discussion upon the same. The question box for a second time will be a feature of this convention. Copies of this question box have been liberally distributed and we must all appreciate the excellence of the production. It reflects great credit upon Mr. C. B. Fairchild, jr., who prepared the questions and edited the data comprising the answers.

The manufacturers' committee has rendered good service to the association and has obtained an exhibit in street railway supplies that is well worth the attention of every delegate. Sufficient time has been allotted for the examination of the exhibits, and I believe the organization known as the Manufacturers' Committee will be a feature hereafter of our conventions.

The entertainment provided, as outlined in the program, is for the ladies. It was deemed [illegible] that [illegible] delegates and supplymen should be confined to the [illegible] which will be held on Wednesday evening.

I wish to urge upon [illegible] delegates [illegible] attending the sessions as outlined in their program. The best results will be accomplished, I am sure, if we take up the business of the convention and proceed with it, leaving the entertainment feature of the convention to the ladies.

In closing I desire to thank my associate officers and members of the executive committee for the support accorded me during my incumbency as president. Their loyalty to the administration and to the association has been unquestioned.

After the routine preliminary business of the association had been completed, came the reading and discussion of the papers.

The first paper was presented by Mr. W. H. Blake, entitled "Contracts Between Company and Municipal Ownership and Management of Public Utilities."

The president called upon Mr. L. E. Gould of the "Street Railway Review" to open the discussion. Mr. Gould said that he believed there would be little in common between municipally owned or operated plants in this country and those abroad which are so widely exhibited as models. The reason is the wide difference in the methods of city government and general political conditions. It is important that Americans look to the character of the men who would be in control of municipally operated street railways in this country, the power they would exercise, and also the political machine that would be ready to hand with say 10,000 city railway employes, each of whom has a brother or two, and perhaps a brother-in-law or two. Also there is to be considered the difference in efficiency—the city's policy is for the present only—the company must plan for years ahead—and the effect of eliminating the element of self-interest in the management. He considered it to be equally important, however, that the facts as to the results achieved by municipalities abroad be shown in America, because advocates of municipal ownership here were prone to cite only alleged successful enterprises, omitting all reference to the failures.

Mr. G. T. Rogers, of the Binghamton Railway Co., held the opinion that there is little need for the present street railway owner to worry, because he believes that it would be a difficult matter for municipalities to obtain control of the railway systems now operating.

Mr. C. S. Powell discussed municipal ownership, comparing the situations in this country and abroad and outlining the system of promotion which exists in England by means of which the successful manager of a small property is promoted to the management of the municipal railway of a larger city. This offers a continual inspiration for the best management of a municipal property.

Mr. Allen then reviewed the zone system of fares as experimented with in Cleveland, Ohio, stating how unsatisfactory were the results.

The next paper was "Publicity" by Mr. J. Harvey White, of the Boston Elevated Railway Co.

Mr. Oren Root, jr., of the New York Railway Co., discussed the attitude of the public service corporations toward the Press, stating that the results would be influenced first by the policy of the paper and the corporation, and secondly by the treatment which the corporation accorded to the representatives of the press. The speaker stated that he did not believe that one can over-estimate the value of polite treatment of press representatives. He cited as an illustration that his company was being criticised at one time because no open cars were being operated. A reporter approached him for an interview and was told in a brief and courteous way the reason for the non-operation of the open cars. Then the reporter was asked to write the article for his paper so that it would be fair. Mr. Root left this entirely in the hands of the reporter. The account which appeared the following day was satisfactory and ample proof that it is a good policy to use press representatives in a polite and generous way. During the discussion, Mr. Root gave other examples, showing the value of the same policy.

Mr. W. E. Harrington, of the Camden & Trenton Railway Co., related some of the press experiences of his company which has tried both policies. As a result of the early endeavors of the company to withhold all news from the press, many articles misrepresenting the company appeared. These in several instances

DELEGATES AND VISITORS AT THE NEW YORK STATE CONVENTION, LAKE GEORGE, JUNE 27-28, 1905.

greatly added to the difficulties of the company in renewing or obtaining franchises for its operation and construction. Later the company changed its policy and assumed the attitude that the press was welcome to all the details of its operation which had value as news. This resulted very satisfactorily. The articles that now appear are correct and the company considers that the newspaper stories are good advertisements, gaining the confidence of the people and increasing receipts.

Mr. W. W. Cole, of the Elmira Water, Light & Railroad Co., stated that no general rule could be laid down as to the policy which all companies should assume toward the press. All companies should have one so-called publicity man to whom reporters would soon learn to apply for news items. This arrangement would make for simplicity, accuracy and the best interests of both the press and the company. Unless a reporter is given the facts, it was Mr. Cole's belief that the reporter would supplement any meagre information that he might have, with inaccurate statements drawn from his own fancy. This breeds trouble for the company and should be avoided.

The Question Box, edited by Mr. C. B. Fairchild, jr., was introduced by him and the topic of advertising discussed by the delegates.

Mr. J. E. Stephenson spoke of the methods used by the International Railway Co., Buffalo, in advertising. This company has found newspaper advertising to be profitable, taking space in different papers on different days so that its advertisement appears in some one of the papers each day but not in any particular paper for many consecutive days. The company also uses folders which cost about one cent each. Announcements of changes in schedules, excursions, etc., are made by means of posters carried in the car window, and so placed that the reading matter may be seen from the side walk.

After the adjournment for noon luncheon, at which time a picture of the delegates and guests was taken, the afternoon session was opened with a continuation of the discussions of advertising.

Mr. E. J. Wilcoxen outlined the advertising methods of the Rochester Railway Co. This company uses advertising cards tacked on fixed boards, carried on the sides of the cars. During the discussion Mr. Wilcoxen described the several interesting advertising schemes this company uses.

Mr. Harrington spoke regarding periodicals, remarking that to be of value a periodical should be newsy, bright and spicy so that each issue would be looked for and an interest maintained. The use of such periodicals is undoubtedly of much value, but the speaker believed that the most good is to be derived from the issuing of good folders including time-tables and a simple but complete map of the line and its connections.

Mr. John H. Pardee stated that the Rochester & Eastern Rapid Railway Co. issues time-tables of a size that fits the vest pocket and he notes that such time-tables are more often made use of and carried by passengers than the larger unwieldy ones. This company also issues a large descriptive folder distributed in the towns. These seem to be preserved for reference. There is no summer resort on this railway but the company handles several classes of traffic. In order to get the people out to increase the summer travel, display notes are inserted in the newspapers and folders are kept in the hotel folder cases in Rochester, Geneva and other cities nearby. To encourage interest in the territory served, this company employs a newspaper writer who furnishes descriptions and pleasing illustrations of interesting objects and localities along the line. These are carefully written and cuts made so that the article can be "syndicated" among the neighboring country newspapers.

Mr. G. T. Rogers told of the "Binghamton Souvenir," which is richly printed, and is 10 x 18 in. in size. These are mailed to all societies within a large radius of Binghamton. This advertises Binghamton and the facilities of the street and interurban railway lines for accommodating society excursions. The Binghamton Railway Co. also runs an advertising car carrying large signs.

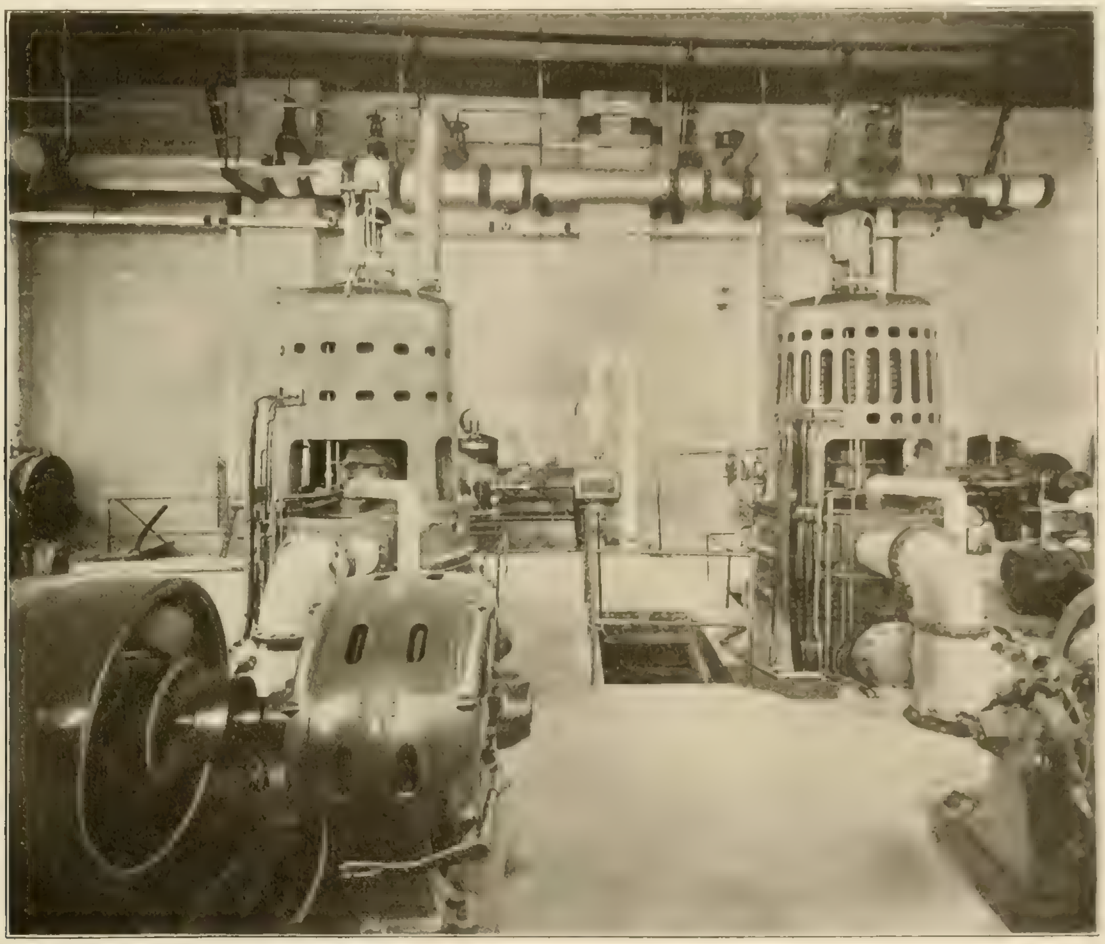
Mr. G. G. Blakeslee told of the methods used in advertising Electric Park, midway between the termini of the Albany & Hudson Railway Co. Newspaper articles are used and transportation is offered to reporters to and from the park. A large frame in which are mounted views of the park and scenes along the

(Continued on page 437.)

Saginaw & Bay City Railway & Light Co.—II.

Describing the New Power House at Saginaw.

In planning for the united operation of the several Saginaw-Bay City properties, the designers of the new power house at Saginaw were confronted with the problem of arranging the details of a station that could furnish current for the city railway line in Saginaw, and for a portion of the interurban line between Saginaw and Bay City, and also lighting current for commercial and street circuits in Saginaw. It was also desirable that the apparatus be of such nature that it could be operated in parallel with the company's power house in Bay City, tying the two together either by means of high potential alternating current feeders or through the direct current feeders of the interurban line. These requirements have been met in the design of the new power plant which has been carrying its varied loads for three months. This power house is located on the east side of the Saginaw River, near the company's gas plant, about midway between East Saginaw and West Saginaw. This location is close to the electrical center of the distribution systems.



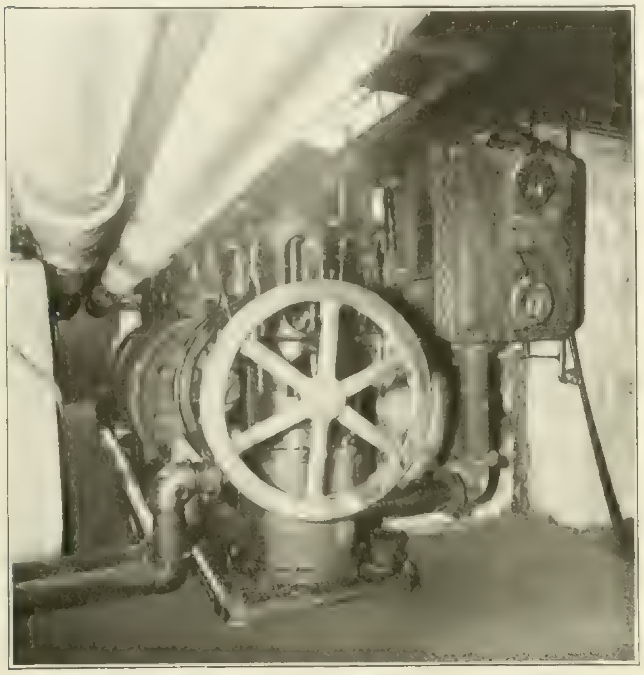
500-KW. CURTIS TURBINE UNITS.

The building, as may be seen from the accompanying illustration, is of a simple, substantial design having 12 and 17-in. walls of sand-lime brick and cut stone window sills. The wall foundations and those of all the apparatus within the building are of concrete. A 17-in. partition wall of brick divides the building into an engine room 85 x 66 ft. and a boiler room 85 x 55 ft. On this and the end walls rest the steel trusses which support the roof. The sheathing for the roof is of 2-in. Norway pine protected by "mastic" roofing compound. The head room between the roof trusses and the [illegible] partition wall admits light and aids ventilation.

Coal is delivered on a siding [illegible] plant. The siding is adjacent to the [illegible] room and is built upon an embankment between the foundation wall of the building and a retaining wall which forms a part of the waterway system of the intake and discharge construction. From the cars, coal is dumped through [illegible] boiler room floor where there is space for a storage of 200 tons. A coal storage bunker is now being built between the retaining wall and the track near the building.

The complete boiler equipment [illegible] vertical boilers, manufactured by Wickes Bros., Saginaw, Mich. Four of these are now installed as illustrated. They are equipped with McLane dumping grates arranged for hand firing. The ash is raked to the front of the ash box, where it falls through the floor into cars running on a track under the fronts of the boilers. The contents of these cars is dumped into an elevator and carried either to a storage pile or loaded onto work cars to be drawn away for ballasting. Steam is generated at 150 lb. pressure. "Reliance" water columns with automatic high and low level signaling attachments are used. A water-tenders runway, built of steel and hung from the roof trusses, will be erected at a suitable level in front of the water columns. The boiler equipment (this station is located in a residence portion of the city) is operated under the Sturtevant system of induced draft, with a steel stack 8 ft. in

diameter, 60 ft. high. There are two fans, each 16 ft. in diameter, exhausting into the breeching at the bottom of the stack, and drawing the gases from the boilers through either of the two paths as operation demands; one of the paths is directly through a chamber at the lower side of the back of the boilers into the fans and up the stack; by the other path the gases are led from the chamber back of the boilers through an installation of 52 sections 10 tubes wide of Green's economizers, then on to the fans and up the stack.



TURBINE AUXILIARIES.

Each of the fans is direct connected to a 14 x 14 in. Sturtevant horizontal engine, located in the engine room, the connecting shaft extending through the partition between the boiler and engine room. The fans are placed back of the middle of the row of boilers with a system of dampers controlling each half of the boilers independently and operated from the engine room side of the partition wall. The economizer scrapers are automatically operated by a 500-volt direct current motor mounted above the economizer chamber.

There are two boiler feed pumps placed with their steam ends together and located in the basement back of the boiler foundations. One is a Blake 12 x 7½ x 10-in., duplex, outside packed, plunger pump of the pot-valve type. The other is a Platt Iron Works Co. 12 x 8 x 12-in., duplex, center packed plunger pump.

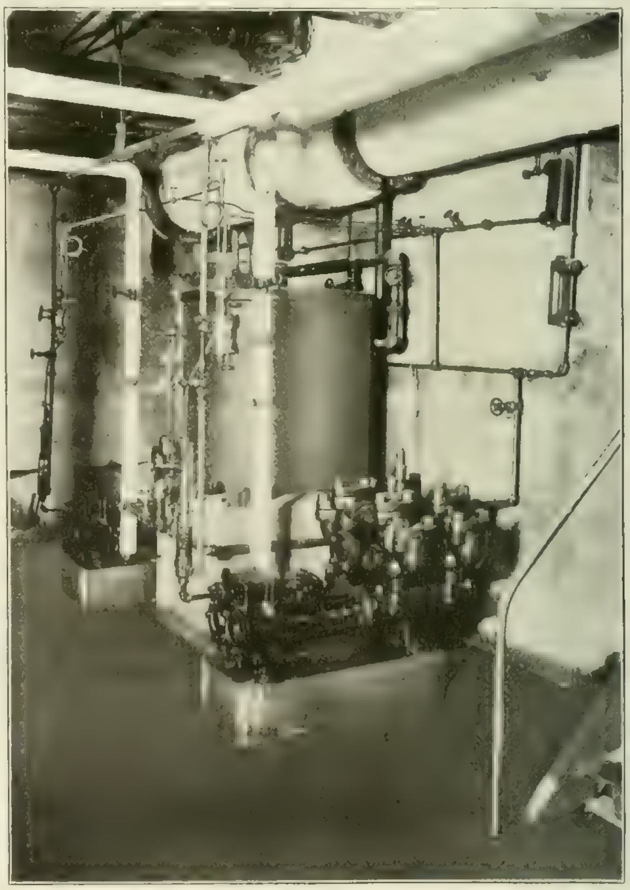
Live steam is taken from the top of each boiler drum through 8-in. pipes with long radius bends. These extend through the partition wall and deliver to the side of the 12-in. main steam header which extends along the partition wall in the engine room 18 ft. above the floor line. For flexibility of operation this header is divided into three sections by two Fairbanks gate valves.

The construction of the support for the main steam header is interesting. The steam pipe and a runway are carried on brackets, whose details of construction are shown in an accompanying illustration. These brackets consist of diagonal struts made up of two 4-in. channel irons held together by stay bolts with separators. The bottoms of these struts rest against the partition wall and the tops are tied by means of 1¼-in. rods to the web of the crane track rail which rests on pilasters. Along the tops of these supporting struts extend two 4-in. channels from which by means of 1¼-in. rods are hung the header supports, and a runway for workmen. The live steam main is mounted on this support so that expansion and contraction are cared for by suitable rollers placed between the piping and its supports. The runway is floored with checkered iron plates and workmen are protected from falling by a gas pipe railing. At one end of the runway a fixed steel ladder connects it with the floor.

There are four generating units. At the south side of the engine room steam is led from the top of the header by a long-radius engine connection 10 in. in diameter through a Hoppes separator to the high pressure cylinder of a 28 x 56 x 48-in., horizontal, Hamilton-Corliss engine, operating at 100 r. p. m. The shaft of this engine is 24 in. in diameter turned down to 22 in. in the bearings which are 40 in. long. Mounted on this shaft are a cast iron flywheel 18 ft. in diameter weighing 50 tons, and the armature of a 1,000-kw., G. E., direct current railway generator, furninshing current at 525 to 575 volts potential. At the north side of the engine room with its cylinder towards the partition wall and connected to the steam main in a similar manner is a 22 x 36-in. Hamilton-Corliss, simple engine. This engine is intended for reserve duty only and is belted to a 500-kw., G. E., direct current railway generator.

Between these two direct current machines are the two Curtis turbine units shown in one of the illustrations. Long radius piping, 6 in. in diameter, leads live steam from the top of the headers to the admission ports of the turbines. These units are of the two-stage type, rated at 500 kw. each, generating 3-phase, 2,300-volt, 60-cycle alternating current. Indicating tachometers mounted on brackets on the machine frame are connected to the shafts of these turbines and each turbine is fitted with an automatic force-feed oiling system.

The oil for the step bearings of the turbines is kept under a constant pressure by two 4½ x 1½ x 4-in. duplex, poppet-valve, plunger pumps located in the basement near the turbine foundations. Before entering the step bearings the oil pressure is reduced from the pump pressure of 200 lb. to 180 lb. pressure, by means of two similar sets of reducing valves. The oil pumps are automatically governed by two Fisher governors, manufactured by the Fisher Governor Co., Marshalltown, Ia. These governors are so cross-



OIL PUMPS FOR TURBINE STEP BEARINGS.

connected that in event of an accident which lowers the oil pressure at one pump, the other pump will automatically be started. After serving its purpose in the step bearings the oil returns to a supply tank of 2½ barrels capacity mounted on a concrete pedestal between the two pump units. Within this tank is a set of cooling coils by means of which the temperature of the oil is kept low. The oil for lubricating the cylinders of the reciprocating engines is supplied by a force-feed oiling system and hand pumps. The bear-

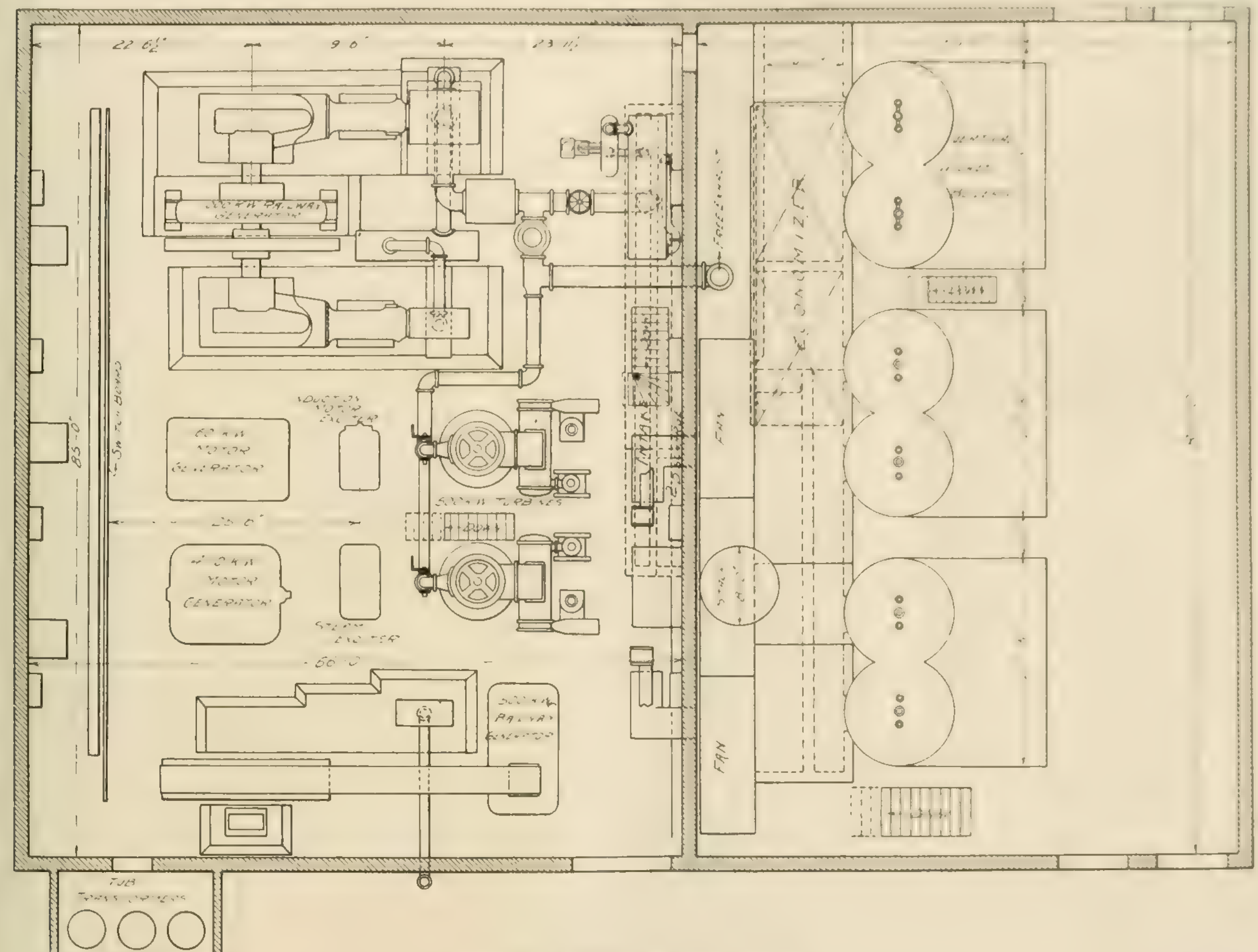
ings of these engines are oiled by a gravity feed system having a 30 gallon pressure tank, placed 18 ft. above the floor line on the south wall of the engine room.

Exciting current for the fields of the turbine generators is furnished by either of two exciter sets. One set consists of a G. E., 125-volt, 280 ampere, direct current generator, driven at a speed of 720 r. p. m., by a G. E., 2,300 volt, 50 h. p. induction motor. The other exciter is of the G. E. marine type, consisting of an 11 x 8-in. vertical engine driving a 125 volt, 240 ampere, direct current generator at a speed of 305 r. p. m.

The cross-compound engine and the turbines are piped for free exhaust. This exhaust pipe is of 24-in. spiral riveted construction, placed in the boiler room close to the partition wall. It has a 24-in. exhaust head above the roof of the boiler room. The free exhaust main is connected to the turbine and to the condenser main from the cross-compound engine by a Davis back pressure valve.

The hot well is of concrete [illegible] boiler. It has dimensions of [illegible] for this condenser is of the vertical steam driven type with cylinders 6 x 14 x 10 in. in size. A 22-in. Hoppes oil separator is placed in the exhaust connection and located between the engine foundations beside the intermediate receiver. [illegible] exhaust line for shutting off the condenser. When this valve is shut the exhaust steam passes through a Davis back-pressure valve and on to the free exhaust pipe. The stem of this valve extends through the engine room floor so that the wheel for operating the valve is accessible at the level of the engine and condenser. The water for condensing purposes is circulated by a 10-in. centrifugal pump driven by an Alberger 8 x 8-in. vertical engine with its suction and with the discharge pipe from the condenser hanging vertically in the intake and discharge wells respectively.

Water for all purposes is taken from the Saginaw River through



HORIZONTAL SECTION OF POWER HOUSE.

An accompanying illustration shows the condenser installation for one of the turbine units. There are two similar installations, one right hand and one left hand, placed on concrete foundations directly under the exhaust ports of the turbines. Two Wheeler surface condensers, each with 1,800 sq. ft. of cooling surface, are used. Water for condensing purposes in each condenser is circulated by a 10-in., high-lift centrifugal pump driven by an 8 x 8-in., vertical engine and the air is drawn from the condenser by an Edwards air pump driven by a 10 x 6-in. vertical engine.

The simple engine driving the belted 500-kw. generator is arranged to run non-condensing with its free exhaust pipe extending directly out of the side of the engine room.

Near the partition wall on the engine room floor and directly back of the low pressure cylinder of the cross-compound engine, is an Alberger horizontal surface condenser of 1,500-h. p. capacity. The condensed steam from the condenser discharges through a T-valve either directly to the hot well or to one or the other of two weighing tanks which in turn discharge to the same hot well.

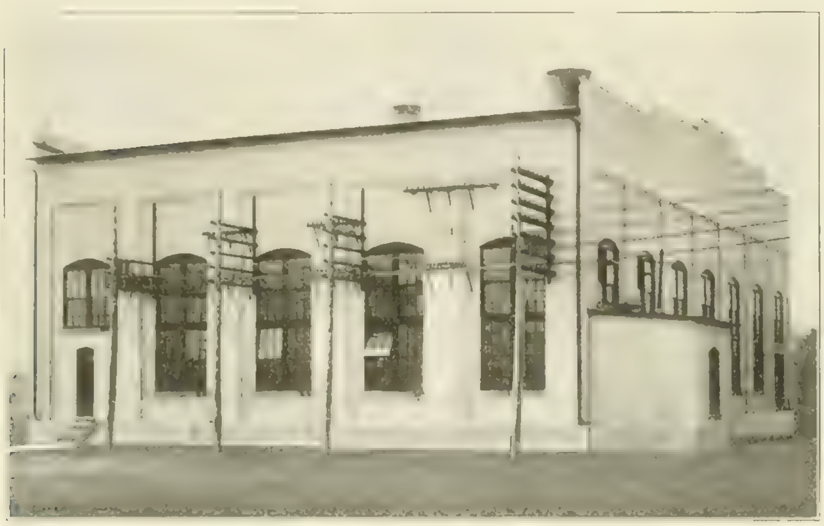
a concrete intake of interesting design. Extending from the [illegible] bank opposite the building is a pier 150 ft. long constructed of piles and sheathed with heavy planking. This pier serves to deflect the current of the river to the forebay of the intake and also to protect the retaining wall earlier mentioned, the intake screen house and the discharge opening. The opening in front of the intake is fitted with four sets of screens operated vertically in grooves in the concrete walls so that at any time any of the screens may be removed for cleaning and the others remain in place. Four feet back of the screens is a similarly designed gate screen for which can be substituted a steel plate. There is a like gate at the mouth of discharge. If at any time it is desired to empty the intake and discharge tunnels these gates can be closed and the water pumped out by the condenser pumps. Each of the tunnels is built of concrete and is 3 x 3 ft. in section. The intake slopes toward the river, and the elevation is such that there will be 2 ft. of water in the intake at the extreme low-water level yet recorded. This elevation places the [illegible]

the floor of the basement. As shown in the horizontal section of the building, the intake and discharge wells are built as two long narrow tanks parallel with the partition wall. The intake well is next to the auxiliary apparatus and the discharge well close to the partition wall. The walls of these wells have been brought up to such a height above the basement floor as will preclude any danger from flooding the building in case of extreme high water in the river.

The auxiliary engines exhaust to an 8-in. auxiliary exhaust header which extends through the basement and is supported by

WICKES VERTICAL BOILERS.

hangers from the engine room floor so that it passes close to all the pumps. A back-pressure valve, set for the receiver pressure of the cross-compound engine, is placed in this exhaust main so that ordinarily the exhaust from the auxiliaries feeds the receiver all the steam that it will take. The surplus steam is turned by the back-pressure valve to a Hoppes form K feed-water heater placed in the boiler house near the south end of the boilers. From the auxiliary main 2½-in. pipes are connected with the second stages



POWER HOUSE, SAGINAW & BAY CITY RAILWAY & LIGHTING CO.

of the turbines so that steam from the auxiliaries is supplied to the lower stages of the turbines in the same manner as to the low pressure cylinder of the cross-compound engine.

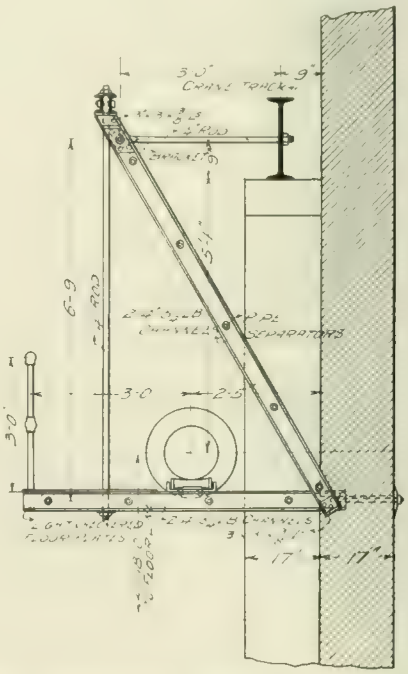
There are four drip taps from the under side of the main steam header leading into a 1½-in. drip main parallel with the header. The drips pass to the basement through a vertical pipe where they unite with the drips from the auxiliary steam header and other live steam drips and are forced by drip pumps to a header extending along the rear of the boilers.

Side by side with the auxiliary exhaust main is a live steam header for the auxiliary engines. Steam is fed to this header through gate valves on the top of the main steam header located above, on the partition wall as earlier described.

For flexibility in operation there are installed in the middle of the engine room two motor generator sets. One set consists of a 780-ampere, 575-volt generator driven at a speed of 400 r. p. m. by a 2,300-volt, 60-cycle, synchronous motor. The other set consists of a 160-kw., 550-volt generator driven at a speed of 400 r. p. m. by a 2,300-volt, 215-h. p., 60-cycle, synchronous motor with a starting compensator. It is by means of these motor generator sets that great flexibility of operation is obtainable, since this and the Bay City station may be thus operated in parallel. The motor generator sets may take direct current from the railway generators, converting it into 2,300-volt alternating current for the lighting system and thus admit shutting down the turbines or they may take alternating current from the turbines converting it to railway current and thus admit shutting down the railway generators. It will be seen that there are also several combinations possible by which if the lighting load or the railway load is excessive, the motor generator sets will assist in dividing the load between the alternating and direct current generating apparatus.

The switchboard for controlling the output of the station is located parallel with and 8 ft. distant from the east wall of the engine room. The board is of the General Electric Co's. make and consists of three double railway feeder panels with a bracket voltmeter; two 500-volt power feeder panels; a railway feeder panel, 3,000-ampere generator panel, 500-kw. railway generator panel, direct and alternating current motor generator panels for the 160-kw. set, direct and alternating current motor generator panels for the 450-kw. set, induction motor exciter panel, exciter panel for the direct current output for both exciters, 500-kw., 2,300-volt panels for the turbine generators, 3-phase power feeder panel; 8 single-phase commercial lighting circuit panels and a panel for distributing the current from three 100-light tub transformers with two circuits to each tub and a potential regulator on each circuit.

There are duplicate sets of copper bus-bars, 2 x ¼ in. in section,



DETAIL OF MAIN STEAM HEADER SUPPORT.

for the 3-phase circuits on the back of the board. These buses are supported on porcelain insulators mounted on a rigid pipe rack. On each of the eight commercial lighting circuits is a line drop compensator and there are meters on each generator and each feeder circuit. The 3-phase feeder circuits are supplied with overload trips on the hand operated oil switches. The alternating current

panels of the motor generator sets are provided with overload and reversal switch trips.

The outgoing feeders pass to wooden racks on the east wall of the engine room and rise to a point about 20 ft. above the floor, then pass through porcelain tubes in the building wall to the strain structures outside, the arrangement of which may be seen in the illustration of the power house. The interior of the engine room is served by a 15 ton Case crane which has a span of 64 ft. 6 in. and is electrically operated.

Question Box.

Mr. S. W. Mower, secretary of the American Railway Mechanical and Electrical Association, has sent to members copies of the questions to be considered in this year's question box before that association. The list is found below:

1. What is the best composition to use in setting an engine bed on its foundation?

2. What are the arguments for and against a solid spider in large generators?

3. What is the best kind and grade of carbon brush for a 550-volt direct connected generator, and what has been the experience around the circuit breakers?

4. Which is the better form of brush holder for a generator; one in which the carbon is free to move up and down, necessitating the current passing the entire length of the brush and being taken from the tip, or a holder which firmly grips the brush and is designed with elasticity enough to allow of the brush following the commutator?

5. Does a storage battery working in conjunction with a power house with moderately fluctuating loads show an ultimate economy?

6. What is a good cleaner for slate switch boards, where burned around the circuit breakers?

7. What economies are shown by buying coal on specification of high B. t. u. contracts?

8. Does the advantage obtained from the use of phono-electric trolley wire outweigh the disadvantage experienced on account of its reduced conductivity?

9. What styles of trolley ear do you recommend? What are the points or advantage of the "Clinch," "Semi-clinch," soldered ear, etc.?

10. What is the most common cause of flash-overs on small 4-pole motors?

11. What is the best method of inspecting motor for low bearings?

12. How often should motors be overhauled? If on a mileage basis, how many miles?

13. What should be the composition of babbit metal for motor bearings?

14. Do you use felt wicking or waste packing with oil in your car journal boxes?

15. What should be the chemical composition of a good car oil?

16. What is an economical figure for lubrication (per mile) of a 20-ton car equipped with four 40-h. p. motors?

17. Is there a satisfactory oil cup for use on old-style motors with gravity grease cups?

18. How shall we do away with the breaking of motor leads where they leave the iron conduit recommended by the board of underwriters?

19. Do you consider it good practice to depend entirely upon car circuit breakers, or do you use a fuse box also?

20. What is the best composition for trolley wheels?

21. What can be done to increase the life and prevent the wearing out of trolley wheel bearings?

22. How large a trolley wheel can be used to advantage on high speed interurban lines?

23. What mileage should a trolley wheel run? How often can it be economically turned down?

24. What methods of trolley wheel lubrication can be employed which will prevent oil from dropping on the car roofs?

25. What tension (in pounds) should a trolley wheel have against the wire?

26. How shall the interurban car of the future be designed, with or without platforms [illegible] the center or at the ends?

How shall they be operated, in [illegible]?

If in trains, shall all be equipped with motors, or will one be a motor car and the balance trailers?

27. On a city, suburban and interurban service, can cars weighing 26 tons complete, equipped with four 50-h. p. motors, maintaining an average speed of 20 miles per [illegible] of 300 miles without seriously impairing the electrical equipment?

28. Providing cars are fairly standardized and in fairly good shape, how many men per car should [illegible] shops and car houses on an electric street railway system operating, say, 400 to 1,000 cars, in order to keep cars in first-class condition?

29. How can cars be given a thorough weekly washing without injuring the varnish or causing the woodwork to rot?

Is it injurious to the varnish to wash a car with warm water in an unheated building?

30. In building new paint shops, what is the best form of painters' scaffold to provide for use at the sides of cars?

31. What is the best type of construction for car body hoists? Shall they be operated below or above the car house floor?

32. Which is the more economical for the general lighting of shops and car houses, arc or incandescent lamps?

33. What is the best method of pit lighting?

34. What is the best system for heating car shops and pits?

35. Do automatic sprinkler equipments in car houses afford sufficient protection from spread or fire to pay for installation?

36. What difference between wheel and track gage do you use, and where measured on your wheels?

37. Which is the more economical arrangement for getting cars to and from car houses, transfer tables or turn outs?

38. Do high carbon rails for street railway work give better results than rails with less than 55 per cent of carbon?

39. What is the best method for the eradication of weeds along the road bed?

40. What has been the experience of the members of the association as to the permanency of soldered copper rail bond?

41. What character of sand is best to use for sanding tracks? By what methods can it be dried? Which is most economical?

42. What is the best form of concrete beam construction as evidenced by actual experience?

43. Has experience shown that portland cement concrete under the tracks in city streets has given results such as to warrant its use in perference to domestic concrete, when the cost of the latter was less than one-half?

44. What character of pavement next to street railway rails gives the best results?

45. Why, in a city where the streets are of ordinary width, cannot a pavement be layed abutting a T-rail with equal facilitity and with ultimately as good results as where some type of grooved or tram girder rail is used?

46. Does the treatment of ties, poles, fence posts, etc., with a preservative fluid sufficiently increase their life to warrant the expense?

What methods are pursued? What do they cost?

47. Has anyone seen an indicator for steam turbines?

Ft. Wayne-Bluffton Contract.

The L. E. Myers Co., steam and electric railway contractor, Chicago, June 21st was awarded the contract for the building of the electric line running from Fort Wayne to Bluffton, Ind., a distance of 23 miles. This contract includes the grading, track laying and overhead construction, and one of the conditions is that work shall be begun within 12 days from date of contract and completed within 120 working days, special conditions requiring rapid completion of the road. This is one of the Fort Wayne & Wabash Valley enterprises, and is under the direction of Mr. C. D. Emmons.

The Myers company will use steam driven grading machines, mechanical track laying machines, locomotives and other modern mechanical appliances in the prosecution of the work in this case, and Mr. C. E. Collins, general superintendent of the L. E. Myers Co., will have personal direction of the work, is confident that he will have it completed well within the time of his company's guarantee.

Piping and Power Station Systems.—VIII.*

BY WILLIAM L. MORRIS, M. E.

Cylinder Lubrication

In designing an oiling system, facilities must first be provided for receiving the oil in barrels, emptying the barrels and disposing of them. If compound engines are used in the station, the cylinder lubrication will require two kinds of oil. There will also be needed a different cylinder oil for the dry vacuum pump and the air compressor. Engine or journal oil is usually the same for the entire plant, the plan being to filter this oil and use it repeatedly. Grease will also be required for some of the bearings, pins, etc. There are some specific requirements in the handling of these materials that to a considerable extent determine the location of the different parts of an oiling system:

1. The oil barrels must be stored in a cool and preferably damp place to avoid leakage.

2. The oil and grease stocks must be separated from other portions of the building in a fire-proof manner and arrangements made so that a fire in the oil room can be subdued and not endanger the station.

3. The oil room must be accessible from the outside, in order that the barrels may be received and discharged.

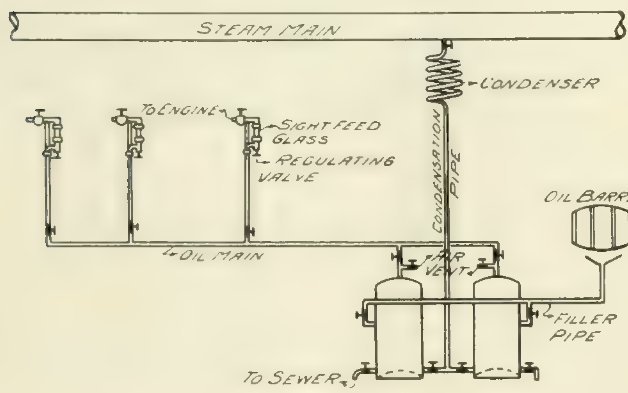


FIG. 54.

4. All the drip lines and the drip receiving tank must be located in a warm place so that the drips will flow freely.

5. Gravity tanks should be located in a place which will be cool in the summer but warm in the winter; and warmer in winter than in the summer, so that at all times the oil will be of a temperature that will insure free flowing and render it easily handled.

6. Cylinder oil and grease should be kept so that the amounts used can be charged to the respective shifts using them.

There are numerous methods of handling oil and various systems that can be used in supplying it to the machines. Cylinder and journal oils should be considered from different standpoints, when planning an oiling system; journal oil is fed onto the bearings in a much greater quantity than actually required, the loss being not appreciable because the drips are collected and returned to the receiving tank. The object of piping oil to bearings is to insure complete lubrication; the lubrication of the cylinders is an entirely different proposition. Instead of providing facilities for feeding an excess of oil into the cylinder, the contrary should be done, that is, plan the system so that it will require the least possible amount of cylinder oil.

One of the methods for placing cylinder oil under pressure and delivering it to the steam machinery which is to be lubricated is illustrated in Fig. 54. The necessary pressure is maintained here by adding to the steam pressure the weight of the water in a condensation pipe connecting the steam main with the supply tanks. The principle employed is the same as that of the standard sight feed lubricator so commonly used.

*Copyright 1905, by the Kenfield Publishing Co.

Two tanks are used, so arranged that one may be shut off from the system while being filled from the supply barrel and the other continue to furnish oil for the lubricating system. This equipment and piping system is the equal of the majority of installations. The most serious objection to it is that the piping is arranged without regard to any definite system.

When this system (Fig. 54) is arranged so that repairs may be made without shutting down the entire oiling system, it assumes the form shown in Fig. 55. For such small inexpensive lines as go to make up an oiling system it is good policy to make even greater provision for repairs than in the larger and more expensive lines. If line valves are placed at the points marked a in Fig. 55, continued operation is more readily insured. The cost of such valves would be slight.

When the style of lubrication shown in Fig. 55 is to be used with high pressure cylinders, it would be a good plan to use it on the low pressure cylinders also, but the pressure, however, should not be as high on the low pressure cylinder oil supply. If city water at about 40-lb. pressure is available, this can be used instead of the condensation columns shown in Fig. 55. Air pressure could also

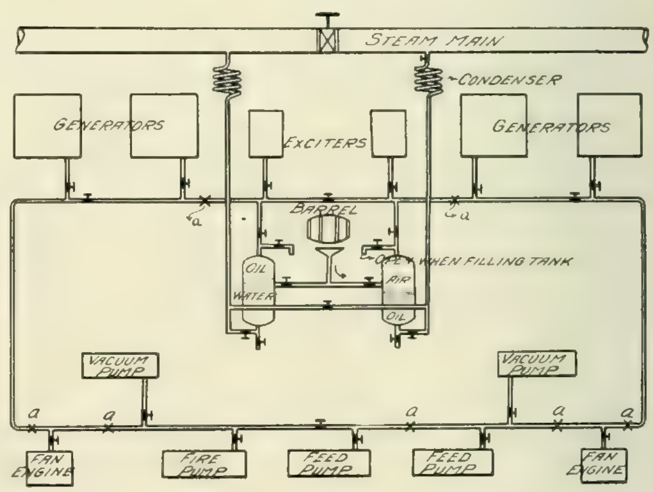


FIG. 55

be used, but since the compressed air system has not been designed with a view for continuous operation its use with the oiling system would be unsafe unless two air compressors are in use and arranged to independently maintain the required pressure. A low pressure cylinder oiling system which can easily be repaired is illustrated in Fig. 56. In this figure the air compressors are shown connected in a safe manner.

There are various pipe systems for feeding cylinder oil, but the general proposition is subject to many objections regardless of the equipment used.

There are two styles of feeders used to deliver oil to an engine. The older method is to use a sight fed glass filled with water and allow the drops of oil to feed up through the water. A drop of oil may seem small in itself, but it is an extremely large quantity when considered from a lubrication standpoint. An engine that is receiving one drop a minute would make, in the case of stoker or similar engines, possibly 250 or 300 revolutions without oil, to one with oil. The size of the drop is not controllable by the operator. But if such a drop could be divided into 10 or more small drops then it would be possible to obtain more economical results in lubricating with sight feed lubricators. This, then, is the weak point of all drop sight feed lubricators, that they seem to be feeding too little or not at all when in reality they are feeding too much.

The best system for handling cylinder oil is unquestionably one which will give the greatest amount of lubrication for the least

cost, and in considering cost both labor and oil must be included. Systems for feeding cylinder oil have so reduced the labor cost of handling the oil that they have made it possible and to a considerable extent excusable to waste oil. Each operator in his shift is relieved of about ten cents' worth of labor and enabled to waste one dollar's worth of oil. Such being the case, instead of spending money to make such installations, it would be better to spend money to avoid their use; however, some people think a plant must be automatic to be modern.

Another method of supplying cylinder oil to sight feed lubricators is illustrated in Fig. 57. This system uses a pump to force oil into

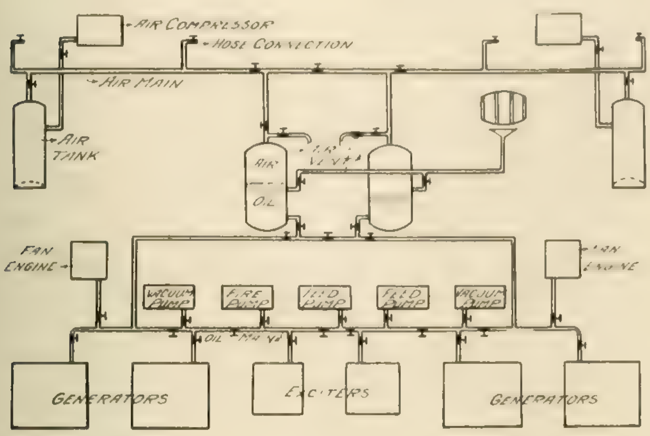


FIG. 56.

the pressure line and controls this pressure with the pump governor, the storage tank being placed higher than the pump so that the oil will flow by gravity from the tanks to the pump suction. Much difficulty is experienced in lifting cylinder oil in a pump suction, and in fact no suction for any service should be arranged except by the gravity method if the machinery is slow running. The system shown in Fig. 57 to be complete must be laid out on the loop plan with duplicate sets of pumps, distribution lines and storage tanks. Ordinarily this loop could be easily arranged by running one line through the engine room to supply all the steam machines there, and the other line through the boiler room to supply all its machinery.

The fact must be remembered that the piping system alone will not insure satisfactory operation. It is the entire system or method that determines the degree of success. For instance, Figs. 55 and 57 are both good pipe systems, but each has objectional features common to all cylinder oil piping systems that are not commercially successful. Figure 55 is mechanically a success since it maintains a steady pressure on the oil a fixed amount in excess of the steam pressure, this being accomplished by the condensation column. This steady pressure is absolutely essential for securing the best economy in drop feeding, which feeding at its best is not the most economical.

In the system shown in Fig. 57 the speed of the pressure pumps is regulated by governors actuated by the pressure on the oil end of the pumps. If this type of regulator is to be at all sensitive it must be constructed with a metallic diaphram. Continued service will eventually dish any metallic diaphram and when this has occurred considerable force is required to pass the dish from one side of the diaphram to the other. If such is the case in an oiling system having recording pressure charts on both steam and oil lines, sudden changes of pressure will be noticed and at times the oil pressure will show even lower than the steam pressure unless the governor is loaded down, in which event the steam pressure may be 160 lb. and the oil pressure 161 lb., then due to the snapping over of the dish in the diaphram a pressure 4 lb. higher than that for which governor valve was set will be needed to close it. Thus if the oil pressure is set at 5 lb. above that of the steam the defect in the diaphram will allow the oil pressure to run 9 lb. higher than the steam pressure before the governor valve closes. In other words, the head on the oil may be increased or decreased nine times and thus cause such a change in the volume of the feed that three times as much oil will be fed at one time as another. With such a governor it is probable that twice as much oil will be used as would be with the system shown in Fig. 55.

If it is wished to secure greater [illegible] sight feed method must be discarded [illegible]

The most common method for reducing the [illegible] of a force feed lubricator directly [illegible] ism of the engine or pump which is to be [illegible]. With this type of oiling system the discharge [illegible] feeds each minute and the total of the [illegible] for less than one drop. Such a system enables the lubrication of each piece of apparatus to be carried on independently and any draft of cool air can have no effect upon the [illegible] the feed as is the case with sight-feed lubrication.

The force-feed lubricators are ordinarily supplied with oil by hand; in fact, this method has been demonstrated to be the more economical and the labor of filling pumps is too slight to be considered seriously. An important consideration is the saving in the quantity of oil used; a skilled operator can more than save the difference between his wages and that of an inferior man by the difference in the amount of oil used alone.

It is due to this fact that the power station should be provided with a means for carefully recording the amounts of oil used by the different shifts. The systems shown in Fig. 55 and Fig. 57 are not designed for this purpose.

If a record is to be kept it may be found necessary to give out oil to each of two men in a shift, one part to be used in the boiler room, the other part in the engine room. The pump supply on each part of the force-feed oiling system should be marked with a line designating the point on the reservoir to which each shift must fill and the oil used in this filling should be taken from a supply can charged to the proper shift. A great deal of oil is wasted in the lubrication of the auxiliary machinery which should require but very little cylinder oil.

If it is found desirable to pump oil from a storage reservoir to the force-feed pumps on the units which are to be lubricated, this could be done with the piping system shown in Fig. 58. With this arrangement it is not necessary that duplicate receiving tanks be used. The air line may have its pressure maintained by a single compressor because the use of this supply arrangement would not be essential for the operation of the engine, since the pumps could be filled at opportune times and each shift would have recorded against it the meter readings showing the amount of oil drawn at the start and finish of its run. If a separate record is to be kept of the amount of oil used in the boiler room, this can be drawn from a supply can whose contents have been charged to that part of the station when withdrawn from the receiving tank in the stock room.

In Fig. 58 the tap A is added for filling hand oilers, etc. With this system there would be two complete piping arrangements, one

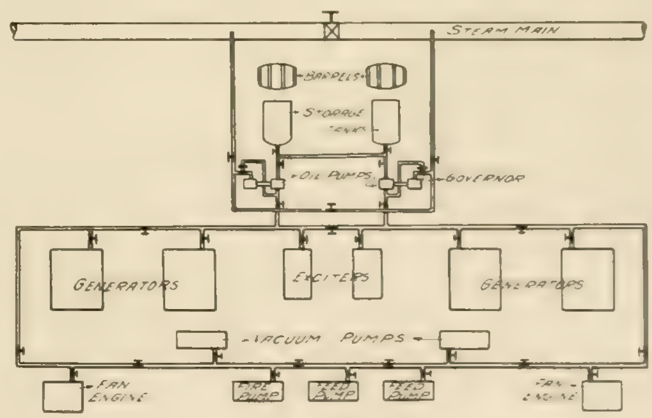


FIG. 57

for supplying oil to the high pressure and one to the low pressure cylinders. The advantages to be gained by using two kinds of cylinder oils with compound engines are too well-known both by the oil manufacturers and the operators to require giving any special reasons for their use.

The installation of a meter in the oil supply line as shown in Fig. 58 allows a possibility of this method being manipulated by the operators. The oil pumps on the engine are not ordinarily arranged to be put under pressure and with the system in Fig. 58 the proper method of operation would be [illegible]

and fill the pump supply to the limiting point which was earlier described, and then close the shut-off valve tightly. But in all probability a dishonest operator would soon learn that by leaving the filler valves slightly open the pumps would still be kept filled by a slight leakage which would be so small in amount that the meter would not record it. This would result in the showing of "good performance" purely by trickery, because the dishonest operators could reduce the apparent reading of the meter as much as they felt sure would not arouse suspicion.

If oil is to be measured and piped a better method is afforded by the use of gage glasses and graduation on the tank, thus dispensing with the meter. A tank 30 in. in diameter holds 3 gallons

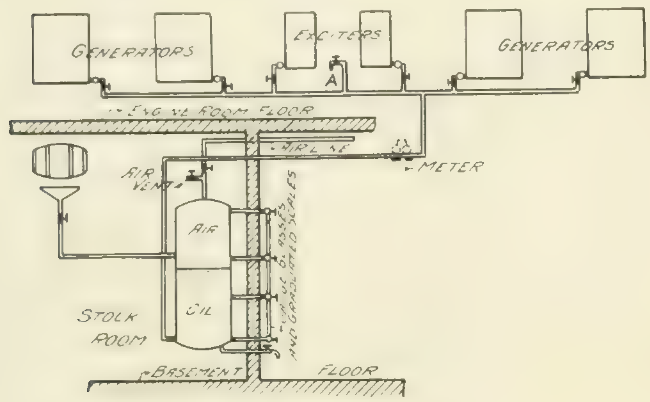


FIG. 58.

for each added inch in height and as the error of reading should be within the limits of 1/8 of a gallon, which with a 30 in. tank means a difference of 1-24 in. on the scale, this would seem too close reading to be gaged accurately. The reading should not be finer than about 1-12 in. to the pint. This fixes the diameter of the tank at 22 in. and with such a diameter and a length of 40 in. its capacity would be equal to one barrel. This tank would hold 1½ gallons per inch of its height.

In the problem plant which is being laid out it will be found best to use the piping system shown in Fig. 58 with the 22-in. stock tank, gage glasses, graduated scale, etc., omitting the meter as shown. Two kinds of cylinder oil may be used. Care will be taken that the pipe lines be located in warm places so that the flow of oil will not be sluggish in cold weather. It will be noticed that a connection is led off from the bottom of the tank so that in case the pressure for any reason is lacking in the supply lines, oil for hand filling may then be withdrawn and the entire piping arrangement as shown in Fig. 58 be shut down for repairs. This feature is the most valuable one of this system; this supply system is merely a convenience and labor-saving device and not necessary for operation. The piping system just described can be used in connection with the regular sight feed lubricators; the pipe line would furnish oil to the lubricators by shutting off the steam pressure, opening the bottom drain, filling the lubricator, closing the oil valve and opening the lubricator into the steam line again. Such a method of operation would be more reliable than that shown in Fig. 55 because each lubricator would be complete in itself and in time of disorder to the general system could be hand filled.

(To be continued.)

The Cambridge Subway.

The passage of the Cambridge Subway Bill by the Massachusetts Legislature during the closing hours of the session recently concluded works the climax of an unusual piece of rapid transit history. It is only a few years since the people of Cambridge were very strongly in favor of elevated railway connection with Boston, former legislation requiring the Boston Elevated Railway Co. to build an elevated road between the West Boston bridge and the vicinity of Brattle Sq. for the purpose of furnishing quicker transportation between the New England metropolis and its adjoining suburb across the Charles River. All this is altered today, the people of Cambridge having changed their minds in favor of a subway and after many months of discussion a bill acceptable to both the city and the railway company has been enacted.

As the law stands it furnishes a good example of the willingness of the road to meet the demands of the public, even when those demands involve serious alteration of plans, and in this case, also, the yielding of the company's perpetual right of ownership in the elevated structure. It is only reasonable therefore that the terms to be met by the city before it can come into possession of the subway should be somewhat exacting. One cannot change a contract without paying the price.

The law now provides that the company may construct in Cambridge, under supervision of the State Railroad Commission, a subway or subways of sufficient size for four tracks between the new West Boston bridge and the vicinity of Harvard and Brattle Sq. suitable terminals for surface car connection to be constructed at or near these points. The road is authorized to issue stock or bonds to meet the cost of construction and the city may purchase the subway at any time after 20 years from its opening, paying back not only the original cost but 8 per cent per annum, less dividends paid, on the increased capitalization. The city is also required to pay an additional 3¼ per cent per annum on the cost of the construction from the time of expenditure until the subway is opened for use.

It is a matter for congratulation that the city and the company have been thus able to come to satisfactory terms, and the attitude of the latter particularly bespeaks a public spirited temper and breadth of view none too common in these days. And on the part of the Cambridge officials concerned, it is refreshing to find a body of public representatives willing to acknowledge their mistake and pay the cost of such a pronounced "turn-over" in the opinions of their constituents. The completion of the subway is certain to revolutionize transportation between the two cities, cutting the running time from 20 or 25 minutes to probably 7 or 8. There would seem to be little need of four tracks at this stage of affairs, and fortunately the bill only requires two at the outset, if its wording is correctly interpreted.

1,200 Miles by Trolley.

One of the most complete and interesting railway guides or folders published, either by steam or electric railways, is a recent publication entitled "1,200 Miles by Trolley," compiled by Mr. R. H. Derrah, general passenger agent Old Colony and Boston & Northern Street Railway systems, Boston, Mass. A map and time tables for the Boston & Northern system is first included in the publication, and is followed by descriptions of the various routes and places of interest along the lines. The same information is then given for the Old Colony system, the street railway lines in Central Massachusetts and in the Connecticut Valley. In the time tables are included the distances, rates of fares and running time, together with information regarding through cars, branch lines, etc. The different routes and trips are described in a most interesting manner, as may be seen from the following paragraph taken from a description of the trip from Boston to Newport through the Blue Hill Reservation:

"Leaving the Dudley St. Station of the Elevated, on a Mattapan car or a car marked Milton via Roslindale, a change is made at Mattapan Square for the through Brockton car, which crosses the beautiful Neponset River. If more convenient one may take an Ashmont and Milton car and change at Milton Lower Mills for car that connects with the through car. The car runs on into Milton, where a branch line runs off to East Milton, and to Quincy through the great granite section. The Reservation, with all its great natural beauty, is now reached. Here one may wander all day in the open or roam at will through the woods. The car runs on through the Chickatawbut and Hancock hills. The Great Blue Hill, surmounted by its weather observatory, looms up on the right."

The Detroit, Ypsilanti, Ann Arbor & Jackson Railway Co. has concluded negotiations with the Detroit & Cleveland Steam Navigation Co. for a joint freight rate to any point in the east or south covered by this company, which means the whole of the east and south, even the New England states as the Detroit & Cleveland Co. has a joint rate with all the lines covering this territory. In addition, through the Anchor Line, the trolley road is able to reach northwestern points, while other negotiations are pending which will assure through-freight service in all directions.

Program Mechanical and Electrical Association.

The program of the American Railway Mechanical and Electrical Association is about completed and the work of the standing committees, which were appointed at the meeting of the executive committee held in New York, February 3rd, is so far under way that we are enabled to give the program about as it will be carried out at the Philadelphia convention, September 25th and 26th. The subjects to be considered by these committees are as follows:

"Controlling Apparatus." J. S. Doyle, master mechanic Interborough Rapid Transit Co., chairman. Report to consist of two papers, one by Hugh Hazelton, electrical engineer of the Hudson Companies, New York, entitled "Multiple Unit Systems of Train Control," and the other by W. A. Pearson, electrical engineer of the New York City Railway Co., covering the street car controllers.

"Way Matters." The report of this committee will include the following papers: "Thermit Rail Welding," by George [illegible] Pelletier, civil engineer Holyoke Street Railway Co., Holyoke, Mass.; "Zinc Welding," by H. B. Nichols, engineer of way, and C. B. Voynow, assistant engineer, of the Philadelphia Rapid Transit Co.; "Electrical Welding," by T. W. Wilson, formerly chief engineer and now general manager of the International Railway Co., Buffalo, being an article published in the "Review" for March and April, 1903, and used by special permission; "Electrical Welding," an article published in the Iron Age, describing the machinery used and the method of operation. These will be followed with a paper on "Cast Welding," by F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway & Light Co., and chairman of the committee, who will also give a summary of the entire report of the committee, which is accompanied by a number of interesting illustrations.

"Brakes," D. F. Carver, chief engineer Public Service Corporation of New Jersey, chairman. Report will include a paper by F. F. Bodler, master mechanic United Railroads of San Francisco, on the "Track Brake," which together with other papers will form the report of this committee.

"Maintenance and Inspection of Electrical Equipment." The preliminary work for the report of this committee has been completed and interesting data have been prepared by William Pestell, of New York, chairman of the committee, with the assistance of H. E. Farrington, of the Boston & Northern Street Railway Co.

"Power Stations." The report on this subject has been assigned to Fred Bushnell, chief engineer of the Rhode Island Co., Providence, R. I., and will include a paper by Mr. Bushnell on this subject. Mr. C. H. Hile, superintendent of wires, Boston Elevated Railway Co., has prepared a paper on "Power Distribution," treating principally of the distributing system of the Boston Elevated Ry. A paper has also been prepared by L. P. Crecelius, chief engineer of the United Railways Co., St. Louis, Mo., on "The Power Station Load Factor as a Factor in the Cost of Operation."

Street Railway Accountants' Association.

The Street Railway Accountants' Association, through its secretary, Mr. Elmer M. White, Hartford, Conn., has issued a circular bearing date, July 1st, regarding the coming annual convention. The ninth annual convention of the association will be held in Philadelphia, the first meeting being on the afternoon of Thursday, September 28th, and continuing all day Friday and if necessary, Saturday. The headquarters of the association will be at Hotel Walton. Announcements of the meetings of the other street railway associations is also contained in the circular.

The new collection of blanks and forms at the St. Louis convention was so helpful that it has seemed best to bring the collection up to date for the Philadelphia meeting and the secretary has requested all members of the association to send to his address a duplicate set of all blanks that their respective companies have adopted since the last meeting. Those members who did not contribute to the 1904 collection are requested to send a complete set of all blanks. Several requests have recently been received for charts of officials or organization charts and the request is made for any members having printed copies to send them. Annual reports of a few companies have been filed heretofore and as the practice has proved a good one, [illegible] to mail them [illegible] member to make [illegible] thereby increase the membership and attendance at the next annual meeting. [illegible] all companies [illegible] individual work [illegible]

A Novel Arrangement for the Target Light.

In our report of the proceedings of the May meeting of the Ohio Interurban Railway [illegible] target light described by Mr. W. H. Abbott of the Roberts & Abbott Co. The report stated that an electric light or lights would be used to illuminate special reflectors placed at the top of the switch stand. In this we were in error since the device proposed would use no light other than that furnished by the head light of the approaching car.

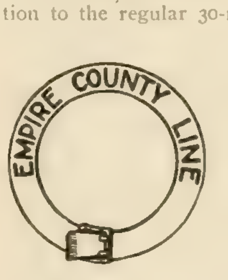
The scheme proposed by Mr. Abbott is novel and interesting. In a discussion regarding the arrangement of switch light for interurban operation, he suggested that the usual target light on a switch stand be replaced by a convex mirror made in the form of a section of a cylinder with its axis identical with that of the switch stand. This mirror would replace the usual target light, being secured to the staff directly above the flags. Its position would be such that when a car is approaching an open switch the mirror would be turned away from the rays of the headlight and no light be reflected. If the switch was closed the convex mirror would reflect a beam of light from a headlight back to the car, thus assuring the motorman of a clear track. The rule should be adopted, that if the motorman of the car does not see the mirror light up as he approaches, he should consider that the switch is against him. The convex mirror should be used in order to obtain a continuous reflecting surface that would turn back a beam of light to the car, even when the position of the car varied between a great distance off and a point close to the switch-stand.

Southwest Missouri Trade Mark.

Editor "Review":

The diagram on our letter heads (see illustration) will answer your request for a copy of our trade mark.

Several years ago, before the time when the trolley roads of Ohio and Indiana were running their much vaunted "Limiteds," the Southwest Missouri had in operation every two hours, in addition to the regular 30-minute service of cars stopping at all places, a through car between Carthage and Joplin which made only three stops between these cities and which covered the distance in 20 minutes less time than the other cars. To this through car we gave the title "The Empire County Express," having in mind at the christening the New York Central's famous "Empire State Express."



Now while New York is without a doubt the Empire State of the American Republic, Jasper County is indisputably the Empire County of the "Grand Old State" of Missouri, hence the name.

After about a year the express service was discontinued. It was popular but was creating dissatisfaction with the slower-going coaches, so the time of all cars between Joplin and Carthage was reduced 10 minutes and the Empire County Express was annulled. The trade mark, however, was preserved under the title "Empire County Line."

Jasper is truly an empire county in virtue of its great annual output of lead and zinc ores, building stone, live stock, wheat, corn, fruits and vegetables, and manufactured articles. The county contains a profusion of beautiful landscapes, numerous prosperous cities, villages, and mining camps and 350 miles of graveled roadways.

Yours truly,

A. H. Rogers, Pres.,

Webb City, Mo. Southwest Missouri Electric Ry.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York 39 Cortlandt Street. Cleveland 302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna Lehmann & Wentzel, Karntnerstrasse.
France, Paris Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV JULY 15, 1905 No. 7

CONTENTS OF THIS NUMBER.

CHICAGO TRACTION MATTERS.

The Chicago traction situation has many sides. One phase, as indicated by the more recent utterances of the mayor, is admirably shown in the cartoon which appeared in the Chicago Tribune for July 7th. It is not too much to say that the public, or that portion of it which in April last voted for immediate municipal ownership, displays about the same reasoning powers as the child that Mr. McCutcheon depicts as crying for the moon. The lantern which the mayor would substitute is a 20-year franchise to be granted to a company formed for the purpose, the company to be managed by five men favorable to municipal ownership, the dividends on stock to be limited to 6 per cent per annum, and the stock certificates to be put in escrow so that they will be non transferable.

The mayor was singularly unfortunate in calling his expert witness from abroad. Mr. Dalrymple is a street railway man and a thorough accountant, and has the courage of his convictions. Knowing the truth, he declined to be made a tool in attaining political ends for the anti-traction party in Chicago. Mr. Dalrymple's report, it is understood, has been submitted to the mayor, but at this writing had not yet been made public.

It will be remembered that the city strenuously objected to having the Chicago Union Traction Co. leases passed upon by the federal instead of the state courts. The so-called Townsend cases which raised this point were finally taken into the state court and here again the outcome was disappointing; Judge Mack on July 5th rendered his decision sustaining the contentions of the Chicago Union Traction Co. on every point except that of jurisdiction, and the amended leases executed last year were upheld.

The mayor and the transportation committee of the council are not in accord as to the methods to be pursued in carrying out the construction of the Adams St. municipal system, and negotiations for the sale of the Union Traction Co. and the Chicago City Railway Co. properties to the municipality are not progressing.

POSSIBILITY OF INTERNATIONAL ACCOUNTING STANDARDS.

The Street Railway Accountants' Association in America; the Municipal Tramways Association and the Tramways and Light Railways Association in Great Britain; the International Tramways and Light Railways Association on the continent of Europe, have all been active in attempts to secure uniformity in methods of accounting and forms of reports. The "Classification of Expenses" is an important feature of the report and the American Standard Classification was adopted in 1897, five years before the form of the American Standard Report was decided upon. In 1903 the British associations recommended forms of reports and last year in Vienna the International association also passed upon a form.

Each of the recommended standard forms of report comprises several elements, though not identical ones, which we may designate as the balance sheet, revenue account, expense account and tables of statistics. As to the first, second and last of these elements, it is natural that there should be differences of opinion among American, British and Continental accountants, regarding what items should be included in each, but a compromise on a general form applicable under all conditions should not be difficult. On the third element, the expense account, there is apt to be more argument, because in this are included a greater number of items, and there exist differences in practice regarding the fundamental classification.

In America we have the division of expense into "Maintenance," "Transportation" and "General." In Great Britain there are five divisions (reduced from six), which are: "Traffic," "General," "General Repairs and Maintenance," "Power" (including repairs to steam and electrical plant), "Permanent Way Renewal Fund." The sub-divisions in the American and the British reports are so nearly the same, both in substance and in name, that one's regret that they are not identical is all the greater.

In the Continental report, however, we find operating expenses divided into nine general divisions: "Management," "Operation," "Power Station," "Electric Line," "Rolling Stock," "Track and Roadway," "Buildings," "General Expenses" and "Miscellaneous." This shows an entirely different basis of sub-division and one that might be difficult to reconcile with the other forms.

The advantages of a report form suitable for the use of any electric railway, wheresoever located, and which could be compared with the report of any other road, are apparent, and now, rather than ten years hence, is the time to secure uniformity with the least labor. The American report, as drafted by the Street Railway Accountants' Association in 1902, has been adopted by the United States Government for Census Reports and approved by the National Association of Railroad Commissioners.

At the convention of the Association of American Railway Accounting Officers early in July it was apparent that the steam railroads are actively interested in electric railway accounting and "the accounting officers of electric railways having joint traffic relations with steam railways" were expressly made eligible for membership in that association. Here is a further indication of the widening influence of the Accountants' Association.

International accounting standards are desirable and we have not abandoned hope that they are possible; and existing hope was strengthened by the fact that the visit of Mr. Dalrymple to America was concluded by a conference on the subject between him, as the representative of the Municipal Tramways Association of Great Britain, and Messrs. Ross, Duffy and Brockway, of the Street Railway Accountants' Association. Of course nothing could be decided, but the work of adjusting differences will be undertaken soon, with promise of at least reaching an acceptable standard for English-speaking accountants.

THE MECHANICAL AND ELECTRICAL ASSOCIATION.

The secretary of the American Railway Mechanical and Electrical Association reports that excellent progress has been made as regards preparations for the September convention. All the reports and papers are in the hands of the secretary and will be issued to the membership in good season to assure intelligent and adequate discussion at the convention. The membership of the association has been considerably increased since the St. Louis meeting and now includes 124 active, 31 associate (company) and 25 junior members.

Reference to the program, as announced on page 417, will show that the association has broadened the scope of its work to correspond with its name, and this year the power house and civil engineering departments, as well as the mechanical department, will have good representation. That the association has heretofore devoted its attention chiefly to shop matters is not a reflection upon it, but merely an indication that it found so much to do in a limited field that the power house subjects were postponed. We consider it extremely gratifying that the three engineering departments are so well covered this year. What has already been done is an earnest for the future of an electric railway engineering association and emphasizes the need for not hampering the M. and E. when reorganizing the associations. The association has taken the best means of securing the support of the members of the A. S. R. A.—showing that it deserves that support.

Unfortunately, the Mechanical and Electrical association has suffered by reason of the uncertainty as to what is to be done in the matter of reorganization. Railway companies have evinced a disposition not to join as associate members until the A. S. R. A. takes action, and the scant support accorded by the companies has made the financial problem of the association a serious one. It is almost certain that, if the railway companies do not provide an adequate revenue, either by joining as associate members or by voting an appropriation through the A. S. R. A., the Mechanical and Electrical association will itself have to reorganize along somewhat different lines, making the body one relying wholly upon its active members. Such a change might increase the good of the association to the individual, but would probably decrease its value to the companies.

SUBURBAN TROLLEY SERVICE.

Considering the improvements of the past few years in urban and interurban rapid transit, it is singular that in so many cities so little real progress has been made in the intermediate field of handling suburban trolley traffic. On some of the older suburban lines the schedules in force today show little improvement in speed in comparison with those of five years ago, and although transfer privileges have been extended and cars run more frequently to accommodate the increased travel due to the development of the territory [illegible] equipment. [illegible] the truth of the territory [illegible] development of real estate and increase of population in the district affected [illegible] portation are offered, even at a higher rate of fare.

A typical case of this kind may be cited in a double-tracked suburban line seven miles in length which connects the center of a large city with a series of thickly populated communities of the purely residential type. At the end of the line the community chances to be under separate municipal government, but to all intents and purposes the entire region traversed is a continuation of homes, the great majority of which depend upon the central municipality for occupation and interests. The running time to the end of the line varies from about 38 minutes during the hours of light traffic to 45 or 50 minutes in the morning and evening rush period; the cars are run throughout the day at intervals of about 5 minutes, and the transfer privileges available on the 5-cent fare in force are almost unsurpassed in extent.

Paralleling this electric line is a steam road, two of whose four tracks are given up to suburban service, with stations about a mile and a quarter apart. The commutation rate from the community seven miles out to the city proper is roughly 8¾ cents; there are 45 inbound and 44 outbound trains per day, 5 of the former and 7 of the latter being express. The running time of express trains is from 13 to 15 minutes, locals going through in 18. The steam railroad terminal is within 7 minutes' walk of the mercantile center of the city.

The result of these conditions is that the steam road gets a great deal of traffic which might be had by the electric line if the schedules of the latter were not so slow. Commuters especially prefer paying the additional 3¾ cents to losing half an hour on the trolley route, even under the disadvantages of smoke, cinders and dirt common in steam railroad service. As far as running time is concerned, even the water boy of a pick and shovel gang at ten cents per hour cannot afford to travel by the trolley line unless he enters or leaves it by a transfer in the urban section of the route. By cutting the running time into a third of that required on the electric line, the steam road offers an almost irresistible advantage to the passenger whose time is valuable. The point is, not that the street railway company does not handle a large traffic upon this line, but that it does not begin to do the business which a faster schedule would undoubtedly attract, especially in the months when open cars are in operation. Although the first mile and a half of the trolley route covers a congested section of the city, the rest of the line is located either in a boulevard right of way, or the center of wide thoroughfares where speeds or 30 or 35 miles per hour could easily be maintained. By putting all double trucked cars with four motor equipments upon the line and spacing the stopping points a little farther apart there would seem to be no reason why the running time could not be reduced to 30 minutes at the outside and probably 25 as a minimum. It is difficult to make fast time with the two motor equipments now in service; the acceleration drops off in the rush hours as it never could with four motors and plenty of current available; and the stops often number 35 or 40 in the 7-mile trip.

THE HIRING, TRAINING AND DISCIPLINE OF EMPLOYES.

There is no class of employes upon whom greater responsibilities rest than those in the train service of railways, steam and electric, and that this fact is recognized is readily apparent in the attention and consideration that has been given and is being given to the hiring, training and discipline of these employes. The rigid examinations to which they are subjected and the severe service in which they are engaged, make them worthy of no mean consideration. That those charged with the management of electric railways have profited by the experience in steam railway practice in this department may [illegible]

[illegible] of examinations and personal records on the Southern Pacific System, which is described on another page.

[illegible] ture, but while the personality of the applicant for a position often commends him for employment, the rigid physical examination to which he is subjected results in the rejection of a majority of applicants. Experience of the steam roads has taught that the master mechanic is the best judge of enginemen, the chief dispatcher of telegraphers and the superintendent of train and station service employes. It would therefore follow that these departmental heads should have the hiring of their respective employes, letting the applicant apply to them for employment, be directed to the company's surgeon for a physical examination such as is set forth in the papers referred to, and returned to them for further examination in the rules and regulations of the company and training in their respective lines of work.

At the February meeting of the Ohio Interurban association one of the speakers in discussing Mr. Kelsay's paper on "Use and Abuse of Car Equipment," strongly urged that motormen be placed under the immediate jurisdiction of the master mechanic, giving to him authority to hire and discharge the men and to administer discipline. One of the principal reasons for this position was that the instruction of the motormen in the operation and care of the car equipment would be more efficient were the head of the mechanical department charged with maintaining discipline.

While excellent in theory this plan of dividing the employment agency into as many parts as there are departments of the organization seems to be considered objectionable by most electric railway companies. On small systems the manager can perhaps afford the time to administer the employment department himself and prefers not to delegate any more authority than is absolutely necessary in so important a matter. With large systems, which are of necessity in large cities, the labor conditions require more careful investigation into the record of an applicant and the large number of men to be employed as motormen and conductors would over-burden the master mechanic and the superintendent; hence, the employment bureau for large roads is the only practical solution.

In training the men after they have been employed the mechanical department should have its share of the work and in this connection the practice of the Lake Shore Electric in sending motormen who have trouble with the equipment, to work in the shops, on their own time, as a penalty, is worthy of attention.

The extent to which regular schools for instruction are utilized in training employes varies greatly, but it is evident that the best managed and most progressive companies favor this systematic instruction under the direction of men especially trained to impart information, rather than to rely entirely upon the "breaking in" the man gets on the car platform.

The matter of discipline involves first a record of the men's work, and the difficulty here lies in keeping the record in such a way that the men are given proper rank. The Brown system of discipline has been widely adopted and it has been found that paper debits and credits are far better than suspensions, and work no hardships on the men as suspensions generally do. The credits are fully as important as the debits, because they make the record show the relative standing of good men as well as which are the poor ones.

THE ASSOCIATION'S NAME.

At the meeting in Philadelphia last month of the A. S. R. A. committee on reorganization, it was voted to recommend that the name be changed to the American Street and Interurban Railway Association. The change is a good one as far as it goes, being a recognition that the industry which the association represents has expanded since 1881. The proposed name follows the precedents of the British and International European associations exactly, if "Interurban" be considered the equivalent of "Light Railway" or "Railway of Local Interest," but we think the modern interurban with 90,000-lb. cars running on 70-lb. or 80-lb. rails can scarcely be described as "light," and within the year probably we shall see some 200 and 300-mile electric lines, so that they will be "local" only insofar as 300 miles is short as compared with possible American distances.

MAYOR DUNNE FINDS IT HARD TO DELIVER THE GOODS.

"Boo-hoo, you promised it to me, and now you want to give me something else."

[From the Chicago Tribune, July 7, 1905.]

The change in name is not sufficiently radical, as it merely describes the field of the association as it is today and without regard to the near future when the electrical equipment of portions of steam railroads will make them desirable members. Neither the New York Central nor the Pennsylvania would care to be classed as a street or an interurban railway (just as in 1899 and also as late as 1904, some of our electrically operated elevated roads objected to joining a "street railway" association), but it would be greatly to the advantage of the association to have these companies as active members, represented by their electrical engineers and heads of the electrically operated divisions.

The change of name of the American Street Railway Association will not be decided upon until the Philadelphia convention in September next and in the meantime we believe the general membership should consider the name question with especial attention to the merits of the title "American Electric Railway Association."

It may be objected to this name that the word "electric" is too much of a limitation, that the rapid progress now making in gasoline motors for railway work demands that provision be made for this motive power. This point may be well taken, but the fact is that today the common bond for the members is that they operate electric railways, rather than street and interurban railways.

An Offer to Electric Railway Men.

Dr. Earl M. Pratt, of the Accuracy Press Bureau, is preparing a 25-cent book on "Memory" and other subjects, for railway men. He offers to send to any person who is in any way connected with street cars a copy of the book prepaid, provided a question on any subject, personal or technical, and 17 cents are sent him, before October, 1905, addressed in care of The Editor of The Street Railway Review, Chicago. He does not promise to answer in his book every question asked, but he wants the question if you want the book.

The line of the La Crosse & Southeastern Railway Co. from La Crosse to Viroqua, Wis., was opened June 27th.

A group of local capitalists has been granted a concession for the electrically equipping and operating of the Warsaw tramways. It is stated that this concession has been sought for during the past 15 years and that the construction work must be completed within two years' time.

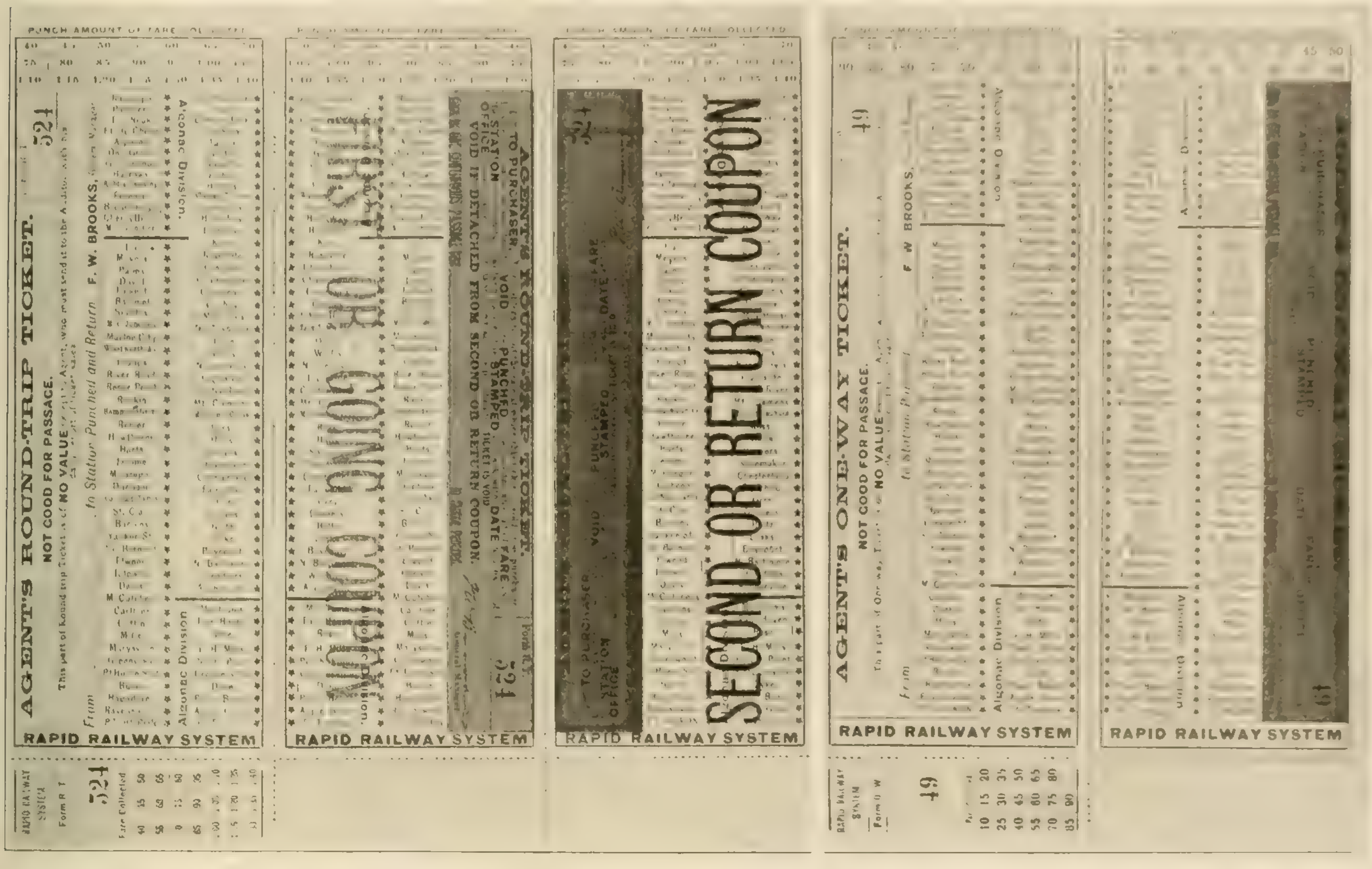
New Type of Agent's Ticket for Rapid Railway System.

To do away with the printing of a multiplicity of tickets such as is necessary in the usual one way and round trip between-station ticket system, the Rapid Railway System between Detroit and Port Huron, Mich., is now using only the type of ticket shown in the accompanying illustration. This ticket for round trip use is made up of three sections of equal size separated by perforations. On each of these sections is a similarly arranged list of all the stops on the system and also a table of fares, the punching of any one of which signifies that that amount of fare as punched has been collected. As before mentioned, this ticket serves for all round trip business on the division whose stations are listed on each of the three sections. When sending a supply of this form of ticket to a station, each section of each ticket has stamped on its face the name of the selling station. The three part ticket is then folded into the size of one part. This process superimposes the lists of stations and fares so that when any one station index or fare amount is punched in the top section, the same index or fare amount is also punched on the other two sections.

On delivering the ticket to the purchaser the agent after having punched the destination to which the ticket is sold and the corresponding amount of fare collected, tears off and retains the left hand one of the three sections. As stated on the face of this section, this agent's stub is of no value except to the issuing agent, who must send it to the auditor with his daily report of ticket sales. The middle and right hand sections are then delivered to the purchaser. On the middle section is printed that this is the first or going coupon. This caution is printed upon the face of the coupon in large green letters. The directions to the purchaser, and the names of the selling station, are printed in black on a rectangular background of the same green color.

"Second or return coupon" is printed upon the face of the right hand coupon in large orange colored letters. The directions for the purchaser and the name of the selling station are printed in black on a rectangular background of the same orange color. All three portions of this ticket are printed on pink paper, thus making the guiding colors quite conspicuous.

The ticket for one way [illegible] going coupon printed [illegible] trip ticket. For the one way ticket [illegible] directions to the purchaser and the name [illegible] printed on a [illegible] rectangular background. One of the advantages of this type of ticket is that it is only necessary for the general passenger agent to keep on hand a supply of the two types of tickets for use at all stations. In this way if an agent's stock runs low his requisition [illegible] [illegible] these tickets [illegible]



ROUND TRIP TICKET ONE WAY TICKET

Personal Records of Employes.

More attention is being given each year by both steam and electric railways to the hiring, training and disciplining of employes and greater care is being exerted in the selection of new men and in the instruction of recruits to increase their efficiency. Railway companies are much more exacting in their requirements and the examinations, both physical and mental, to which an applicant is subjected have resulted in the rejection of probably a majority of applicants. A personal record system, in which is included the application and physical examination [illegible] adopted by the Southern Pacific system and has met with a great deal of success, from which interesting and valuable data may be obtained for the institution of such a system on electric railways. In this system, application is made in person either to the master mechanic for engine service, and to the superintendent for train or station service, and those applicants whose neatness and apparent intelligence commend them are furnished with the following application blank, which is made in triplicate:

PERSONAL RECORD.

Application for situation as [illegible]

[illegible]

1. Name in full.................
2. Date of birth [illegible]
3. Description: Height [illegible] Weight [illegible] eyes [illegible] [illegible] marks..................
4. Name [illegible]

Residence (city, street and number)

6. Name of father and mother, if living

Residence (city, street and number)

If father and mother are not living, name and address of nearest relative

7. Names and addresses of any persons dependent on you for support or to whose support you are contributing

8. By whom employed at present?........... Where?........
No. Street Town or City. State

In what capacity are you employed

9. Why did you leave your last place?........................

10. No. letters of recommendation enclosed..................

11. State what railroad experience you have had, giving names of roads, in what capacity employed, length of service on each road. If you have not previously been employed by a railroad company, state by whom, and when and where you were employed. (Applicant must here give his history for last five years, beginning with his position of five years ago and giving each year in regular order down to date.)

Name of railroad or previous employer.

Town or city at which employed.

Name of state.

Name and present address of previous employer.

What was your occupation?

Date you entered their service.

Date you left their service.

12. Have you ever been discharged or suspended from any situation? If so, state particulars, when and where

13. Have you ever been injured? If so, when ...
where ... how ... and extent of injuries.

14. Have you now, or did you ever, have any litigation with any railroad company? ... If so, what company?..

15. Have you ever been in the employ of this company before? If so, state when, in what capacity, on what division, and cause of leaving ...

Did you then hand in personal record?........................

16. Do you use intoxicating liquors?.............

17. Have you ever before made application for employment and been subjected to a physical examination? If so, when............ where ... and by what physician was examination made? ... and were you accepted or rejected?........

I hereby authorize this company and its officers, and the officers of any other company, person or firm by which I have been heretofore employed, to answer any or all inquiries to as my conduct and qualifications while in such service, and, so far as they may know, the cause of my leaving the same.

18. My hearing is ... and eyesight .... and I ....able to distinguish color.

In consideration of my employment by said company, I further agree that whenever I shall sustain any personal injury, while in the service of said company, I will allow its surgeons, and any medical examiners it may select, to examine my person and body as often as the company may deem necessary in respect to the alleged injury, and I hereby waive all objections to such surgeons or medical examiners testifying whenever called upon by the company, and I further agree that my refusal to allow any such examination to be made or testimony to be given shall be a bar to the institution or prosecution of any action on account of such injuries; and any action pending at the time of such refusal shall at once abate in consequence thereof.

It is understood that my employment is temporary; permanent employment conditioned on my furnishing satisfactory reference from last employer.

I hereby acknowledge receipt of a copy of the rules and regulations for the government of employes of the operating department of this company, and all amendments thereto, and also a copy of the current time table, and agree to familiarize myself with and observe all the same, and to keep advised of such amendments to said rules as may be hereafter made, and have had explained to me the dangerous nature of the service in which I am about to engage.

Signature (No initials) ...

Witness

My present address is........................

Dated ... this ... day of ... 190

The applicant then reports to the company's surgeon to have his sight and hearing tested and for a physical examination. This physical examination is most severe and is intended to disclose any constitutional or organic defects that might in any way interfere with the proper discharge of his duties. The physician's certificate of examination is reproduced herewith, from which the scope and nature of the examination may be ascertained. The surgeon making the tests and examinations reports the result on this blank, sending two copies of the reports to the superintendent or master mechanic and the other to the chief surgeon. If the applicant is accepted and given employment a fee of $1 is deducted from his wages for this examination, otherwise the company pays for it.

CERTIFICATE OF EXAMINATION.

No.

190

Examination of

Age Nativity Employed as Applicant for Position as At

EMPLOYEES AND APPLICANTS.

1ST TEST DISTANCE VISION 20 FT | 2D TEST REFRACTION 20 FT

Right Eye Left Eye | Right Eye Left Eye

3D TEST—READING VISION, 14 IN | 4TH TEST—FIELD OF VISION 3 FT

Right Eye Left Eye

5TH TEST HEARING

Right Ear—With Watch Left Ear—With Watch

6TH TEST COLOR SENSE

To match Green skein To match Red skein

" Pink " " Blue skein

With Signal Flags and Lanterns

7TH TEST GENERAL CONDITION

Case Synopsis

APPLICANTS ONLY.

The applicant has ... the Company in ... Tests, and ...

Signature of Applicant

THIS IS TO CERTIFY, That the above named party has this day presented himself for examination, ... that I have made the examination in a careful and thorough manner, and in accordance with Company's instructions; and that the information herein contained, so far as I have been able to discover ... is correct.

M. D.

Examiner at

EXAMINATION CERTIFICATE (ORIGINAL SIZE 8½ X 14 IN.)

After passing the physical examination the applicant is given a copy of the rules and regulations of the operating department and is given a mental examination. Enginemen are examined by the master mechanic or traveling engineer, trainmen by the superintendent or train master, and operators and station men by the superintendent or chief dispatcher. If suitable proficiency is made in this last examination, he is given employment conditioned on furnishing satisfactory reference from his last employer. When the applicant enters the service one copy of this blank (personal record and certificate of examination) is transmitted to the manager, together with all letters of recommendation, clearance cards and a portrait of the applicant, and the other filed with his photograph in the office of the superintendent or master mechanic. Thus a complete record is kept of all employes on each division by the division officers and of all employes on the entire system in the offices of the manager and the chief surgeon.

Uniform Standards of Examination of Railway Employes.*

BY DR. F. H. PECK, CHIEF SURGEON, UTICA & MOHAWK VALLEY RAILWAY CO.

I am placed in a position of some embarrassment in coming before a convention of men engaged in the executive department of railway management, with a paper which has to deal solely with medical questions, in their relation to the policy of the railway surgical department. In order to make myself perfectly clear to the lay mind, I shall endeavor to divest my subject of all technical terms as much as possible.

To increase the factor of safety to the utmost, compatible with the rapid transportation demanded by the strenuous times in which we live, must be the endeavor of all railway managers. A recent newspaper article informs me that in 1903 the number of persons killed and injured on the railways in the United States reached a

DR. F. H. PECK.

total of more than 80,000. Of this great number I believe that a large proportion were injured through their own carelessness, or contributory negligence. But it is possible to reduce the number of casualties by improving the personnel of railway employes. The only way to accomplish this result is by the establishment of uniform standards of examination, in the hands of competent surgeons, of all applicants for positions in the operative service of the railways, with rules requiring the re-examination of these employes, as often as once in five years, or after recovery from serious illness or injury.

At the first glance it would seem that the responsibilities of the electric motorman are not nearly so great as those of the engine-driver on the steam roads, as the lighter load renders the momentum of the electric car but a small fraction of that of the heavy steam train, and emergency stops can be made in much shorter space. This difference in momentum, and the difference in center of gravity in favor of the electric car staying on the track, should make the trolley much less hazardous both to the passengers and to those on crossings and in streets used by the respective roads. On the other hand, the fact that the trolley traverses the thickly peopled streets of our cities tends to act as an offset to the extra factor of safety inherent in the car and its mode of propulsion.

The factor of safety to the public is best conserved by the rigid examination of all candidates for employment as motormen and conductors. Both should be men of sobriety, with sound minds in healthy bodies, of good nerve,—quick and decisive in an emergency, and in the perfect possession of visual and auditory faculties.

In the examination I would recommend two classifications or standards of requirements, one for new applicants for employment and for old employes seeking promotion, which should most rigidly insist on the possession of full normal vision and hearing; the other for re-examination of experienced employes not seeking promotion should require at least two-thirds normal vision and hearing. This for the reason that the [illegible] conductor has by experience [illegible] render him quite [illegible] faculties, though the former [illegible] faculty of vision and hearing.

[illegible]

The Snellen test [illegible] curacy of vision [illegible] paper on which are printed [illegible] each line of type bearing a number which shows the distance in feet at which the line should be read by the normal eye. Thus on the card which I exhibit the top line is numbered "70" and should be read at the distance of 70 [illegible] "20" should be read at the distance of 20 ft. In testing vision the card is placed in good illumination [illegible] candidate. Each eye is tested separately, by directing the patient to cover the other. He is then required to read the lines as far down the card as possible, and his acuity of vision is recorded as a fraction; the numerator being the distance in feet at which he reads the types, and the denominator being the numeral corresponding to the smallest line correctly read. Thus normal vision is indicated by the fraction 20/20, which means that he can read the line marked "20" at 20 ft. If he cannot read this line but can the one next above, his defect in vision is indicated by the fraction 20/30, which means that he reads at 20 ft. the line which he should read at 30 ft. If he reads all but three of the letters in the line marked "20" correctly, and mistakes those three for letters of somewhat similar appearance he should be passed as possessing normal vision.

New applicants for the position of motormen should be possessed of normal vision and their examination papers should bear the fraction 20/20 as recording the vision of each eye without the aid of glasses. This rule should also apply to motormen in the service seeking promotion. Candidates for the position of conductor whose vision equals 20/30 with each eye without glasses, and is susceptible of correction by the use of glasses so that they can read 20/30, are marked as "Average" for employment.

Color Tests.

In testing for defects in color perception I use both the Holengren test worsteds and the Williams color test lantern—both of which I exhibit. By the worsted skeins color vision is tested by selecting one of the large untagged skeins and requiring the candidate to pick out and lay beside it all the skeins of the same color in its various shades. The small skeins have each a metal tag stamped with a number. Those corresponding to the test skeins have odd numbers, while those liable to be confused with the test colors by the color-blind subject, and called "confusion skeins" bear even numbers. The colors which are liable to be mistaken for each other by the person who is color blind are green for red and vice versa, grey for green, and brown for red.

Color blindness varies in degree in different individuals; those who pick out red or rose-colored skeins and place them with the green as being all of one color, or those who select light greens when picking out the reds, are radically color blind; while those who choose light brown or grey in selecting reds and greens respectively have a seriously defective color perception, and are none of them fitted for positions requiring prompt recognition of red and green signals. Those who handle all the colors over and over with marked hesitation before coming to a decision though they may finally be correct in grouping the colors, have a slow, and therefore defective color perception, and it is my practice to further test them with the lantern.

The lantern is so arranged that by turning a circular disk in front of the lights different primary colored glasses are successively illuminated, as well as their corresponding numbers; though the latter are concealed behind a smaller disk, and can only be seen by the operator. There is in addition a sliding diaphragm perforated with apertures of different sizes to give the effect of various distances to the test colored lights. If the applicant can correctly and readily call the names of the colors illuminated he is accepted. If he mistakes reds for greens or vice versa he is rejected. One thing in which the examiner should exercise great care is to differentiate between color ignorance and color blindness. Many men of the class who apply for positions as trolley employes have a defec-

*Read before the Street Railway Association of the State of New York, Lake George, June, 1905.

[illegible] cannot readily name the colors, though their color perception may be normally acute. The grouping of the [illegible]

Tests for Hearing.

For testing the hearing I use the voice test and the tuning fork. In the former after testing the vision of each eye separately by the

SURGEON'S CERTIFICATE OF EXAMINATION.

Age

Color Sense — Hearing

Green .... — Right ear
Red — Left ear
Purple
Whisper or acoumeter

of Respiration

Name — Date

Its present condition

If so what and when?

otherwise? If so

Heart
Lungs
Kidneys
Joints
Veins
Feet and Legs
Hands and Arms
Spine
Urinary Organs

Is his appearance that of a temperate man?

or been recently vaccinated

His height is ....feet .. inches, weight .... lbs., color of eyes........ ......; of hair .

First class
Average
Defective

Signature

Surgeon

Signature of applicant to be taken at Surgeon's office

(Sign here)

Remarks

EXAMINATION BLANK (ORIGINAL 8 X 13 IN.)

Snellen test cards, I direct the candidate to plug one ear with his finger; then standing by the test cards, at a distance of 20 ft from him, I ask him in a low voice what is the last letter in the line he has just read; then with the other ear stopped, I ask him

DIAGRAMMATIC FIGURES ON BLANK.

what is the first letter in the line, or if he can read any of the letters next smaller. Usually he will repeat my question, or will show by his answer whether he has heard correctly, and will be unconscious that I am testing his hearing, imagining that reading the letters with his ears successively obstructed is a continuation of the visual test. If he shows any doubt in regard to the voice test I further test his hearing with the tuning fork. Standing behind him I direct him to tell me the point at which he begins to hear the instrument as I approach it to either ear. I set the fork ringing by pinching the ends between my thumb and forefinger and suddenly releasing them, so that his attention may not be called to the loud noise, which would be caused by striking the fork against any hard substance. Asking him to describe the character of the noise he hears I can judge whether he is honestly telling when he hears the fork. The hum of the fork should be heard at about 20 in., while its tone should be clearly heard and described at 5 or 6 in. The record of his hearing is made in a fraction of which 20 is the denominator, representing the distance at which the examiner stands from him in the voice test. Perfect hearing is indicated by the fraction 20/20; one-half perfect by 10/20, etc.

Physical Health Examination.

The application blank should show applicant's name, occupation, residence, age, height, weight, color of eyes and hair; the pulse and respiration should be recorded; also history of any illness subsequent to the diseases of childhood. Specific examination should be made as to the presence of hernia or any deformity. The history of any injury or accident should be elicited and significant scars or deformities marked on the diagrammatic figures on the blank. Special examination should be made as to the existence of any disease of heart, lungs, kidneys, and urinary organs, joints, veins, hands and feet, arms and legs, and spine. Examination for hydrocele, varicocele or varicose veins should not be omitted. The question as to the use of intoxicants should be supplemented by the examiner's opinion as to whether applicant shows evidence of using liquor. A history of recent vaccination should be required, or in its absence re-vaccination. The examiner should express the opinion as to whether the candidate appears bright and alert, or dull and slow in his mental processes and finally the surgeon should state whether he considers the applicant to be first class, average or defective for the position sought, giving his reasons, in case of rejection, in a space left for supplementary remarks.

Types of Interurban Cars.*

BY J. A. SHANNAHAN, GENERAL SUPERINTENDENT, FONDA, JOHNSTOWN & GLOVERSVILLE R. R.

It is the purpose of this paper to describe two of the types of interurban cars in service on the Fonda, Johnstown & Gloversville R. R., the service in which they are used, and to point out their advantages and disadvantages for that service. It may perhaps be well to describe first the conditions of service which were to be satisfied by these two cars.

The cities to be connected were Gloversville, Johnstown, Amsterdam and Schenectady, the total length of line being 33 miles. The builders of the line realized that two distinct kinds of travel must be provided for, the through long-distance rider, who must be carried in the shortest possible time and with a maximum of comfort, and the local short-distance rider, who desires to be carried from his own door to that of his neighbor, a few miles distant.

To provide for the long distance rider the company arranged what was termed a limited service, which made the run of 33 miles in a little less than 1½ hours, and provided for no stops outside of the cities. To care for this limited service the management caused to be designed a car capable of making an average speed of 45 miles per hour, and with every convenience possible to a passenger in an electric car.

The dimensions of the car are: Length over all, 55 ft. 4 in.; width over all, 8 ft. 9 in. The trucks are spaced 33 ft. center to center. The weight of the car body is 53,500 lb., and of car complete with trucks and motors is 86,500 lb. The great weight is because of the steel floor frame, which has been illustrated and described in several of the technical journals in the past. (See "Review" for August, 1903, page 495.) The management of the company felt that inasmuch as the cars were to run at high speed, that every precaution should be taken to safeguard the passengers

*Read before the Street Railway Association of the State of New York, Lake George, June, 1905.

against possible accident, [illegible] frame. The great weight of the car has, however, [illegible] another most desirable result, namely, an easy and comfortable riding car. The writer does not wish to be understood as stating that this result is accomplished because of the weight of the car body alone, but that it is the combination of trucks with the heavy body which has brought it about. In [illegible] I feel that the following points must be considered in looking to the comfort of the passenger:

1. Easy riding qualities in the car and truck.
2. Comfortable seats.
3. Toilet conveniences.
4. A smoking room which shall be comfortable for the occupants, but unobjectionable to the other passengers.
5. Ice water, luggage racks, etc.

The first has already been considered and need not be referred to, further than to state that the trucks were manufactured by the Taylor Electric Truck Co. The second point being the seats, need not be particularly discussed beyond stating that they are of the "Walkover" type, with head-roll back made by the Hale & Kilburn Manufacturing Co., and upholstered in plush. The seats are 37 in. long, 19½ in. deep, with a back 24½ in. high, and an arm rest. These seats were designed especially for this car, and have proved most comfortable in every way.

After considerable discussion it was decided to place in the cars a toilet room similar to those in a first-class steam coach.

The proper location for the smoking room was carefully studied, and it was finally decided to pattern after that in use in the Pullman cars, except that the seats should be longitudinal rather than lateral. That the occupants of the smoking room are entirely isolated, and ladies not obliged to pass through the compartment in entering or leaving the car, has proved a most satisfactory arrangement.

Each car is equipped with an ice water tank, which is given attention at the end of each round trip. The luggage racks run the entire length of the main compartment on each side of the car. Another feature especially designed for the convenience of the passenger is the window. When closed the view is not obstructed by any wire guard or grating, but when the window is dropped in warm weather a brass grill, placed above the top of the sash and attached to it, provides the necessary protection. When the window is raised the grill passes entirely out of sight.

Care was taken that the car should be so well lighted that passengers would have no difficulty in reading in any part. The result is that the car is brilliantly lighted, there being forty 16-c. p. incandescent lamps in the main compartment alone.

The vestibules are arranged in a manner similar to those of a Pullman car. The steps do not project beyond the side of the car and are covered by a trap door when not in use. Each vestibule is provided with a motorman's cab.

The heating of the cars is accomplished by a Peter Smith hot water heater. The further precaution has been taken of applying storm sash to these cars, and we experience no difficulty in keeping them properly warmed at all times.

The cars are equipped with the Westinghouse straight air brakes, and also with the Sterling safety hand brake.

The interior of the car is finished in tabasco mahogany, with marquetrie design in border and panel.

The electrical equipment consists of four G. E. 73 motors (75 h. p. each) with Type M train control. The motors appear to be admirably adapted to the service, as no difficulty has been experienced in making the run of 33 miles, of which eight miles is in streets or highways, regularly in 1 hour and 24 minutes.

The particular advantages claimed for the car are:

The ability to make the run at high speed, thus successfully competing with the steam railroads.

The possession by the passenger of all the comforts found in a modern steam railroad coach.

The minimum liability of injuries to passengers, which was admirably demonstrated a few months ago in an accident in which one of these cars, running at a speed of 45 miles per hour, crashed into a 15-ton steam road roller. The roller was almost completely demolished, while the damage to the car was confined almost entirely to the front vestibule, and was repaired for the sum of $625. Though the car carried 34 passengers, none was seriously injured.

For the conditions [illegible] designed, the [illegible] advantage. It might [illegible] unloading [illegible] eral rearrangement of the entire car. The placing of the smoking compartment in [illegible] car make [illegible] provided for [illegible] faster running en route.

The car was designed in the office of Mr. C. H. Ledlie, consulting engineer for the [illegible] supervision, and was built by the [illegible] car complete was about [illegible] pensive a car may be questioned, but it was the belief of this company that sufficient additional traffic would be attracted by such a car to justify its purchase, and the results of eighteen months' operation completely demonstrates the correctness of this belief.

No reference has been made to the value of such a car as an advertisement for the railway, but there is no doubt that the company has received much favorable notice for operating so fine a type of car.

To provide for the short haul business the company arranged what is known as the accommodation service, which provides for slower speed than the limited cars make and for a large number of additional stops. To cover the accommodation runs we purchased eight cars manufactured by the St. Louis Car Co. as one of its standard types of interurban car. The dimensions of the car are: Length over all, 45 ft. 4 in.; width over all, 9 ft. The trucks are spaced 22 ft. center to center. The weight of the car body is 36,000 lb., and of car complete with trucks and motors, 58,700 lb.

The car has side or main sills of 5 x 8 in. yellow pine, reinforced by a ¾ x 8 in. steel plate, and [illegible] pine, reinforced by 5-in. channels.

The car is equipped with the St. Louis Car Co. seats, upholstered with rattan. The seats are not provided with an arm rest. The car is mounted on the St. Louis Car Co.'s No. 23 trucks, and equipped with the Christensen straight air brakes, and four G. E. 57 motors.

The interior is finished in quartered oak. The heating is accomplished by a Peter Smith hot water heater.

These cars make the run of 33 miles in two hours.

The advantages of the heavier car for the limited and fast service have been spoken of, and I believe are quite apparent. As to whether the lighter car's advantages for the accommodation service are as real may be questioned. That its passengers can be unloaded and loaded in less time is unquestionable, and that it can make the accommodation runs with the frequent stops with a much less consumption of power is equally true. But whether the amount saved in these ways will equal the increase in the damage account due to the lighter construction of the wooden car is a question which is not easily answered.

Publicity.*

BY [illegible] HARVEY WHITE, BOSTON [illegible]

How to obtain fair treatment from the local press is a problem that puzzles a great many railway managers. A persistently hostile press not only exasperates and embarrasses, but tends to create an unfriendly public sentiment that might in an extreme case jeopardize the success and even threaten the existence of a company. Many street railway men seem to think that it is the deliberate policy of most, if not all, newspapers to attack and misrepresent all public service corporations. They treat any talk about a spirit of fairness on the part of the public press as the silly imaginings of an impractical and inexperienced theorist.

It is not in the nature of things that all newspaper stories and editorials written in the rush of newspaper life and necessity can ever be made as judicially fair as court decisions or as accurate as mathematical calculations, but it does not follow that because there are some grounds for criticism that either the inaccuracy or injustice necessarily spring [illegible]

*Read before the [illegible] at New York [illegible]

other [illegible]. On the contrary, newspaper men [illegible] and whoever [illegible] contrary opinion has either been peculiarly unfortunate in his experience or has been [illegible].

Every street railway manager desires the good will of the newspapers toward his corporation, and ordinarily it is not a difficult thing to obtain. The most effective means of securing it are persistent courtesy, good temper and frankness. The battle is more than half won if the newspapers understand that a company is ready at all times to supply them with information that may be desired unless there are serious reasons for not doing so. An occasional refusal of news, particularly if an explanation is made as to why the information is withheld, does not create ill will, but when reporters and city editors find themselves thwarted in every effort to obtain news the result is quite certain to be that the columns of the papers will not furnish much reading matter that will delight the corporation management.

When the Boston Elevated Railway Co. began operation in 1897 it was decided to assign to some person the special duty of looking after the needs of ten daily and forty odd weekly newspapers published in the territory in which the company operates. The writer of this article was selected for that purpose, and for the past seven years has devoted much of his time to dealing with newspapers and newspaper men. The experiment has proved sufficiently successful to warrant its continuance, and it is hoped and expected that as time goes on a larger measure of success will be brought about.

It would be pleasant to be able to state that nothing ever appears in the papers to which the company can find valid grounds for objecting, but the lamentable truth is that no such Utopian state has been brought about. This much, however, has been accomplished. The newspapers generally recognize that the management of the company is endeavoring conscientiously to please the public and to provide a good service, and, what is of more importance, they are willing to say so. Furthermore, the reporters and news editors, as a rule, make an honest effort to be perfectly just to the company in the presentation of news. The occasional misrepresentations usually spring not from malice, but either from inaccurate information from outside sources or too great zeal to make a story interesting. In brief, it may be said that the policy of the company has contributed materially toward the creation of an atmosphere of good will between the press and the corporation, although it has not resulted in the entire elimination of newspaper comment to which objection can fairly be made.

The president of your association has seen fit to ask for a description of how the press department, if it can be dignified by the name of department, of the Boston Elevated Railway Co. is conducted. It is all so simple and the details follow so much as a matter of course that it is a discouraging undertaking to attempt to find items of sufficient importance to justify an encroachment upon the time and attention of such a body as will assemble at your convention. But as the request has been made, and made under circumstances that precluded a refusal, the task will be assayed without apology or further justification

The work of the press agent of this company differs from that of most men occupying corresponding positions, in that there is practically no advertising to be handled. The only regular advertising, if it can be so termed, is the publication of time-tables in the suburban papers. These are paid for in cash and not in transportation, as is customary with many companies. The company issues no passes or other free transportation to anybody, except that during the summer months it places in the hands of certain charitable institutions and associations upwards of fifty thousand free tickets to be distributed among the sick and children of the poor, who cannot afford even a nickel for a fresh air outing away from the tenement districts.

Practically the only other advertising is the occasional publication of statements of facts that the company wishes to place before the public. When it is desired to insure the publication in full in every edition of a paper, or when the company wishes to secure the publication of a certain matter at greater length than its strict news value calls for, then the company pays for the space that is required. Such occasions are, however, very rare, and practically all of the work of the department is confined strictly to supplying news which the papers use in their own way.

Success in dealing with newspapers along the lines indicated requires some general understanding of the purposes, practices and ethics of the newspaper business. The aim of all publishers is to attract readers, for upon the number and character of the readers depends the value of the paper as an advertising medium, and upon the advertising receipts depends the prosperity of the paper. Most newspapers are ambitious for a larger circulation. This they aim to secure by meeting the demands of the public for news. Therefore all newspapers try to print the news their readers desire, try to present it in an interesting way, and try to make their news columns reliable sources of information.

The recital of these elmentary principles of newspaper practice and policy may appear unnecessary and not germane to the subject matter under discussion, but the writer considers an understanding of them of much consequence. When dealing with another person it is often useful to know in advance what the other fellow wants. Many persons who have seen little of the inside of newspaper management imagine that newspapers strive more for sensation than they do for accuracy. This idea is fallacious. To be sure newspapers delight in sensational facts, but no paper can afford to gain a reputation for being unreliable. Nothing piques the pride of a reporter or editor more than to have an "esteemed contemporary" show that a write-up is a fake.

The aim of newspapers to secure accuracy has been thus emphasized in order to give point to the assertion that if a street railway management finds itself constantly misrepresented as to facts, the chances are that the company itself is at fault. If public service corporations generally would adopt the policy of giving as much, instead of as little, news to the papers as possible, it is quite certain that the papers would not only print the facts with reasonable accuracy, but would welcome such action.

Some men are timid or over-cautious in dealing with newspaper men for fear that they are not to be trusted. In an experience of seven years the writer has had a confidence abused but once, and that was in a matter of no vital importance. As a class, reporters and editors have a sense of professional honor that may be relied upon implicitly. In fact it reaches a point that the outside public would scarcely credit. The greenest cub reporter learns among his first lessons that the violation of a confidence is sufficient grounds for discharge. If a person desired to keep something out of a paper, his best course in many cases would be to tell the whole story in confidence to a reporter or the city editor and trust to the honor of the newspaper not to abuse the confidence. It may appear that the writer entertains a too exalted opinion of the men who are engaged in the profession of journalism, as the business is usually termed by those who are not engaged in it, but it is founded on an experience that makes it impossible to hold any other opinion.

When a reporter enters the office he is given immediate attention. He is offered a chair, usually given a cigar and made to feel that he is welcome. He states his business and is given the information he desires as fully and explicitly as possible. If the subject appears difficult for him to fully grasp, as technical subjects are apt to prove, he is supplied with a memorandum of the principal points. Oftentimes it happens that a reporter does not really know what is wanted, as assignments are frequently given to reporters in very vague terms. In such cases every possible assistance is given to help him out of his dilemma.

It sometimes happens that it is unwise, improper or impossible to supply the information. In such cases, especially if the reporter is a new man who is trying to establish himself with his paper, the city or managing editor is called up and the situation explained to him. Ordinarily a city editor will promptly relieve a reporter from his assignment under such circumstances. The reporter then goes away contented, for he feels that although he has not obtained his story, he will not be held accountable for a failure. This is an illustration of the many little things that persons not familiar with newspaper methods seldom think of. When a reporter is assigned to secure a particular story he is expected to get it. If he is unsuccessful, it injures his standing with his paper. Under such circumstances there is always a temptation to exercise the imagination a little and fake up some kind of a story, which would not be written in a spirit of especial friendliness toward the person or corporation that refused the material. It is therefore a good rule, if one desires to win the heart of a news gatherer, to either give a reporter what he asks or ask his superior to relieve him of the obligation of getting it.

One very important policy that must be strictly adhered to if he wishes to have any influence with newspapers is to be strictly truthful and sincere. If the confidence of news gatherers is ever lost in the good faith of a press agent, he will forever be discredited. He must have an unimpeachable reputation for truth telling or his statement will be neither sought nor valued.

A press department such as is being described is in a sense a bureau of information of unusual scope. The head of the department is called upon to answer a range of questions that is almost beyond imagination, for it must be understood that one of the principal aims of city editors in general, and Sunday editors in particular, is to discover subjects for stories that no one else has ever thought of. In order to meet these demands, that are often trivial and whimsical, the press agent must have access at all times to information in every department.

The questions that are asked deal not only with the routine of the service, operation of the system and allied technical subjects, such as engineering, electricity and mechanics, but they also include legal questions, relations between the public and public service corporations, labor matters, finance, political economy, sociology and a multiplicity of other topics of popular or academic discussion. The range is wide and does not lack variety.

If a press agent has any doubts as to the propriety of answering the questions asked, he should seek instruction from the management, but he ought to be able to decide upon the expediency of giving out news matter in most cases without bothering his superior officer, whose time is so fully occupied that it should be trespassed upon only in cases of real necessity. The rule is, consult the management in case of doubt, but do not be in doubt too often.

Another fairly important work of the department is the preparation of complete articles for use in newspapers and magazines. There is considerable demand for authoritative and popular articles of this kind not only in this country, but in Canada, England and Germany. Some of these articles are often "syndicated"—that is to say, they are sent to a considerable number of papers for simultaneous publication—if they are believed to be of general interest. Sometimes fifty or more papers use a single story of this kind. This service can be supplied to the newspapers at small cost. The greatest care must be exercised to keep these articles strictly within the field of legitimate news and not permit them to encroach upon the advertising field. Such stories deal with subjects of considerable magnitude and general interest, such as the construction of a tunnel or the installation of important and novel equipment.

A corporation that takes the position that what it is doing is its own business, and not the public's, is apt to find itself in hot water a great portion of the time. The public insists not only on being well treated, but upon having the means of judging for itself as to whether or not it is being well used. A company that is giving good service cannot today afford to hide its light under a bushel, but should do all in its power to demonstrate to the public that the service is good. A company that is unable to supply a really satisfactory service will usually find that it has much to gain and little to lose by perfect frankness with the press and the public. If the public is convinced that the management is really doing its best, the amount of fault-finding will be reduced to a minimum, and some sympathy will be given to a management that is battling with adverse conditions and difficulties. It is quite as important to explain the faults as it is to extol the virtues of a company, for it is a trait of human nature to regard with reasonable complaisance many things that have to be endured if a sufficiently good reason is given for their existence.

The press affords the best and most available medium for a street railway to keep itself before the public in its true guise. Most companies would be happy if they could make the public see them as they really are. The thing that managers complain of is not that they and their companies are exposed to public criticism, but that they are misrepresented. The most effective remedy is co-operation with the newspapers upon the basis of frankness on the part of the company and fairness on the part of the paper. Such an arrangement is usually feasible and agreeable to both parties.

For the convenience of patrons the East St. Louis & Suburban Railway Co. has put on sale in convenient form, books containing 20 tickets each, good on either East St. Louis or interurban lines. No reduction is made in the rate of fare.

Coal Handling Locomotive Cranes for Electric Railway Power Plants.

Locomotive cranes [illegible] more used for handling [illegible] railway power plants. The [illegible] important item [illegible] cheapest and most satisfactory machine for doing this work.

The cost for handling [illegible]

No. 2 Brownhoist [illegible]

3 cents per ton, and it may run as low as one cent per ton. These costs are of course entirely dependent on the different local conditions for each place, but they can be accepted as an average.

The capacity of a No. 2 Brownhoist [illegible] tons per 10 hours. A machine of this kind is thus capable of handling the necessary fuel for a plant of several thousand horse power.

In order to reach such favorable figures in regard to cost and

[illegible]

capacity the detail arrangements of the locomotive crane are very carefully worked out as to insure the necessary speed and endurance both in the [illegible] handling locomotive crane of today has therefore very little in common with those locomotive cranes mostly seen around the yards [illegible]

[illegible] by the Browning Engineering Co., [illegible] Cleveland, and also a standard yard crane with hook block which shows the general arrangement of the machinery.

The Browning company has made the manufacture of locomotive cranes a specialty for a number of years and has succeeded in increasing the capacity of the cranes and at the same time reducing the hard labor of the operator. The latest machines of this kind [illegible] the largest [illegible]

STANDARD YARD CRANE WITH HOOK BLOCK.

include every possible improvement, and promise to make the work of the operator more like play.

The crane is also used for handling and disposing of the ashes. In such cases the ashes are filled into a small buggy and run to the end of the power house and dumped into a pit. From there the ashes are later on picked up by the grab bucket and transferred to cars or wagons as required.

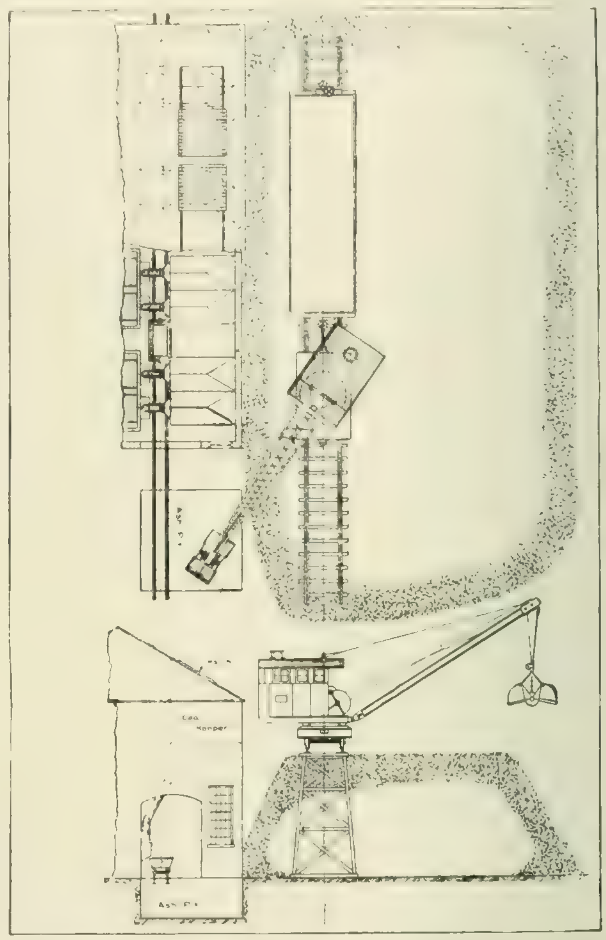
The arriving of the coal and shipping of the ashes by rail is, of course, connected with a considerable amount of switching and

HANDLING ASHES OR COAL IN CARS.

shifting of cars around the yard, and this work is entirely taken care of by the locomotive crane. Only the saving in switching charges will many times reach a considerable amount, and in addition to this there always are a great many odd jobs for lifting and loading machinery and material around the yard of a plant, which has to be done, and for which the crane is always available and convenient. In connection with this it also ought to be mentioned that it only taken ten minutes to exchage the grab bucket for a hook block in case the handling of material of another nature should become imperative.

Other features that speak favorably for the locomotive crane are the small initial cost in connection with the low expense for operation and repairs. The initial cost is small because it does not include more than the price for the machine, for the reason that the tracks must generally be put in under any condition.

All that has to be done, therefore, is to erect the crane on the



BROWNING COAL STORAGE AND ASH HANDLING SYSTEM.

track, get the steam up and start the crane. Should it later on for some reason or another be found advisable to use any other means for handling the fuel, the locomotive crane can always be made useful on other work, and such a machine always finds a ready market.

Cincinnati Northern Traction Co.

The Westinghouse Electric & Manufacturing Co. has just closed a contract for the equipment of the main generating station and four rotary converter sub-stations of the Cincinnati Northern Traction Co. The power house will be located at Hamilton, O., and the original installation will be of 5,000-kw. capacity, with provisions for ultimately increasing it to 10,000 kw.

In the generating station will be located three 1,500-kw. and one 500-kw., three-phase, rotating field, enclosed turbo-type generators, and three 300-kw. rotary converters. Current will be generated at 375 volts, thus avoiding the necessity of lowering transformers for the main station rotaries. The outgoing lines will then be equipped with raising transformers having a ratio of 375 to 33,000 volts. Each generator will be driven by a Westinghouse-Parsons steam turbine and excited by a direct-current generator attached to the end of the turbine shaft from which its power will be derived.

Each sub-station will contain a 300-kw. rotary converter supplied by three 100-kw., 33,000 to 375 volt step-down transformers. All transformers are of the oil-insulated self-cooling type. Besides the apparatus mentioned, the contract includes all necessary switchboards and protective devices for the control and protection of apparatus in the power house and rotary stations.

Some High Potential Trolley Operation Details.

In discussing line construction for utilizing high potential in the operation of electric railroads as described in the recent paper read before the American Institute of Electrical Engineers by Mr. Varney and Mr. Damon, Mr. F. N. Waterman adds some observations in the way of further details that have been found advantageous on some European lines.

The longest experience with the problem of conveying energy at high pressure to a moving vehicle has been that of the Ganz Co., which has now extended over about five years. This has all been with three-phase currents at 3,000 volts and low frequency, and therefore two trolley wires were employed. The preliminary trials on the experimental line at Budapest lasted for something over a year, and the system has been operated in Italy altogether nearly four years, of which two and one-half years represent actual practical service. The original line erected at Budapest was practically reproduced at Valtellina, except for a few minor details.

During the experimental work at Budapest both single and double-catenary suspension were tried, the construction being essentially similar to that used on the Spindersfeld line. The cross-suspension type, however, was adopted, the system of double insulators and double supports being used. A considerable sag was allowed in span-wires, and every effort was made to give an elastic and uniform suspension. The insulators, as installed, are extremely heavy, and certainly do not aid in securing this result. Dry wood, impregnated, as suggested by Mr. Damon, forms an important feature both of the old and new construction.

For long spans and at switches a very interesting special type of span-wire construction is used, particularly where the trolley wires are lowered to pass under bridges, and for this reason undue rise and fall with the passage of the trolley would be objectionable. This consists of a catenary type of cross-suspension connected at intervals by suspension wires with an upwardly arched span-wire, which carries the insulators, thus making a construction that does not sacrifice the substantial elasticity of the line, but holds it accurately in place, permitting a limited rise and fall with the passage of the trolley.

Owing the very small clearance of the tunnels, difficulty was experienced in keeping the wire from grounding between supports. This was overcome by shortening the distance between supports, and weighting the conductors by clamping small iron rails upon them, which were put on in sections several feet in length in the same manner as a mechanical clip.

Although the construction is not by any means heavy, and the workmanship shows the effect of inexperience on the part of the linemen, it has successfully withstood the wear and tear of use, and so far as I have been able to learn is still in place. In one or two instances at the beginning of the experimental operation the trolley caught in the supension-wire, owing to the improper location of curves and turnouts. The result was to break some portion of the trolley mechanism, but to leave the rest of the line unharmed.

For the latest construction the double-catenary type is used; no span-wire supports whatever being employed, and two messenger wires serve to carry both contact conductors. The spacing of the conductors is maintained by wooden insulator-bars upon which the insulators proper are carried, and to which supports from the messenger wires are attached. The insulators have been very much lightened by the substitution of pressed steel for malleable iron castings. The messenger wires are carried on iron girders spanning the track and placed 130 ft. apart; the distance between points of attachment to the wire is 65 ft., there being two supports between girders and none immediately under them.

The block-signal system is interconnected directly with the contact conductors, and the entrance of a train into a section in face of a danger signal disconnects the section. In addition, the conductors within the limits of the stations, and for a definite distance on each side, are dead at all times, save when a train is actually approaching or starting from a station. These sections can only be thrown in by the signal operator. It is customary for express trains to coast over the dead parts of the conductors with trolleys down, and it is the usual practice for trains moving at full speed to lower the trolleys at all switches, excepting such trains as are off schedule and are making up time.

The feature of double insulation, which is used throughout, has proved particularly useful in rendering possible the breakage of a single insulator [illegible] part can be effected [illegible] come particularly [illegible] where special liability to mechanical breakdown exists. The idea of cutting out sections at stations, and the extension of the same idea carried out on the Spinderfeld line, of cutting out sections under bridges where the right of way passes under highways, seems also worthy of consideration, at least for special cases.

The Valtellina system seems to have been free from trouble with the overhead construction to a remarkable extent, notwithstanding the fact that two overhead wires are required, and this fact emphasizes the importance of using a trolley contact device that cannot get off from the wire and thus either break insulators or pull down the construction.

The trolley itself is a single apparatus and not two independent devices. It requires, however, two separate bases and poles, the same as if there were two single trolleys. The outer ends of the two poles are connected by a continuous bar of impregnated wood, the centre portion of which for a distance of about eight inches is the full diameter of the rolling contacts. On either side the diameter is reduced to receive two contact cylinders, which are slipped over and supported on insulated ball bearings, the current being taken off by carbon contact rings at the ends and carried by flexible jumpers to the trolley poles.

The cross-bar, with its contact rollers, is flexibly connected to the ends of the arms by horizontal spiral springs, permitting simultaneous contact with the two wires even where they are at widely different heights. The rollers originally used were of copper, which gave trouble by elongation under the hammering incident to service, and a resulting binding of the bearings. Ganz & Co. now send out copper-plated steel rollers, and claim for them a service of 10,000 km. per roller, or 20,000 km. per vehicle, before replating becomes necessary. The copper rollers gave a life of 30,000 to 40,000 km. per vehicle, but then had to be entirely renewed. The operating company prefers bronze, and finds no trouble from elongation.

The trolley poles are supported by spiral springs in tension, the tension being put on from within the vehicle by compressed air. With this device the slow-moving trains take 300 amperes without sparking or burning the wire. The normal speed of passenger trains is 40 miles per hour, and the maximum current that has been taken off at that speed is about 240 amperes, under which conditions the collectors worked satisfactorily. The highest speed at which the device has been tested is 62 miles an hour, taking off a current of about 100 amperes. This test was made without alteration of springs or line construction and gave entirely satisfactory results. The plan of construction employed has therefore demonstrated its effectiveness at moderate speeds in spite of the handicap of the extreme weight of the insulators.

After two years of use the trolley wires show practically neither wear nor evidence of burning. Very little sparking is perceptible at night when running at full speed; but as would naturally be expected, such flashing as does occur takes place at the points of suspension. The type of trolley used seems therefore to combine the advantages of the wheel and bow forms. It cannot leave the wire, and, as at present constructed, cannot catch. The rolling contact practically eliminates the wear on the wire and contact conductors. The only serious objection to the overhead construction raised by the local engineer was to the location of the wires over the track, necessitating much of the work being done at night, or else conducted under serious disadvantages. During the entire period of operation no one has been injured or killed by contact with the overhead construction, but an engineer of the Ganz Co. was killed in one of the sub-stations.

The organization for the maintenance of overhead construction is very interesting. The line is 66 miles long, and for the purpose of controlling is divided into five sections, for each of which five men are required. Their duties include patrolling the line and visiting the sub-stations at regular intervals. When not otherwise engaged one man is always on duty at the sub-stations. In general charge of all sections is a superintendent who reports to the electrical engineer.

The total cost of maintenance of primary and secondary lines, care, attendance and maintenance of sub-stations, and patrolling of the line on this plant is about $102 per mile per annum. This force is not kept fully occupied, but it is held that no smaller force would be allowable. The engineers of the operating company, and of the

Rete Adriatica, seem to agree that the exigencies of trunk-line railway service demand that a sufficient force should be maintained to insure the prompt resumption of service in case of accident, and that the cost of maintenance and repairs, and of the supervision of substations is not determined by the actual labor involved, but by the necessity for prompt action in emergencies. The difference in cost of maintenance between a three-phase and a single-phase line on trunk-line railways is, therefore, according to this view, simply the difference in the cost of material, and hence a negligibly small quantity. This point of view is interesting, and, so far as I know, has not been mentioned in just the same form in this country; but in view of the higher cost of labor here it is questionable how far the plant could be adopted.

Regarding the Huber system, the practical difficulties are not fully brought out in the papers of the evening. The contact device itself is carried on a rectangular framework hinged to the car roof, and leaning outwardly for contact with the conductors when at the side of the line, but requiring to be moved inward when the line passes the center of the track in entering tunnels and bridges. This movement is not automatic, and does not follow from mere change of position, but must be caused by special actuating devices, which must be operated from within the train, or by means of a contact-rail laid along the side of the track and operated by a contact-shoe. Any failure of this auxiliary contact would mean the tearing of the structure from the roof of the locomotive. The actual contact-maker is a light brass tube, which, as seen on the experimental line, showed deep cuts, indicating rapid wear from use; and wherever it showed the effects of wear the damage was considerable. As used on the experimental line last spring, the device gave the impression of being still in the early experimental stages.

Municipal Ownership Too Costly for Kingston, Ont.

The Toronto Globe for June 18, 1905, publishes the following dispatch from Kingston, Ont., under date of June 17th:

"The long looked for report of J. M. Campbell, the city's expert on the advisability of the city taking over the plant, has been submitted. It is on the basis of cutting off the Williamsville line, a reduced winter service, and no taxes. The estimated yearly receipts are $23,068, and expenditures $20,078. This leaves a net revenue of $2,990 a year, but the interest is not included in this, which would mean about $6,000, or a net loss of $3,000 a year.

"The civic committee has decided to give up the idea of municipal ownership for the present, and recommended as concessions to any company who should purchase the road the right to a double track, exemption from taxes, reduced service and cutting off the Williamsville line. They will also supply power at cost of labor and material up to September.

"This afternoon Dr. Ball, who is here representing an American syndicate, made an offer of $70,000 for the plant to the bondholders. The bondholders' former offer to the city was $125,000."

Objections to Steel Ties.

Mr. Joseph T. Richards, chief engineer maintenance of way, Pennsylvania R. R., recently made a summary of the objections to the use of steel ties, as follows:

1. They increase expansion and contraction in all parts of the track.
2. They weigh about one-half as much as wooden ties and do not make heavy enough track.
3. The connection of metal and metal between the rail and the tie is very detrimental.
4. They are noisy.
5. They have not the elasticity or cushion that a wooden tie has.
6. They cost more.
7. They could not be used where our automatic signals are used, because they would connect the current between the rails.

And lastly, there is no difficulty in getting all the wooden ties we require, and the greatest standard road in England (the London & Northwestern) is now getting 21 years of life out of cross ties by creosoting them at a cost of 15 cents per tie.

New Electric Locomotive for the Bex Gryon Villars Railway.

BY E. GUARINI

The accompanying illustration shows the new electric locomotive that the Compagnie de l'Industrie Electrique et Mechanique of Geneva, which promotes the patents of its chief engineer, Mr. Thury, has recently furnished the Bex Gryon Villars Ry. of Switzerland. This is the third locomotive of this design which has been furnished this railway by the same manufacturer.

There are two motors placed on each locomotive. These motors have cast steel frames and six radial poles. The armature winding

SWISS MOUNTAIN LOCOMOTIVE

is placed in grooves, and the diameter of the bore is 580 mm. The motors are mounted on a cast iron frame which rests on the sills of the car. The motor pinion drives a second shaft mounted on the motor frame. On this shaft is a 250-mm. pinion, which engages with a gear of 1,062 mm. diameter. On the shaft of this gear are two pinions which mesh with the toothed racks between the running rails, and thus drive the car. The combined ratio of these gears is 1 to 8, and the diameter of the pinions engaging with the rack is 573 mm. Each motor is of 100 h. p. capacity. The maximum speed reached by these locomotives sometimes exceeds 12 km. per hour, and often on 29 per cent grades.

Some similar locomotives furnished by the same company have been operating in a satisfactory way on a line from Argle to Leysin, not far from Bex.

A New Shop Device.

A patent controlled by B. F. Sturtevant Co., of Boston, Mass., has just been issued for a special type of exhaust hood for grinding and polishing wheels. Its special feature consists of a receptacle to catch the particles of solid matter passing from the wheel. The suction being controlled so that it is not quite sufficient to draw them away, these particles fall to the bottom and are there collected, while the practically free air passes through a collector, where the last vestige of dust is removed. The receptacle can be readily emptied when it becomes filled, and its use avoids excessive wear on the exhaust fan, piping and collector. The hood is so designed with hinges and clips that the wheel may be readily removed or adjusted to fit the wheel as it wears to a smaller diameter. The outlet is connected to the exhaust fan, and a shield, a swivel plate and an extension slide may be adjusted so as to more fully enclose the wheel and prevent the discharge of particles into the room.

Car Sanitation in Indiana.

Editor "Review":

We send herewith rules governing sanitation of cars which were agreed upon June 12th, and also present the following account of the meeting:

The Indiana State Board of Health, according to pre-arrangements made some weeks before, held a conference June 12th with representatives from the railroad, suburban electric, and city street car companies of Indiana concerning car sanitation. The steam railroads represented were the Big Four, the Pennsylvania System, the Lake Shore, the Lake Erie & Western and the Monon. All the trolley lines were represented by a special attorney. Several street railway companies were also represented. The meeting was called to order by President Davis, of the State Board of Health, who announced the object of the meeting to be to adopt practical and sensible rules governing the sanitation of cars, saying that it was to be hoped that all members of this conference would have in view the idea of formulating rules which would attain the object aimed at, which would be in every way practicable, which would be agreeable to all and which can and will be enforced."

Following are the rules which the conference recommended:

PROPOSED RULES.

Rule I.

Steam Railway Coaches.—Day coaches shall be thoroughly cleaned at the end of each trip, and in no instance shall a day coach go uncleaned longer than two days. The thorough cleaning of day coaches shall consist as follows: (a) Windows and doors shall first be opened and the aisle strip, if there be any, removed from the car; (b) all upholstering dusted and brushed; (c) floor mopped or swept after it has been sprinkled, to which may be added an approved disinfectant; (d) after cleaning as in (c), the floor may be scrubbed with soap and water to which soda ash or like cleansing agent may be added, and after scrubbing the floor should be mopped with a solution of formaldehyde of 1 or 2 per cent strength, or with a solution of other approved disinfectant; (e) all arms of seats, panels between windows, window ledges and windows shall be washed with soap and water, to which a cleansing agent may be added, and after washing, should be wiped off with an efficient disinfecting solution; (f) closet floors and walls shall be cleaned by sweeping and washing and wiping with a disinfecting solution, and urinals and hoppers thoroughly cleaned and disinfected; (g) water coolers shall be frequently emptied, rinsed and scalded, and shall be filled with potable drinking water when in service; (h) and lastly, day coaches shall be disinfected with formaldehyde gas in quantities of not less than 40 fluid ounces of 40 per cent formaldehyde to each coach at the period of general cleaning and renovation, said period not to exceed 90 days, and also whenever a case of any listed disease is known to have been carried.

Plush seats and backs shall be removed when possible, and dusted by air blast.

Rule 2.

Placards shall be displayed in all railway waiting rooms in Indiana, having plainly displayed thereon the following notice: (See Rule 4 for notice.)

Rule 3.

Parlor, buffet and dining cars shall be cleaned at the end of each trip, as set forth in Rule 1, carpets and draperies to be removed, dusted and sunned and aired, provided meteorological conditions permit. Food boxes, refrigerators, closets, drawers and cupboards to be cleaned, scalded and treated with a 1 or 2 per cent solution of formaldehyde at least once each week in spring, summer and autumn months, and once every two weeks in winter months.

Rule 4.

Suburban electric and street cars shall be cleaned as follows: (a) Windows and doors shall be opened and the aisle strip, if there be any, removed from the car; (b) all upholstering dusted and brushed; (c) floor mopped or swept after it has been sprinkled with water to which should be added an approved disinfectant; (d) after cleaning as in (c), the floor should be scrubbed with soap and water to which soda ash or like cleansing agent may be added, and after scrubbing, the floor should be mopped with a solution of formaldehyde of 1 or 2 per cent strength, or with a solution of other approved disinfectant; (e) arms of seats, window panels between windows, window ledges and windows shall be washed with soap and water to which a cleansing agent may be added, and after such washing should be wiped off with an efficient disinfectant solution; (f) closet floors and walls shall be cleansed by sweeping, washing and wiping with disinfectant solution every week, and floors of closets, urinals and hoppers shall be thoroughly cleansed and disinfected every day; (g) water coolers shall be frequently emptied, rinsed and [illegible] a 2 per cent solution of formaldehyde, and shall be filled with potable drinking water when in service; (h) electric suburban coaches shall be disinfected with formaldehyde gas in quantities of not less than 40 fluid ounces of 40 per cent formaldehyde to each coach at the period of general cleaning and renovation, not to exceed 90 days, and also whenever a case of any listed disease is known to have been carried.

Plush seats and backs shall be removed when possible, and dusted by air blast. Carpets and mattings are condemned and forbidden in smoking compartments, but rubber aisle strips or lineoleum may be used.

Placards shall be displayed in all waiting rooms and stations located in towns, villages and cities in Indiana, having plainly displayed thereon, the following notice:

"SPITTING ON THE FLOOR
"IS
"FORBIDDEN.

"Consumption, la grippe, coughs, colds and all diseases of the air "passages are spread by spitting, and these maladies kill 12,000 "people annually in Indiana." It is therefore forbidden to spit on "the floor. Penalty, five dollars fine.

"It is the duty of trainmen to warn against violating this health "rule.

"By order of the

"Indiana State Board of Health."

Rule 5.

Conductors and brakemen in charge of steam trains and conductors and motormen in charge of suburban electric and street cars shall pay proper attention to ventilation, and shall promptly reprove and warn all persons who spit on the floor or otherwise befoul the car in which they are riding. They shall also inquire concerning any case of sickness which they may notice, and determine as best they can whether or not it is a listed disease, and if found or suspected to be listed, the health officer at the next stop may be appealed to for the purpose of caring for the case as seems best.

Rule 6.

Sleeping cars.—Upon arrival at cleaning terminals, sleeping cars shall be cleaned as follows: (a) Windows, doors and ventilators opened; (b) upper berths let down, seat bottoms lifted off and mattresses, blankets, pillows and curtains, etc., loosely displayed for airing, and provided the weather will permit, all the articles named shall be aired outside the cars; (c) carpets, rugs and portieres shall be removed from cars, weather permitting, and dusted and aired in the open, otherwise the work shall be done as best can be in the wide opened car; (d) after cleaning, the floor should be scrubbed with soap and water to which soda ash or like cleansing agent may be added, and after scrubbing the floor should be mopped with a solution of formaldehyde of 1 per cent or 2 per cent strength or with a solution of other approved disinfectant; (e) all windows and woodwork shall be thoroughly cleaned with approved detergents and carefully wiped; (f) closets, spittoons and toilet arrangements shall be thoroughly cleaned and disinfected with an approved disinfectant every day; (g) sleeping cars shall be disinfected at least once a month in an approved manner with formaldehyde gas, as set forth in (h) of Rule 1, and they shall also be disinfected if at any time it is known that a person with a listed infectious disease has been carried. Pullman conductors and porters shall see to it that as good ventilation as is possible is always maintained.

Rule 7.

The listed diseases are declared to be smallpox, diphtheria, scarlet fever, erysipelas, measles, and common carriers and their employes

are forbidden to knowingly carry any person afflicted with the above named diseases.

Recommendations.

It is recommended that conductors and brakemen be supplied with pocket paper pads, upon each slip the following to be printed:

"Spitting on the floor is forbidden. It is nasty and contrary to "law. All disease of the lungs and air passages, also certain other "diseases, are spread by dried spit. Over 12,000 people die annually "in Indiana from spit disease caught from spitters. Not less than "200,000 cases of sickness are caused thereby in Indiana annually. "Spitting on the floors and sidewalks must stop. Ladies do not "spit. Gentlemen will not spit.

"Indiana State Board of Health."

Conductors and brakemen should hand these slips to spitters. They may also be handed to passengers who are not spitters. Persistence in this matter will surely lessen the spitting evil. This will make traveling more pleasant and so encourage travel. Car cleaning will also be made less difficult and less expensive.

Disinfection.

The best and cheapest disinfection of cars and rooms may be accomplished in the following way: Close all openings, and for each 1,000 cu. ft. use six and one-half ounces of permanganate potassium and one pint of 40 per cent solution of formaldehyde. Place the permanaganate in a large tin dish-pan or any like vessel, then pour the formaldehyde solution upon it. The formaldehyde gas will be quickly set free and will penetrate plush, curtains, carpets and all parts of the car or room, causing complete disinfection. The rapid disengagement of the gas is an important point, and this method further commends itself because no fire or apparatus is required.

It is now necessary for the State Board of Health to formally pass and promulgate them. This being done, they will have all the force of law in Indiana.

The Indiana Supreme Court has decided that "the rules of the State Board of Health, passed for the purpose of protecting the health of the people, when reasonable and within the purview of the statutes, have all the force of law."

It is almost certain that the State Board of Health will formally pass the rules as herewith given.

Very truly yours,

J. N. HURTY, Secretary,

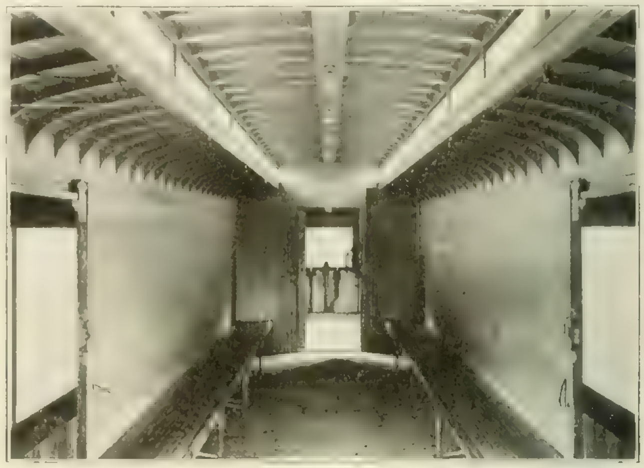
Indianapolis, Ind. State Board of Health.

Annual Meeting of the Galena Signal Oil Co.

At the annual meeting of the Galena Signal Oil Co., held at the company's home office in Franklin, Pa., June 5th to 9th, the salesmen and experts of the company were present, representing every state in the Union as well as many foreign countries. Franklin is a very beautiful little city surrounded by beautiful mountain scenery and the excellent accommodations and service received at the headquarters, the Alsace Hotel, made the meeting a success socially as well as otherwise.

New Equipment for Los Angeles.

The American Car Co. has recently delivered to the Vallejo, Benecia & Napa Valley Railroad Co., Vallejo, Cal., baggage and express cars of the type illustrated. The car is divided into two compartments and is 44 ft. long and 8 ft. 10 in. over the sills, including facing. One compartment is 14 ft. 1½ in. long and the other is 29 ft. 10½ in. long, and has longitudinal seats arranged to fold against the sides. This arrangement is a very practical one and the space and seats can be utilized in such a way as to meet a variety of conditions. On each side of the car are two sliding doors with openings 4 ft. 6 in. by 5 ft. 8 in. The car is lighted by incandescent lamps at intervals along the strip extending from end to end of car at the center under the roof. The construction throughout is unusually substantial. The car is mounted on the American Car Co's. No. 23-B. M. C. B. trucks, with a wheel base of 6 ft. 4 in. and 33-in. wheels. Brill angle iron bumpers, "Dedenda" gongs, and channel iron drawbars are included in the equipment. The car will be operated with the single phase system.



INTERIOR OF EXPRESS CAR.

EXPRESS CAR FOR VALLEJO, BENICIA & NAPA VALLEY R. R.

Seeing San Francisco.

The management of the United Railroads of San Francisco has recently published an interesting folder concerning the instructive and enjoyable trips made by its observation cars. The pamphlet is replete with illustrations of the more important buildings and points of interest about the city and also includes pertinent information regarding this "city of hills," its street railways, municipal government, and other interesting items, such as the first discovery of gold, the first ship that sailed into San Francisco Bay, its public schools, newspapers, etc. Three trips each are made daily over the outer route and inner route, of about two hours' duration, and the fare is 50 cents for the round trip. The service is enjoying a very liberal patronage, especially from tourists.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since [illegible] have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible] to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901 to Ap[illegible]. Vol. V [illegible]. Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram: four volumes, $[illegible]; single volume, $2.[illegible]]

CARE REQUIRED TO SEE THAT PASSENGERS GET TO PLACE OF SAFETY ON CARS.

Normile vs. Wheeling Traction Co. (W. Va.), 49 S. E. Rep. 1030. Feb. 14, 1905.

Where a street car company stops its cars for the purpose of receiving passengers, the supreme court of appeals of West Virginia holds that it is charged with the highest degree of care to see that all passengers lawfully entering its cars get to a place of safety thereon before starting its cars.

CURVE INCIDENTAL TO CONSTRUCTION OF RAILWAY. PERMISSION TO CHANGE CURVE MAY BE GRANTED BY RESOLUTION OR MOTION, AND DUTY IN RESPECT TO LOCATION AND CONSTRUCTION MAY BE DELEGATED.

Mannel vs. Detroit, Mt. Clemens & Marine City Railway (Mich.), 102 N. W. Rep. 633. Feb. 27, 1905.

The complainant in this case was the owner of certain corner property, where a curve was changed to his alleged detriment. He contended that permission to change the curve, which was granted by motion, could only be given by an ordinance regularly enacted and accepted in writing by the defendant, for the reason that the statute under which the defendant was authorized to act, being section 6446 of the compiled laws of Michigan of 1897, provided this method for street railway companies to obtain the right to construct and maintain car lines in cities and villages. This, the supreme court of Michigan says, was true as to the original or subsequent grant of a right to construct or maintain a street railway, or any material portion of it, through and upon the streets of a city. There were, however, certain things to be done in the operation and maintenance of such a road, which were incidental. The ordinance granting the defendant certain rights in the streets of the city provided that the location of all poles, the location and construction of all sidetracks, spurs, switches, etc., should be under the control and subject to the approval of the common council. This ordinance made no provision for curves. It would be unreasonable to suppose the legislature intended that a railroad must turn from one street into another at right angles. It was reasonable, therefore, to hold that this was one of the incidents to the construction of this railway, which was to be under the control of the common council. The common council, under the authority of the statute referred to, had entered into a contract with the defendant company to construct and maintain its railway upon and along the streets of the city. By the terms of this contract certain matters incidental to this construction and maintenance were left under the direction and control of the council. This court holds that the construction of curves to connect one street with another was one of those matters entirely under the control of the council, such control to be exercised in a reasonable and consistent manner, and by proper action of the council through its proper officers.

The care and control of the streets, under the charter of the city, was placed by the legislature in the council. The council, by ordinance, having granted to the defendant the right under the statute to construct and maintain its railway upon certain streets in a certain manner, a further grant was necessary, but it was contemplated in the ordinance that those things usual and necessary to be done were to be left under the control of the council. It was not necessary to enact an ordinance. The council, by resolution or motion, could grant permission to change this curve. The duty of the council in respect to the location and construction of this curve was ministerial, and could be delegated to the committee on streets, or to a proper official.

CROSSING STREET BETWEEN TWO MOVING [illegible] CARS.

Fitzgerald vs. New York City Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 73[illegible]. Mar. 21, [illegible].

It cannot be said to be [illegible] by the appellate term of the supreme [illegible] New York [illegible] for a person to cross [illegible] car.

ELECTRIC STREET CARS INTENDED TO RUN RAPIDLY AND ALL USING THE STREET MUST TAKE NOTICE OF THE INCREASED DANGER.

McKee vs. Harrisburg Traction Co. (Pa.), 60 Atl. Rep. 498. Mar. 6, 1905.

It is intended, the supreme court of Pennsylvania says, that electric street cars should run rapidly. The use of electricity as a motive power by street railway companies has increased the danger to all persons using city streets, and of this danger they must take notice.

WHEN FAILURE TO STOP CAR PROMPTLY AFTER COLLISION NOT CONCLUSIVE EVIDENCE OF NEGLIGENCE.

Riley vs. Shreveport Traction Co. (La.), 38 So. Rep. 83. Jan. 30, 1905. Rehearing denied Feb. 27, 1905.

The fact that a car runs quite a distance after an accident, the supreme court of Louisiran holds, is not conclusive that there was negligence on the part of the motorman, if the weight of the testimony shows that the car was disabled in the collision, and thereby became uncontrollable, and for that reason slipped many feet on the wet rails.

CONDUCTOR MAY REFRESH MEMORY FROM REPORT.

Clark vs. Union Traction Co. (Pa.), 60 Atl. Rep. 302. Feb. 20, 1905.

Where a conductor, at the time of an accident to an alighting passenger, made a report in writing, containing the names, addresses, and occupations of the passengers who were standing on the back platform of the car and saw the plaintiff get off, which report also contained the name and address of the plaintiff, the supreme court of Pennsylvania holds that, while testifying, the conductor should have been allowed to refresh his memory from the report so made, and that the trial court erred in refusing to permit him so to do.

STREET RAILWAY NOT EMBRACED IN STATUTE MAKING CERTAIN JUDGMENTS AGAINST ANY RAILWAY SUPERIOR TO ANY MORTGAGE.

Daly Bank & Trust Co. of Butte vs. Great Falls Street Railway Co. (Mont.), 80 Pac. Rep. 252. Apr. 4, 1905.

Section 707, division 5, compiled statutes of Montana of 1887, which provides that "A judgment against any railway corporation for any injury to persons or property, or for material furnished, or work or labor done upon any of the property of such corporation, shall be a lien within the county where recovered on the property of such corporation, and such lien shall be prior and superior to the lien of any mortgage or trust deed provided for in this act," the supreme court of Montana holds, cannot be held to embrace street railways.

RUNNING THROUGH SWITCH—COURTS WILL TAKE COGNIZANCE THAT CARS DO NOT RUN WITH ENTIRE SMOOTHNESS—NO PRESUMPTION OF NEGLIGENCE FROM INJURY ALONE.

State, to Use of Charles, vs. United Railways & Electric Co. (Md.), 60 Atl. Rep. 249. Mar. 22, 1905.

There is nothing in itself unlawful or negligent, the court of appeals of Maryland holds, in running a car through a switch instead of continuing on the main track of a single-track railway.

It is a matter of common knowledge, of which the courts will take cognizance, that street cars do not run with entire smoothness, but are subject to occasional jars and undulations as they enter or leave switches, or cross intersecting tracks, or encounter obstacles or slight inequalities in the track.

The mere fact that a person is injured while a passenger on a car does not of itself raise a presumption of negligence, in the absence of surrounding circumstances from which a legitimate inference of negligence can be drawn.

RIDING ON PLATFORM OR GOING ON STEP BEFORE STOPPING OF CAR CONTRIBUTORY NEGLIGENCE.

Gaffney vs. Union Traction Co. (Pa.), 60 Atl. Rep 488. Mar. 6, 1905.

A passenger was riding on the back platform of a street car, though his own testimony showed that there was available room inside. This in itself, the supreme court of Pennsylvania says, was negligence as a matter of law. But, further, as the car was approaching his destination, and he had told the conductor to stop, he voluntarily put himself in a place of much greater danger by getting down on the step while the car was still in motion, and he was thrown off, as he said, by a sudden jerk. There was really no sufficient evidence that the jerk of the car was due to negligence of the company; but, even if it had been, the passenger's own negligence, the court holds, would have barred his recovering damages. How far a passenger on a street car may carry his preparation to alight when the car is approaching his destination, the court says, depends so entirely on the exact circumstances that a discussion would be useless in a case like this, where the facts put him outside of any possible rule of justification.

ATTEMPTING TO CROSS TRACKS ON UNUSED STREET AT NIGHT CONTRIBUTORY NEGLIGENCE.

Kalberg vs. Seattle Electric Co. (Wash.), 79 Pac. Rep. 1101. Mar. 24, 1905.

The plaintiff, who had just alighted from a car, tripped on a rail and was injured in attempting to cross the tracks diagonally on a dark night. The tracks were so constructed that the ends of the ties on each side thereof were exposed, and above the surface of the ground. The point where the plaintiff attempted to cross the tracks was not a public crossing. No part of the street on the side of the platform on which she alighted toward her house had ever been used as a street or public thoroughfare, except by the street car company for its own cars. The street was in its natural state, ungraded, unimproved, and unused. The plaintiff was familiar with all of the surroundings, and the condition of the tracks, and the danger of attempting to cross them at that place in the dark. She also knew that there was another way, but a trifle further, by which she could have avoided the obstruction. In endeavoring to cross these tracks at that place in the dark under these circumstances, the supreme court of Washington holds that she must be held to have been guilty of contributory negligence.

CONDUCTOR ON SINGLE TRACK RAILWAY TO LOOK FOR PASSENGERS ON BOTH SIDES.

Redington vs. Harrisburg Traction Co. (Pa.), 69 Atl. Rep. 305. Feb. 20, 1905.

A car open to receive passengers from both sides, on a single track railway, having been stopped at a street crossing to allow a passenger, who had signaled, to get on, the supreme court of Pennsylvania holds that the conductor was bound to look for the entry of passengers from both sides before signaling to the motorman to go ahead. It says that it was his duty to have seen a passenger who attempted to board the car on the other side from that of the passenger first mentioned. The company had invited her to enter from the other side of the car, so that it could not be said that she was entering from the wrong side, or from a place where the conductor had no reason to expect a passenger to be. If this had been a double-track road, where passengers were universally expected to get on and off at the right-hand side of the platform, the conductor might have been excused for presuming that passengers would enter from one side only. But under the circumstances he was bound to look for the entry of passengers from both sides. The car having been stopped at a street crossing, where passengers were to be expected to get on, it was the duty of the conductor to give sufficient time to all persons who might wish to enter the car to do so in safety. He had no more right to imperil the safety of an intending passenger upon one side of the car than upon the other.

VALIDITY OF PURCHASE BY COMPANY OF SHARES OF ITS CAPITAL STOCK, AND OF NOTE GIVEN THEREFOR.

Leonard vs. Draper (Mass.), 73 N. E. Rep. 644. Mar. 3, 1905.

A note, executed in the name of a street railway corporation, was given for capital stock of the corporation, which its officers thought it desirable to have the corporation buy. It was suggested that the purchase of shares of its capital stock by a street railway company was illegal, and that therefore a note given in payment for such stock was void. But the supreme judicial court of Massachusetts says that it was referred to no authority in support of this proposition. Such a purchase was not a reduction of the capital stock, within the meaning of the Revised Laws, chapter 112, sec. 22, for the stock was kept in existence, ready to be sold and transferred to another party. The prohibition of ownership by a street railway company contained in Rev. Laws, c. 112, sec. 26, relates to stock in another company, and not to the purchase of its own stock. The right of corporations to purchase their own stock, unless forbidden by statute, has been recognized. The court discovers no element of illegality in the note. Nor does it see any reason to doubt that it was given for a valuable consideration. It was given for stock which was delivered in exchange for the note. The stock was property, and it was then supposed to be of value. The mere fact that subsequently it proved to be worthless did not affect the validity of the note.

RIGHT OF PASSENGER ORDERED OUT OF CAR TO ASSUME THAT RUNNING BOARD HAS BEEN LOWERED.

La Clair vs. New York City Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 837. Mar. 21, 1905.

A passenger on a car had with her two small children—one a baby in arms, and the other a boy whom she led. The car was an open car, and before it reached its stopping place the conductor lowered the rail on the right side, and raised the rail on the left. When the car reached its destination it stopped, and the conductor cried, "All out!" This passenger, who was occupying a seat in about the middle of the car, arose, and, placing the baby on her left arm, and leading the boy with her right hand, proceeded to the edge of the car. She placed the boy on the seat, and, while holding the baby on her left arm, stepped fom the car. The running board was up, and she fell to the street, and was injured. On cross-examination she admitted that she did not look to see if the running board was in place before she stepped and the trial court dismissed the complaint on the ground that, as a matter of law, she was guilty of contributory negligence. But the appellate term of the supreme court of New York thinks that this was error. It says that the woman had the right to assume that the conductor would not order her out of the car until the step or running board had been properly adjusted for her to leave the car in safety, and her failure to observe was not negligence, as a matter of law. The circumstances were significant and important. She was in the presence of the conductor, who was in duty bound to care for her, and she had a right to assume that he would do his duty. The baby was on her left arm, and the sight of the running board or step

may have been cut off, had she looked to see it, and her attention may have been diverted by care for the safety of her charges. Whether or not she was herself negligent was a question of fact which should have been submitted to the jury for determination under all the facts and circumstances of the case.

LIMIT TO LIABILITY FOR PAVING—ASSESSMENTS NOT CONCLUSIVE WITHOUT PROPER NOTICE.

City of Mobile vs. Mobile Light & Railway Co. (Ala.), 38 So. Rep. 127. Dec. 20, 1904.

Section 85, page 2397, of the Acts of Alabama of 1900-01, provides for an estimation of the cost of paving, and an apportionment thereof between those who may be liable. But the supreme court of Alabama says that it cannot see how this section contemplates the fixing of the defendant's liability on an estimate which includes the cost of improvements on parts of streets over which its line does not run. It may have cost more to improve one part than another. And under no contention could the share of the defendant exceed what the cost of its area bears to the cost of improvements on that part of the street over which its line is laid.

Moreover, the court finds that the statute in question, both in section 85 and section 91, imposes upon railways only the cost of paving between the rails and 18 inches on each side thereof. The writer of the opinion is unable to see how underground drainage or sewerage can come within the head of "Paving." The court, however, does not pretend to hold in this case that paving does not include curbing and certain kinds of drainage, or that the defendant would not be liable for the preparation of the foundation for the reception of the pavement, or for such curbing as might be deemed necessary for drainage, and which has been placed within that territory between its rails or within 18 inches on either side thereof. But the court cannot conceive of any liability on the part of this company, under the terms of the statute, for any cost that may have been incurred by the city for curbing or drainage beyond the confines of the defendant's territory.

Section 87 requires notice to be given by publication in a newspaper, and by mailing a notice to each abutting owner whose name and address are known. Section 91 provides that the assessment and collection from the owner of railways shall be made and collected "as herein provided for as to other property owners." The court holds that an assessment cannot be conclusive in the absence of the giving of the proper notice.

CONSTRUCTION OF STATUTE REQUIRING SUBMISSION OF ORDINANCE TO VOTE.

State vs. Common Council of City of Wauwautosa (Wis.), 102 N. W. Rep. 804. Mar. 14, 1905.

Section 1 of chapter 387, page 612, laws of Wisconsin for 1903, provides that "no ordinance for granting either a street railroad * * * franchise, or for the extension of the life of any such existing franchise, shall be operative in any city" until "submitted to a direct vote," as prescribed therein, if demanded. The supreme court of Wisconsin says that this was manifestly intended to cover two classes of cases—one where there is an original grant of such franchise, and the other where there is the extension of the life of an existing franchise and hence applies both to the original grant of such franchise and to the extension of the life of an existing franchise. Obviously, an ordinance authorizing the extension of an existing line and system of street railway in a city upon streets or highways therein, with the term of such extension expiring by the express terms thereof at the same time as the franchise of which it is a part, is not the original grant of such franchise. Nor is it the extension of the life of an existing franchise. The last part of said section 1, the supreme court says, expressly declares that "if," as in the case at bar, "the term of such extension expires at the same time as the franchise of which it is a part," then "the provisions of the section" requiring "that the ordinance be submitted to a direct vote," as therein prescribed, "shall not apply to the extension of any existing line or system upon any street or highway." The life of a franchise only continues during the period of its existence. The section contemplates the extension of any existing line of street railway upon other streets and highways without any extension of the life of an existing franchise. In other words, the act contemplates [illegible] in place as well as time. Since the [illegible] the original grant of a [illegible] an existing franchise [illegible] provision of the section requiring the [illegible] to a direct vote" as therein prescribed. On the contrary, that ordinance merely extended the line and [illegible] then existing in the city upon the other streets and highways of that city, and hence came within the last clause of the section. In other words, the lines and system of street railways existing in the city when the ordinance was adopted were thereby extended to other streets and highways as therein mentioned. Such is the plain meaning of the statute in question.

POWER OF STATE WITH ASSENT OF COMPANY TO CHANGE CONTRACT BETWEEN CITY AND COMPANY AS TO PAVING.

City of Worcester vs. Worcester Consolidated Street Railway Co. (U. S.), 25 S. C. Rep. 327. Feb. 20, 1905.

The supreme court of the United States says that it has no doubt that the legislature of the commonwealth, in the exercise of its general legislative power, could abrogate the provisions of the contract between the city and the railroad company with the assent of the latter, and provide another and a different method for the paving and repairing of the streets through which the tracks of the railroad company were laid under the permit of their extended location. It says that it seems plain to it that the asserted right to demand the continuance of the obligation to pave and repair the streets, as contained in the orders or decrees of the board of aldermen granting to the defendant the right to extend the locations of its tracks on the conditions named, did not amount to property held by the corporation, which the legislature was unable to touch, either by way of limitation or extinguishment. If these restrictions or conditions were to be regarded as a contract, it thinks the legislature would have the same right to terminate it, with the consent of the railroad company, that the city itself would have. These restrictions and conditions were of a public nature, imposed as a means of collecting from the railroad company part, or possibly the whole, of the expenses of paving or repaving the streets in which the tracks were laid, and that method of collection did not become an absolute property right in favor of the city, as against the right of the legislature to alter or abolish it, or substitute some other method with the consent of the company, even though as to the company itself there might be a contract not alterable except with its consent. If the contrary contention of the city were held valid, it would very largely diminish the right of the legislature to deal with its creature in public matters, in a manner which the legislature might regard as for the public welfare. Nor does the court think there was any force in the contention that the city had a proprietary right in the property of the railroad company, reserved to it under the original statute of incorporation which simply gave the city the right, during the continuance of the charter of the corporation, and after the expiration of ten years from the opening of any part of the road for use, to purchase all its franchises, property, rights, etc. That right was not affected by the legislation in question, even assuming (which the court does not for a moment intimate) that the act of 1898 in question affected the right of the city to make the purchase under the sections referred to.

NOT REQUIRED TO GIVE TRANSFERS AFTER ASSIGNMENT OF FRANCHISE.

Reynolds vs. Pacific Electric Railway Co. (Cal.), 80 Pac. Rep. 77. Feb. 11, 1905.

The city of Los Angeles granted to one Kays and his assigns a franchise for the construction and operation of an electric street railway over and along certain streets, and in particular over a portion of Ninth street. Section 6 of the ordinance read: "Provided, further, that said grantee and his assigns will issue to and receive from the present line of street railway located on Mateo street and Santa Fe avenue, and all other lines of street railways in said city operated by said grantee or his assigns, transfers good for continuous single trips thereon in said city." Thereafter the

Los Angeles Railway Company acquired the Ninth street franchise by assignment and in turn, sold and transferred it to the Pacific Electric Railway Company.

The supreme court of California says that the plain and obvious meaning of section 6 is that the person or corporation owning and enjoying the franchise to operate cars upon East Ninth street shall be bound to the performance of certain obligations by reason of that ownership and enjoyment, and amongst these obligations is the one that he shall give and receive transfers to the Ninth Street line, and from the Ninth Street line from and to such other intersecting lines of street cars as he may operate. It is a well-settled rule that a grant, assignment, lease, or transfer of a franchise such as this carries with it or imposes upon the grantee or assignee all the duties and obligations which rested upon the original holder of the franchise. It is the simple proposition that he who enjoys the privileges shall suffer the burdens. But, the court says, the industry of counsel and the court's own independent investigation failed to bring to light one case where it is held that the liabilities and burdens remain when the full enjoyment of the franchise and its privileges have been legally passed on to another.

The language of section 6 is clear and unmistakable that Kays, the grantee of the franchise, and whoever else may hold it by assignment, shall fulfill the obligations in consideration of the benefits. While the Los Angeles Railway Company was the assignee of Kays, it admittedly fulfilled all obligations. When it transferred the franchise by valid legal sale to the Pacific Electric Railway Company, the Los Angeles Railway Company ceased to be the assignee of the franchise, and the Pacific Electric Railway Company then became the assignee. The two corporations being independent, no right existed to compel an interchange of transfers between them.

INJURY TO PERSON ATTEMPTING TO BOARD CAR INSIDE OF BARN.

Kroeger vs. Seattle Electric Co. (Wash.), 79 Pac. Rep. 1115. Mar. 22, 1905.

The first regular car to leave a car barn in the morning for a certain point left it at 5:15 a. m. A number of persons were in the habit of going to the barn for the purpose of taking this car. It would seem that from four to six persons, on an average, took this car every morning. A majority of these were police officers, who went off duty at 4 o'clock in the morning. The few civilians who took the car were usually persons employed on the city streets or elsewhere during the night. These people would reach the car barn some time before the car was due to leave, and would enter the barn and take their seats in the car, there to rest, read the paper, or sleep, as they saw fit. No person other than employes was invited into the barn, and none of those above-mentioned was forbidden to enter it. The plaintiff reached the barn one morning when the car was almost ready to start, the front of the car being about even with the front of the barn, leaving the entrance at the front of the car not to exceed from two to four feet distant from the barn door. When all was in readiness, the motorman and conductor gave the usual signals to start, the car moved forward, the plaintiff attempted to enter through the front door or entrance of the car, and was caught and crushed between the car and the barn door.

The supreme court of Washington says that it cannot think that the limited use made of this barn by the few persons mentioned at the times and under the circumstances stated had the effect to transform this place from a car barn and workshop into a passenger station or depot. There was nothing about the place to mislead one, or to induce one to believe that the barn was a proper place for passengers to enter cars for rest or for sleep. When a majority of those persons entered the barn to take the car, the car was standing on trestles over a pit, without a crew, and it would be going entirely too far to hold that the company was a common carrier of passengers in relation to a car so situated. All persons who entered this barn to take cars did so between the hours of 5 and 6 o'clock in the morning. They adopted this practice for their own comfort and convenience. All their surroundings indicated to them clearly and fully the purpose for which the barn was constructed and used, and the dangers incident to taking the cars at that place. Considering all these facts, and more especially the class of persons who thus entered the barn in violation of the rules of the company, even conceding such rules to have been unknown to them, the court has no hesitancy in saying that the company was not a common carrier of passengers in this barn, and was not responsible for injuries resulting to passengers from faulty construction of the barn.

The plaintiff was either negligent in not discovering or observing the danger, or he was reckless in his attempt to avoid it, and there seems no room to doubt as a matter of law that he was guilty of contributory negligence, and that such negligence was the direct and proximate cause of his unfortunate accident. The court should have so instructed the jury.

TITLE TO CONDITIONALLY FURNISHED RAILS, TRUCKS, MOTORS, AND MOTOR EQUIPMENTS—CONSTRUCTION OF REQUIREMENT AS TO MAKING OF ROLLING STOCK.

Lorain Steel Co. vs. Norfolk & Bristol Street Railway Co. (Mass.), 73 N. E. 646. Mar. 3, 1905.

It was expressly provided by a contract to furnish and equip a street railway with rails, trucks, motors, and motor equipments, that the materials made or supplied for this purpose should remain the property of the vendor until payment therefor had been fully made. This condition was not complied with, and, unless its performance was waived, or the defendant had acquired a paramount title, the supreme judicial court of Massachusetts says that the vendor, and hence the plaintiff, to whose rights it had succeeded, could maintain replevin to recover the rails and other articles delivered, or tort in the nature of trover for their conversion, even if the mortgagee, under whom the defendant claimed, was found to be a purchaser for value, and without notice.

When the contract was entered into, and the rails delivered, it was understood that they were to be used in the construction of a track for the railway company, and the court holds, an assent to such use by the vendor was implied from the very nature of the undertaking. But by the laying of the rails as a part of the defendant's track they did not lose their character of personality, and become realty, by the fact of annexation, because the defendant's predecessor had no land, or interest in land, of which they could form a part.

As to the trucks, motors, and motor equipments, it was insisted that under chapter 326, page 355 of the Massachusetts statutes of 1894, they must be classed as "street railway rolling stock," a conditional sale of which is not valid against a purchaser in good faith, and without notice, unless shown by a written instrument duly acknowledged and recorded in the office of the secretary of the commonwealth. But the court says that if the language employed is given its ordinary meaning, the rolling stock of street railways means cars fully equipped for the transportation of passengers or of freight, so far as they are permitted to transport merchandise. The requirement that each car held by such a title shall be plainly marked on each side with the name of the vendor, followed by the word "owner," applies to the completed vehicle, and not to the separate parts of trucks, motors, trolley pole, electric wiring, and frame of the car of which the whole is composed. It is the car, and not its component parts, that is meant. The purpose of the statute is to afford protection to attaching creditors and purchasers of the character described in the act, and to prevent them from being misled to their injury by a debtor or vendor who has no title to property of this description, though in its possession, and which it apparently owns, but where the ownership at the time is actually in another. Nor is this meaning changed by the use of the word "equipment" in the title of the act.

Again, the court says that, even if the amount originally due was reduced by payments so that the remainder of the unpaid purchase price was less than the market value of the property converted, yet the plaintiff had the general title, with the right to immediate possession by reason of the failure of the defendant to comply with the conditions of the contract. If such right of possession was asserted, and the property retaken without suit, the vendee, under a contract like this, would have no cause of action to recover back money already paid; and where such a claim cannot be directly asserted, and is not actionable, it is not admissible in evidence either by way of mitigation of damages or to avoid circuity of action.

New York State Meeting.

(Continued from page 10[illegible])

line [illegible] hang in hotel offices and similar places [illegible] bill boards are extensively used and the company employs an advertising man whose duties includes the getting and arranging of excursions.

Mr. Pardee described a folder issued by the Rochester & Eastern Rapid Railway Co. devoted to the description of this road and its schedules together with those of connecting lines. This folder consists of 28 pages including the covers. The cost for 25,000 such folders, designed for one season's use is $350, but by the insertion of [illegible] advertising the company receives $275 toward the original cost of the folders.

The next paper was "Suitable Cars for City and Suburban Service," by Mr. T. W. Wilson, general manager International Railway Co., of Buffalo, which was read by the author.

In discussion, Mr. Root stated his belief that there is no substitute for the open car unless it is a convertible type. People do not patronize the semi-convertible cars as willingly as the open cars, but when waiting on a street corner will allow a closed car to pass and board the following open car. He did not believe that one type of car was suitable for both summer and winter use on Manhattan Island and illustrated this fact with statements concerning the use of convertible cars on lines enjoying heavy traffic.

The next paper "Types of Interurban Cars," by Mr. J. N. Shannahan, general superintendent, electric division of the Fonda, Johnstown & Gloversville R. R., was read by the author.

As introductory to the discussion of this paper, Mr. Cole reviewed some tests made by students of Cornell University for the purpose of determining the comparative operating costs of single and double-truck cars.

Mr. J. E. Duffy stated that the Syracuse Rapid Transit Railway Co. until five years ago had used a single-truck car with a 22-ft. body, but since that time has been making use of a double-truck car with a 33-ft. body and a capacity for seating 44 passengers. This type of car has been found too large for the outlying lines and when fully loaded it is difficult for the conductor to collect the large number of fares. The last order for cars to be used in the city service specified a 28-ft. body, which size it is thought will be satisfactory for operation on both the city and outlying lines.

Mr. D. F. Carver, of Rochester, favored the use of semi-convertible cars with the windows raising into the roof. Fifty such cars are now in use in Rochester and are of great advantage in time of sudden rain storms, because of the short time required to convert them to closed cars. The speaker believed that the management should bid strongly for increased business as well as make the operation costs low and therefore thought that safety and comfort to passengers favored a double-truck car.

Mr. W. E. Harrington favored for purely city service a single-truck car, having an 8-ft. wheel base and a 22-ft. body, stating that the larger double-truck cars required an increase in the power station and equipment, and that this point is very often neglected when arguing the relative merits of the two kinds of cars.

Mr. Fred Du Bois, Syracuse, was of the opinion that a double-truck car is less expensive to maintain on account of its smoother running and better tractive distribution, hence less spinning of wheels and less bearing wear.

Mr. J. G. Baukat, Schenectady Railway Co., favored single-truck cars with an 8-ft, wheel base for city use and cited the fact that the maintenance of single-truck brake rigging was less than that for double truck cars.

Mr. H. J. Clark, Auburn & Syracuse Electric R. R., described the country through which his line operates, stating that there are a number of grades and no tangents on the line over three miles long and only two of such length. This company operates cars weighing 34 tons of which 14 tons is in body. The length over all is 50 ft. and 40 ft. over end posts. The width is 8 ft., 3 in., to which the construction was limited by the track centers in Syracuse.

The cars have the monitor roof and the floor is 4 ft. above the head of the track rail, thus permitting the inspection of the motors and equipment from the outside car floor. The Westinghouse air brakes are used and each car is equipped with four Westinghouse No. 76 motors. The first cars purchased had cane-covered seats, but those cars recently built have been equipped with cane covered seats in the smoking compartment [illegible] main compartment.

Mr. Baukat described the experiences and tests of the Schenectady Railway Co. with [illegible] stating that this company formerly used electric heaters, but had substituted the hot water heaters. It was the speaker's belief that a strong car floor is the best investment in car building. He described a type of car built for the Schenectady Railway Co., which has a 43-ft. body and the floor made rigid by [illegible] are riveted angles for the attaching of [illegible] attaching of the posts.

Mr. Harrington [illegible] necessary for successful results. He described the club car operated by his company over an 11-mile surburban line. This car has a 33-ft body and weighs 33,000 lbs. It is equipped with four Westinghouse No. 56 motors.

On the conclusion of the discussion on this subject the convention adjourned until Wednesday morning, when the first paper "Uniform Standards of Examination of Railway Employes," by Dr. F. H. Peck of Utica, was read by the author.

In discussion, Mr. N. W. Bolen, of the Public Service Corporation of New Jersey, stated that this company has a superintendent of employment, who is in entire charge of the examining and hiring of all platform men, briefly describing the methods followed. (See St. Ry. Review, Oct. 20, 1904, page 836.) Special attention is given to examining the eyes and ears.

Mr. D. Ryan, Syracuse Rapid Transit Railway Co., stated that before forming any standards as to the eye examinations of motormen a differentation should be made between the requirements of high and low speed roads. The color tests should be more stringent in examining prospective employes for interurban lines on which the speed is high and the track unprotected from the sun. He believed that a slight deformity, such as the loss of a finger or toe, should not rule against a candidate, but that the examination of the candidate's heart and lungs should be a careful one. There is always danger of a motorman dropping dead at a critical time. He also held that an important part of an examination is the relative intelligence, and this can be gaged by the manner in which a candidate fills in his application blank and answers questions. Any claim agent would bear out this by stating the value of intelligently written accident reports and their bearing upon easy adjustment of damage claims.

Mr. E. S. Fassett, United Traction Co., Albany, N. Y., stated that the candidates for positions on his cars must show an eye test of not less than 10-15 and that a motorman must be able to show a grip test of 75 lbs. in either hand.

On motion it was voted that a committee of five be appointed to draw up standard blanks for the examination and re-examination of employes.

In reply to an inquiry Dr. Peck stated that no motorman should be employed whose eye sight needs correction and that a conductor whose eye sight tests 20-30 should be satisfactory and glasses fitted to make this correction. He suggested limiting the ages of applicants as from 20 to 35 years.

The best type of cars for city service was further discussed. Mr. Fassett stated that the Albany city lines could handle the crowds best with single truck cars not over 20 ft. long in the body: a conductor does better work on a short car and cannot well care for more than 65 passengers.

Mr. R. E. Danforth, of the Rochester Railway Co., favored the use of a short car for roads having short lines with a short haul and a close headway. He described the cars used in Rochester and in Buffalo. In Rochester are operated 40 to 50 single truck standard 28-ft. body cars with long platforms and wide doors. It is the rule to use the front platform for unloading passengers at junction points, loading the passengers by the rear platform at the same time. Local conditions govern the choice of the equipment, but in the northern cities two motors are not enough for a double-truck car on account of the snow, and four motors are advantageous on account of the increased tractive effect. In Rochester local conditions limited the w[illegible] reason closed cars have a longitudinal seat on one side for half the car length with cross seats opposite; the other half of the car has a similar arrangement, but with the order reversed and the longitudinal seat [illegible] other half.

At this time question No. 20, regarding the fire proofing of cars was discussed. The general opinion seemed to be that the Underwriters' rules provided a safe wiring and that pipe conduits should be used for all main leads. Mr. Baukat stated that the Schenectady Railway Co. uses all flexible cable carried in pipes underneath the car floor and that the openings at the ends of the conduits are provided with water proof bushings to prevent chafing.

Mr. Calisch described the wiring for the cars which the Brill company is building for the Chicago City Railway Co. These are equipped with four 40-h. p. motors. From the trolley bases the cables are laid in conduits down the corner posts and through fuses and circuit breakers in series. Three systems of conduits are provided under the cars; two are for the control wiring. Each motor will be served from a special junction box.

Mr. W. J. Harvie stated that in the wiring of large express cars owned by the Utica & Mohawk Valley Railway Co., the low pressure wires are carried in iron pipes and the 500-volt wires in oak molding have four slots. He questioned the superior value of iron over wood for enclosing car wires and stated that in his belief the wiring of a car need not be elaborate.

The next subject from the question box, which was discussed, was No. 21, regarding the use of oil instead of grease for axle and motor bearings. Mr. W. H. Collins stated that bearings in the

R. E. DANFORTH.
President New York State Association, 1905-6.

equipment of the Fonda, Johnstown & Gloversville Railway Co. have been run approximately 100,000 miles with no noticeable wear. These cars are equipped with G. E. 73 motors, using oil in cups.

Mr. Baukat stated that the use of oil had lowered the lubrication cost on his road from $4,800 to $1,800 per year.

Mr. Du Bois described the roller bearing that is being given a test in Syracuse and has been run two years with no noticeable wear. This bearing is oiled by means of a cup which has no provision for stopping the flow of oil while the car is not operating.

Mr. Danforth believed that the relative costs for the two methods of lubrication were about the same, but that the use of oil increased the life of the bearings two or three times; further, that two grades of oil should be used, one for summer and one for winter.

Mr. Collins considered that the use of oil effects a saving of about 25 per cent in lubrication cost, increases the life of the bearings and eliminates the "striping" of armatures on the pole. Oil cups should be cleaned once a month.

A discussion regarding wheels next followed as outlined in questions Nos. 23 and 24. The speakers favored the use of steel tired wheels and the rolled steel wheel for all service except that in the cities. It was suggested that the diameter of new steel wheels be increased to compensate for the wear and reduction by turning so that no trouble would originate from below equipment rubbing on the pavement after the wheel had been in use some time.

The Standard Rules' Committee reported that inquiry had recently been made of the members of the association as to whether they had adopted the rules which the state association adopted in September, 1904, and if so whether they had followed the rules exactly, or if they had modified them, whether these modifications were in the nature of general rules or peculiar to the locality. Of 45 letters sent, 18 received replies. Ten companies have adopted the rules making only such modifications as were necessary for the special locality. Two roads have adopted the city rules but have not adopted the rules for interurban service. Four of the roads

Income and Operating Expenses per Mile for Electric Railways Members of the New York State Association.

COMPILED BY H. M. BEARDSLEY, ELMIRA.

COMPANY	Car Miles	Income. Operation.	Expenses, Cents Maintenance.	Operation.	General.	Total
United Traction Co., Albany....	8,297,632	20.37	1.97	9.00	2.30	13.27
Auburn & Syracuse.....	901,822	26.39	4.23	9.00	4.43	17.66
Binghamton Ry.......	1,210,622	19.76	2.01	7.28	1.52	10.81
Brooklyn Heights R. R.........	53,891,975	25.24	3.23	9.24	2.56	15.03
Coney Is. & Brooklyn.......	6,391,140	25.72	2.79	10.66	3.26	16.71
International Ry., Buffalo.....	15,153,937	22.90	2.38	8.67	2.81	13.86
Rochester & Eastern.......	270,548	26.97	4.10	13.61	6.12	24.13
Cortland County Traction......	218,871	21.65	4.00	8.12	2.31	14.44
Elmira Water, Light & R. R...	1,206,965	16.08	3.64	7.17	1.18	11.99
Citizens R. L. & P. Co., Fishkill	179,982	24.94	6.01	8.60	2.15	16.76
Dunkirk & Fredonia...........	122,935	34.38	4.97	17.06	2.50	24.53
Buffalo, Gardenville & Ebenezer	97,614	14.35	3.82	7.49	.72	12.03
Hudson Valley Ry.............	2,265,130	20.54	4.26	8.62	3.67	16.55
Hornellsville Elec. Ry..........	181,440	8.74	2.38	5.42	.83	8.63
Ithaca Street Ry..............	375,492	23.34	2.32	11.77	2.84	16.93
Kingston Consolidated R. R....	493,599	24.93	3.40	8.36	2.96	14.72
Elmira & Seneca Lake.........	201,721	19.45	4.88	9.86	3.41	18.15
Orange County Traction.......	528,392	21.34	4.14	8.30	3.93	16.37
New York City Ry..........	15,383,254	33.35	3.17	10.67	3.70	17.54
Ogdensburg Street Ry.........	314,160	8.87	1.50	4.79	1.06	7.35
Oneida Ry.	147,340	8.42	1.17	7.16	1.16	9.49
Oneonta, Cooperstown & Richfield Springs	574,360	13.53	3.95	8.61	2.46	15.02
Peekskill L. & R. Co...........	293,398	17.05	1.38	7.78	2.52	11.68
Plattsburg Traction	132,573	15.84	1.45	5.75	2.74	9.94
New York & Stamford.........	764,196	15.92	1.28	6.92	3.01	11.21
Poughkeepsie City & Wappingers Falls	464,781	21.17	3.98	9.91	2.30	16.19
Rochester Ry.	6,138,030	24.23	2.65	9.27	1.94	13.86
Schenectady Ry.	2,755,036	23.96	3.63	10.19	4.20	18.02
Syracuse, Lakeside & Baldwinsville	226,967	22.46	3.10	6.93	2.94	12.97
Syracuse Rapid Transit........	3,869,887	21.56	2.52	7.57	2.58	12.67
Syracuse & Suburban	438,492	19.05	2.69	5.59	3.56	11.84
Utica & Mohawk Valley	3,394,271	21.36	2.57	9.37	2.58	14.52

have not yet adopted the Standard Rules, but two of them wrote that they intended to within the next year. Three of the interurban roads have adopted the Standard Steam Railroad Rules.

These replies seem to indicate that the rules adopted for the city service are being generally accepted. The rules for interurban service, however, seem to need further modification, and the committee suggested that changes should be made in the interurban rules to bring them nearer to the Standard Rules of the steam railroads.

On motion the report was accepted.

The nominating committee submitted for the approval of the delegates the following list of officers for the coming year. On motion this report was accepted, and the secretary instructed to cast the ballot for these officers: President, R. E. Danforth, Rochester; First Vice-President, B. B. Nostrand, jr., Peekskill; Second Vice-President, J. H. Pardee, Canandaigua; Secretary, C. B. Fairchild, jr., New York; Treasurer, W. W. Cole, Elmira; Executive Committee, E. F. Peck, Schenectady; J. H. Shannahan, Gloversville; T. W. Wilson, Buffalo; Oren Root, jr., New York. It was voted that the president and vice-president be made members of this committee.

The executive committee was instructed to fix the place of the next meeting.

Mr. A. L. Judson, accountant for the New York Board of Railroad Commission, made a brief address urging that electric railway accounts be made to conform to those of steam roads.

The executive committee was on motion charged with the duty of considering what action should be taken looking to a revision of the railroad laws of the state.

The convention then adjourned, after passing resolutions thanking President Allen, and the Hudson Valley Railway Co.

The Chicago & Joliet Electric Railway Co. has recently placed on sale a round-trip ticket, good for the round-trip from Joliet to Chicago and return via Aurora. The other roads that are party to this ticket are the Chicago City Railway Co., the Aurora, Elgin & Chicago Electric Railroad Co. and the Joliet, Plainfield & Aurora R. R. Co. The ticket consists of four coupons, 1¼ x 2¼ in.; the first coupon is blue and is detached for the fare Joliet to Chicago; the other coupons are white with one, two and three blue bars respectively and are for the fares on the city line, from Chicago to Aurora, and Aurora to Joliet. The ticket for the reverse trip starting from Chicago has but three coupons and is pink. The fare for the round-trip is $1.25.

Suitable Cars for City and Suburban Service.*

BY [illegible] [illegible]SON, GENERAL MANAGER INTER[illegible] [illegible] CO.

No subject connected with the business [illegible] railroading presents such an interesting topic for discussion and investigation, and upon which there is such a diversity of [illegible] as that of "Suitable Cars for City and Suburban Service." Every city and every system has an equipment to which it points with pride and calls its standard, and very rarely do any two standards agree. This is, of course, justified, to some extent, by the fact that local conditions of climate or franchise must govern, but too often does the personal equation of the management have the deciding vote. It does seem, however, that, in view of the experience of the last 20 years, we should be able to approximate some general standard to which we could work as nearly as may be.

On inspecting the cars in use in the various localities, one is impressed by the fact that the general trend is towards a larger and more commodious car. In interurban traffic we seem to be approaching very nearly to steam railroad practice, and very rightly, too, as the conditions existing on a modern, up-to-date interurban line are very similar to those on a steam road. By comparing the average dimensions, it will be seen that while an interurban electric car averages 40 ft. over corner posts, the steam coach averages about 60 ft.; that while the length over buffers of the trolley car averages about 50 ft., the steam passenger coach goes to 70 ft., and that while the weight of the interurban car body averages about 30,000 lb., the steam passenger coach will average about 40,000 lb. These increases in the weights and lengths of interurban cars have all been gradual but sure, and the reasons for them may be summarized as follows:

First, it must be kept in mind that the chief business of an interurban electric road is to compete with the steam roads. Up to a few years ago the suburban traffic was entirely handled by the latter and the people have become accustomed to the wide seats and commodious quarters of those roads. In order to divert the traffic to the trolley lines it is necessary to furnish as many of these conveniences as possible, added to which are the natural advantage of electricity over steam, such as the freedom from smoke and dirt, the transfer privilege and frequency of service.

In order to make a paying proposition out of an interurban line it is absolutely necessary that everyone shall be provided with a seat, except in cases of emergency; therefore, the larger the car the more it will earn per mile and per hour. The limits of size will be largely at the mercy of local conditions.

In 1895, when the Buffalo & Niagara Falls line was first equipped, a car was adopted having a 28 ft. body, with a length over all of 37 ft. 6 in., a width over all of 8 ft. 3½ in., and a seating capacity of 40 persons. In 1898, when the Buffalo & Lockport line was built, the body was increased to 31 ft. 8 in., the length over all to 42 ft. 8 in., the width over all to 8 ft. 4½ in., and the seating capacity to 44 persons. Last year in the new interurban car for Buffalo the length of the body was still further increased to 34 ft., the length over all to 44 ft. 6 in., the width over all to 8 ft. 6 in., and the seating capacity to 48 persons. This latter type is the maximum which it is safe to operate over the Buffalo bridges. If we had been entirely unhampered by local conditions we would have probably made the car one window longer and 6 in. wider, with an added seating capacity of eight persons; in other words, 56 instead of 48. This would have made the car about 50 ft. long over all, and about 9 ft. wide.

Another reason for the increase in weight and length of the interurban car is the question of safety. In order to compete successfully with steam roads (and that is surely the object of all interurban properties), it is necessary to operate the cars at 45 or 50 miles an hour. In order to do this safely, heavy M. C. B. trucks, powerful motors, and strong bodies are necessary, and all of these factors tend to increase the dimensions.

When there is heavy traffic from one thickly populated city or town to another, and one car will not carry the people, then the multiple control, or the trailer service, becomes advisable. In Buffalo, it was found that a three-car train, composed of two multiple control motor cars and one trailer, gave the best results. Economy in wages is evident, only one motorman and three conductors being required for the train. Th[illegible] imizes the danger of collision, in that, instead of having three separate units under three separate controls and sets of orders there is but one unit and one set of orders. This method of operation is especially valuable on single track road with sidings, where the liability of accident is directly proportioned to the number of sections. It may be possible that eventually it will be advisable to operate a four-car train, though it would seem that this would be a little too unwieldy for the run in the city. On the Buffalo & Niagara Falls line, on the other hand, it is not practicable to operate three-car trains, primarily because the line is full of curves and grades, necessitating the constant slowing down of the car and the subsequent building up of speed, and it would be impossible to make the schedule run except with a single car. Buffalo experimented last year with a 44½ ft. trailer behind the same length motor car on this division, and found that the service was too much for the motors.

In summing up the interurban situation, it would seem that 60 ft. is about the limit of the length over all of cars which are operated on an interurban line with city terminals. Where the line is entirely on private right of way there is no reason why the cars cannot more closely approximate steam practice. As the steam roads have had years of experience, there is no reason why we should not avail ourselves of that experience.

Turning now to the subject of city service, we are confronted with different conditions in different cities which require many varieties of equipment ranging from the small motor and trailer car of Washington to the commodious 46-ft. cars of St. Louis and Chicago. The local conditions must be considered before criticising the equipment of any city. In Washington they have two small open cars, one a motor and one a trailer, the whole train being handled by one motorman and one conductor. The climate is so mild that portions of these open cars are run all the year 'round. The carrying capacity of these two cars is about 80 people seated, and when it is considered that the weight of the motor car is only 17,000 lb., and the weight of the trailer car 7,000 lb., it will be seen at once that for this service this system is probably as economical as could be devised, both in the consumption of power and in the wages of trainmen. An interesting fact in connection with this service is that they have fewer accidents with one conductor handling the two cars than they formerly had with two.

The trailer service, however, as a general rule (except in very large cities), is only economical and advisable for travel during rush hours and handling crowds from amusement parks, baseball games, etc. As an all-day proposition, in cities with moderate travel, it is hard to fill two cars unless the schedule is arranged to fill the cars rather than to give adequate service to the public. If the motor car is a closed car and the trailer an open car, as is the case in Buffalo, the people naturally take the open car, and the closed motors run practically empty in summer. For the handling of crowds Buffalo has found the trailers invaluable, as at least three trailers, and sometimes four, can be attached to a motor car, thus giving a total capacity of 250 persons to the five-car train. The motor and trailer cars, of course, are equipped with air brakes and controlled entirely by one motorman from the front car, with a conductor on each car. The economy of this method of handling crowds in trainmen's wages and power consumed is obvious.

During the past year Buffalo has been operating closed trailers as "smokers" during the winter, and open smoking trailers during the summer, but, as stated above, except in rush hours it is hard to comfortably fill the train.

In answer to the query as to what is a suitable car for the city service, it seems that first and foremost the car should be designed for both summer and winter conditions. It is not economical to carry a long line of open cars which have to be jacked up in the fall and stored away for six or seven months without earning a dollar, and the same is true of the closed cars which are stored during the summer. This fact is becoming generally recognized among street railway managers, and has caused the development of the convertible and the semi-convertible types. During the past year, hundreds of these cars of both types have been built and are now in successful operation. As to the meaning of the terms "convertible" and "semi-convertible," it may be said that the former is a car which during the summer time is entirely open, with either a running board on the side or an aisle in the center, or both, and in the winter time is a closed car; while the latter is simply a closed

*Read before the Street Railway Association of the State of New York, Lake George, June, 1905.

car with cross seats and large windows, the bottom sill of the window averaging about 25 in. from the floor, and the sash disappearing into roof pockets. For mild climates a full convertible car is most appropriate, while for cities such as Buffalo, Detroit and Chicago the semi-convertible car is preferable. Cleveland experimented with the full convertible type last year, and during the summer was delighted with them; but when the cold weather came on it was found almost impossible to keep the cars warm.

The following is submitted as our idea of the best car for service in northern cities: First, the car should be a semi-convertible one with a width the maximum that track centers and clearances will allow and the length of body averaging about 30 ft. The openings into the body of the car should be as wide as possible with double sliding doors. The platform should be at least 6 ft. in length, to allow two persons to enter or leave the car at the same time, and also to accommodate a large number of standing passengers. The car may be either a double or single ender, but for Buffalo service it is necessary to operate the car from either end, and even where the car is normally operated from one end only, it would seem to be poor economy not to install an emergency controller at the other end. A platform similar to the Detroit platform, but without the railing dividing it into two compartments is suggested; instead of this railing an upright rod on both sides of the platform might be preferable. In arranging the seats, those near the door should be longitudinal, in order to allow more standing room, while those in the center of the car can be transverse, in order to encourage the people to ride and also for the reason that standing room is not so valuable in this portion of the car. With a 30-ft. body it would be possible to get seven cross seats on each side, or a seating capacity of 28 people, and this, together with four on each of the longitudinal seats, would make the total seating capacity of the car 44, with plenty of standing room at rush hours. This seems to be the average seating capacity of the latest types of cars in American cities, as will be seen by examining the following table:

One of the classes of accidents which is most prevalent in electric railway service today is that of falling on or off the car. In order to minimize this class, we suggest the adoption of swinging gates similar to those now in use in Minneapolis. These gates should be placed on the right-hand side of the rear platform and should be operated by the motorman by means of a lever. It does not seem that the gate would be needed or advisable for the front platform, as the motorman can watch the entering and exit of passengers at his platform very readily. Having equipped the car with this gate and having installed a mirror, by means of which the motorman can see everything that occurs at the rear step, the starting of the car can then devolve upon the motorman, who, after glancing at his front step and seeing in his mirror that the rear step is clear, can then close his rear gates, give two taps with the gong as a signal to the conductor that all is clear and then start his car upon two bells from the conductor. This will leave the latter free to devote his time to the collection of fares and the stopping of the car upon signal from the passengers.

The car as above described is a practicable proposition and should be well liked by the public. The cross seat arrangement will afford all the delights and conveniences of an open car without any of the dangers on account of running board. In case of sudden change in the weather, such as a thunder storm, the conductor can, within a very few minutes, convert the car into a closed one. With the gate, as above described, it may be possible to educate the public to enter by the front platform and leave by the rear, which will very greatly facilitate the loading and unloading of the car and decrease the number of accidents. The wide platforms will accommodate smokers both front and rear, and smoking is something that will have to be provided for.

The equipment of this car should be four motors of a type sufficiently powerful to pull three or four trailers, if necessary, and with a truck which will be most suitable for all year service.

In conclusion, it may be said that in recent years the traveling public has awakened to the fact that it has rights. The laws are becoming more exacting and too much attention cannot be paid to the wishes of the people and their representatives, the state and city officials. These people, having granted valuable franchises, have a right to demand good service and modern conveniences. It is the business of street railway companies to give this service and more, too, for the best policy of a management is not only to give the service the people demand, but to make that service so attractive that the people will wish to ride, thus creating an entirely new business as well as taking care of the old.

The cross-seat car is one of these modern conveniences. It is prescribed by law today in Chicago and other cities, and, in our opinion, will be within a few years the standard street railway car of America.

Latest Standards of Electric Cars in American Cities.

Place	Car Length: Over Bumpers	Car Length: Over Corners	Platform Length	Width Maximum	Car Op. 1 or 2 Dir'ns	Seats: No. Cross	Seats: No. Long	Total	Length Cross Seats	Width Aisle
Brooklyn	41'	....	....	...	2	40	8	48	34"	24 "
Buffalo	36' 5 "	26'	4' 8½"	8'	2	0	34	34	0	0
Chicago	45' 9 "	32' 5 "	6' 2 "	9' "	2	28	16	44	35"	28 "
Detroit	41'	29'	5' and [illegible]	8' 1 " (over sills)	1	24	19	43	..	..
Jersey City, Newark, etc.	42' 8 "	30' 8 "	6' (includes bumpers)	7' 11½"	2	35	8	43	.	..
Kansas City	43' 3 "	30' 7 "	5' 9 "	8' 6 "	2	36	8	44	34"	..
Nashville	42'	30' 6 "	5'	7' 11½"	2	28	16	44	34"	23½"
Philadelphia	37' (over crown pieces)	28'	4' 6 "	8' 3 " (over posts)	2	32	8	40	.	.
Queensboro, N. Y. City	40' 8 " (over vestibules)	30' 8 "	5'	8' 6 "	2	28	16	44	37"	24 "
St. Louis	46 (approx.)	33' 4⅜"	3' and 7'	9' 1 "	1	40	12	52	32"	32 "
Toledo	41' 4½"	30' 8 "	4' 8½" and 6'	8' 2 "	1	28	16	44	34"	26 "

It may be argued that a 30-ft. body makes too large a car for the conductor to handle comfortably and economically, and this is true of cars in which the seats are longitudinal; for example, in Buffalo the cars of the "800" type have a 30-ft. body, will seat 40 and will stand, in a pinch, about 60 more, making a total of 100 passengers. This is a great many people for the conductor to handle, as invariably the best of the old conductors miss quite a number, while the new conductor will usually fail to get more than 90 per cent of his fares. The 30-ft. body, however, with the cross-seating arrangement, as suggested above, precludes the crowding of the car to the extent possible in the longitudinal seat type, and for this reason we think it will make a reasonable and practicable car with cross seats.

In order to encourage pleasure riding, the windows in the semi-convertible car should be very large, thus making the car cool and inviting in the summer time. In the winter, in order to provide against snow and bitter weather, it will be necessary to have a permanent storm sash which can be put on during severe weather.

The cars of the Portland & Yarmouth Street Ry. are all designated by names instead of numbers.

Contrasts Between Company and Municipal Ownership and Management of Public Utilities.*

BY H. W. BLAKE

Four general plans, with many variations in their detail, have been adopted the world over for the introduction and maintenance of public utilities.

1. Governmental or municipal ownership and operation.
2. Governmental or municipal ownership, with private operation.
3. Perpetual concessions of franchises to private companies or individuals.
4. Concessions to private companies or individuals, limited to a term of years, at the expiration of which the property is usually taken over by the government or municipality, sometimes on a favorable basis to the concessionaire, sometimes on a basis of virtual confiscation of the tangible property.

While there is a superfluity of literature in existence on the subject, and while reports of municipally owned public utilities are available from Great Britain and elsewhere in Europe, this material is of little value in forming conclusions here, either as to the actual net results that have been accomplished from municipal ownership and management in Europe, or on the feasibility of introducing the system here to advantage. To permit of proper comparisons being made and correct conclusions reached, two most important things must be done:

The account of those European municipalities which have made the most favorable showing for their reproductive undertakings (so-called) should be rearranged by expert American accountants in accordance with standard American practice, to the end that definite comparisons may be made with results obtained in this country by public utility companies.

A definite setting forth of differences in conditions between Europe and America should be made, showing those of every name or nature which have either a direct or indirect bearing on public utility service, such as suffrage, tenure of office, municipal methods, density of population, rates of wages, character of population, its use of public utilities, service rendered, etc.

With this material available and properly presented, it would be easy for the American public to form opinions and act in accordance with the best interests.

If our present system of caring for public utilities is wrong, the sooner such a situation is realized the better; if it is right, every good citizen should be placed in a position to conscientiously uphold it. In demonstrating the truth, the responsibility for ascertaining and promulgating it may rest upon you and your kindred associations.

Returning to the definition given early in this paper, as to the general methods adopted throughout the world for the creation and maintenance of public utilities, certain facts should be stated which have seemingly been demonstrated by experience everywhere.

The best of service for the present cannot be had, unless the future is anticipated, so far as financial investments are concerned. These necessary investments cannot and will not be made unless there is a permanent franchise for the investor, or its equivalent in the form of an agreement to take his investment off his hands at a stipulated time, for its value. Franchises for public utilities which are limited as to time, without provision for the purchase of the property involved at its full value, always and naturally mean poor service in the later years of the existence of the franchise. These facts should be constantly borne in mind on considering British tramway conditions of the past and present, and in contrasting them with similar conditions here.

British tramway companies have, and have had, very limited franchises. Britain is a country where the theory of vested rights, and due compensation therefor, has been carried to the furthest degree on everything excepting tramways. A few years since British owners were awakened with a shock to a realization of the fact that, in addition to the severe restrictions under which they had labored, at the expiration of the franchises they were at the mercy of the respective municipalities where their properties were located in regard to their [illegible] were to be practically [illegible]. What [illegible] of repairs and [illegible] would [illegible] on a property [illegible] had nearly expired? At the expiration of the [illegible] the municipality stepped in with the equivalent of [illegible] perpetual franchise, taking the existing property [illegible] at a nominal valuation; with its municipal credit available to raise capital so far as Parliament approved, with the results of a tax to make good deficiencies, with very few restrictions, and with the experience of America [illegible] hundred of millions of dollars to [illegible] struction of an up-to-date street railway system.

Under these conditions, it is not strange that municipal ownership and management of street railways in Great Britain is able to make a somewhat favorable showing as contrasted with company ownership and management there in the past. What American street railway management could not have accomplished wonders under like conditions?

While the municipalities of the United Kingdom enjoy exclusive perpetual franchises, and the other advantages recited for conducting a successful street railway business, with few exceptions they are prohibited from constructing lines beyond their municipal boundaries. In consequence, the essential is lacking for constructing systems radiating out through the surrounding districts, and thus affording the public the facilities and services which it requires and which would tend to redistribute the population, as has been done about every American city. With very few exceptions, the British municipalities have opposed the construction of suburban and interurban lines to connect with their municipal street railway systems, and in only two or three cases in the entire United Kingdom have trackage rights for such systems been granted over municipal lines, or have they been permitted to enter municipalities where the tramways were under municipal control.

Not only has the great essential to a most important public utility, i. e., the best possible service, been prevented, but in the method of adjusting fares the fact has apparently been lost sight of that one of the greatest advantages which can arise to a community from its street railway system, is in encouraging its poorer classes to reside in its suburbs under more healthful conditions than is possible in crowded tenements within the city; because, while charging lower fares for shorter distances than the universal American fare, for greater distances the British rate is higher than in this country, and no transfers are given in Great Britain.

The accompanying maps, all of which have been reproduced to the same scale, give a better idea than any figures of the small size of a number of the principal European systems as compared with those of American cities of the same population. The maps of the American cities do not represent, of course, the entire extent of the interurban lines, because in the case of Boston and Milwaukee the interurban connecting lines extend beyond the confines of the state, and in the case of Buffalo far beyond the limits of the map. They show, however, that the American policy of a 5-cent fare encourages the development of the suburbs, while the European policy of a zone system of fares congests the population into tenement districts. The population figures given under the several maps are those of the 1900 census for the American cities, and for 1901 in the case of the British cities.

So far as the British municipal tramways are concerned, it is safe to say that an American syndicate could be organized which would give each and all British municipalities a better service than they now have, providing the syndicate were simply permitted to enjoy the same franchise privileges, and this without calling for a dollar of public funds to accomplish such results. It would seem, therefore, as if the one argument in favor of municipal ownership of street railways would be the profit which the municipalities may derive from operation. Let us glance at what the results have so far been in this respect.

In 1904 there was invested in all the tramways, municipal and company, of the United Kingdom, practically $232,000,000, of which about $140,000,000 was the direct investment of the municipalities.

Upon the above investment practically $1,438,000 was directly paid as taxes by the municipalties and tramway companies. Of this presumably, however, about $790,000 was paid as national income tax, leaving the amount paid for municipal taxation about $538,000. To this should be added not over $150,000 paid as municipal taxes by the holders of tramway companies [illegible]

*Extracts from a paper before the Street Railway Association of the State of New York, June, 1905.

contributed to the respective public treasuries as municipal tramways as earnings.

So the total financial benefits which British municipalities derived as taxes from the operation of all street railways in Great Britain, and in which their funds to the amount of $140,000,000 were invested, was $1,723,000.

For the same fiscal year the street railways of the state of New York paid directly as state and municipal taxes $2,656,233.74. Considering that the individual holders of street railway securities issued in this state contributed as personal taxes thereon at the low rate of three-fourths of 1 per cent on the face value of their securities, they turned into our public treasuries $3,516,000. That is, the total financial benefits which the people of the state of New York have derived from street railway taxation for this year was $6,172,233, and this without the investment of a dollar of public fund in the properties.

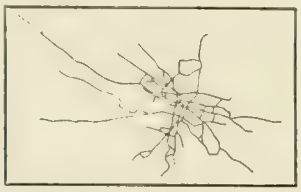
The above facts tell their own story as regards facilities and service afforded the public.

Now for a glimpse of results from operation, which may demonstrate the comparative ability shown by British street railway managers and those of the Empire State.

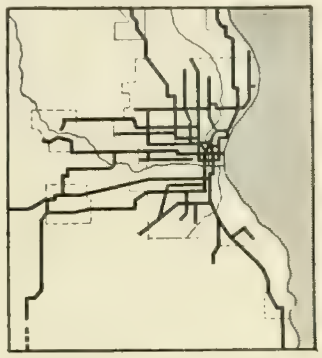
As is well known, the rates of salaries and wages paid on British municipal tramways is not over one-half those paid in this state.

In the fiscal year of 1904 the tramways in Great Britain earned from operation $40,690,000 in round figures; the operating expenses, excluding taxes, were approximately $25,510,000, leaving net earnings from operation $15,180,000; from which it will be seen that the percentage of operating expenses to gross earnings was 62.7.

The street railways of New York earned from operation $51,964,744, and their operating expenses were $31,397,623, leaving net earnings from operation $20,567,122, such operating expenses being 60.42 per cent of gross earnings from operation.

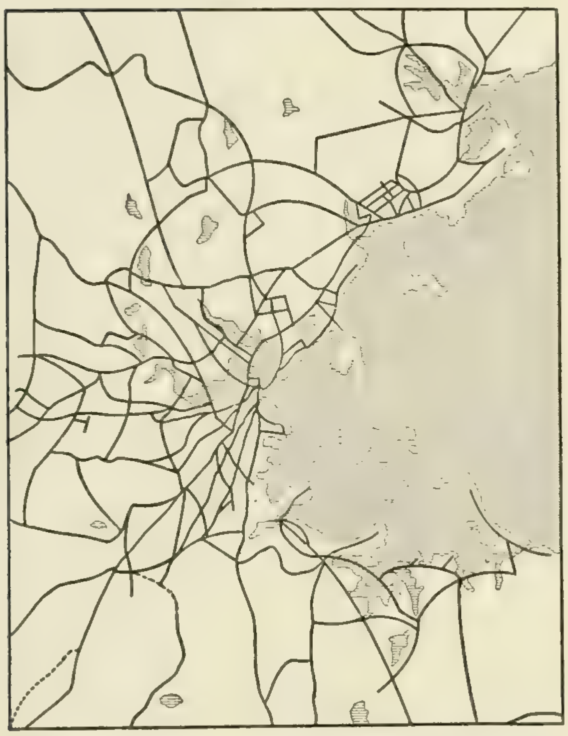


Electric Railway System of Glasgow. (Pop. 735,906)



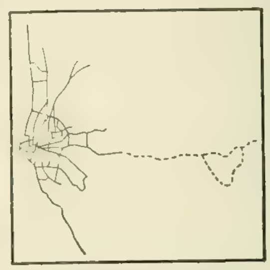
Electric Railway System of Milwaukee. (Pop. 285,315)

Electric Railway System of Newcastle-on-Tyne. (Pop. 215,900)

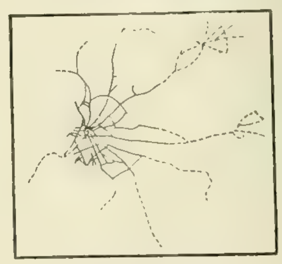


Electric Railway System of Boston. (Pop. 560,892)

Electric Railway System of Buffalo. (Pop. 352,387)



Electric Railway System of Liverpool. (Pop. 684,947)



Electric Railway System Manchester. (Pop. 543,96

AMERICAN AND BRITISH STREET RAILWAYS COMPARED.

Under the British system, on the 1st of July, 1904, there were in operation but 2,900 miles of street railway track in the entire United Kingdom. At the same time in the United States there were in operation over 31,000 miles of track.

In Great Britain alone there were but 2,529 miles for a population of over 37,000,000. In this Empire State, with a population of, say, 7,500,000, there were at the same time 3,062 miles of track.

In Great Britain the average population per mile of track was approximately 14,630; in this state it was approximately 2,375.

In Great Britain 183,352,706 car-miles were run and 1,712,424,198 passengers carried; in New York state 199,767,097 car-miles were run and 1,341,766,931 passengers carried. From this it is seen that the average passengers carried per car-mile were 9.34 in Great Britain, and in New York state 6.71. In this connection it should not be forgotten that the average American street car is 50 per cent longer and much heavier than the corresponding English car.

In the operating expenses for the street railways of New York state are included $19,812,227 paid for salaries and wages. If the rates were the same here as those paid in Great Britain, and the present efficiency of employes maintained, it is clearly apparent that New York street railways could afford to give still greater facilities to the public than is now possible, or could pay much larger dividends.

Let us look at another most important feature of operating expenses:

The British tramways, in the fiscal year of 1904, paid less than $575,000 on account of accidents, or, say, a little above 2.26 per cent of their operating expenses. The street railways of New York for that year paid approximately $2,615,000 on account of their accidents, or, say, 8.32 per cent of their operating expenses.

It is to be regretted that statistics are not available which will show the average distance ridden by passengers in Great Britain

and in this state, but it is safe to say that the average ride per passenger in New York state is more than twice as long as in Great Britain. Here the average fare paid per passenger for his longer ride is 3.83 cents; in Great Britain it is an average of 2.3 cents for the shorter ride.

In view of what has been stated as regards comparative rates of wages and accident accounts, it will be seen at a glance that the passenger in New York state is receiving greater value for the fare which he pays than does the passenger in Great Britain. This would only be possible under our superior American management which is best demonstrated by some comparisons on the more important features of operating expense.

While fuel is cheap in Great Britain, and although light cars are used, the cost of tractive power, as it is officially designated there, averages over 3.3 cents per car-mile. In New York state, with much heavier cars and higher speeds, the expense averages about 2.42 cents.

This fact, of course, demonstrates that either greater engineering skill and business judgment have been displayed in constructing power stations here than in Great Britain, or that they are much more economically operated than in Great Britain, despite the lower rate of wages prevailing there.

For traffic expense, as it is termed there, or operation of cars, as it is designated by our railroad commissioners, the average expense in Great Britain is about 6.28 cents per car-mile. In this state this average expense is approximately 7.35 cents, or a difference against us of 1.7 cents; but as approximately 70 per cent of this particular expense in America is represented by wages, it is seen at a glance how much more efficiently American managers utilize their high-priced transportation labor.

It is obvious that on the recently reconstructed tramway lines of Great Britain present repairs and maintenance are less than they will be a few years hence, and it is to be questioned if this has been duly considered by their management.

The expenditures in 1904 for track, line and car repairs and maintenance there were approximately $4,150,000, averaging $1,645 per mile of track and 2.26 cents per car-mile. In New York state the total expenditure for similar repairs and maintenance was $6,049,054, averaging $1,075 per mile of track and 3.03 cents per car-mile.

In all probability we have not reached our maximum expense for repairs and maintenance. Naturally Great Britain must go through this same experience, and as these expenses increase one of three things must happen in Great Britain: either fares must be increased, payments to sinking funds that have been created to pay indebtedness incurred for tramway development cannot be made, or the deficits paid out of public funds raised from taxation.

As to how serious the question of local indebtedness and consequent taxation is at present in the United Kingdom, it should be stated that the total local indebtedness at the present time is practically $1,800,000,000, an increase of about $1,000,000,000 in 30 years.

In England and Wales alone, from 1884 to 1900, the population had increased but approximately 18 per cent; taxable valuation had increased but 21 per cent; local indebtedness, however, had increased about 78 per cent, and the rate of local taxation had increased about 73 per cent. Over half the increase of local indebtedness has resulted from the embarkation of municipalities in what is there known as municipal trading—i. e., purchase and operation of public utilities and similar enterprises.

The present financial condition of certain British municipalities on such matters is seemingly not unlike that which existed two or three decades ago in the United States, where municipalities, counties and states pledged their credit to aid in the construction of railroads and other similar enterprises, which eventually resulted in financial disaster. It would not be strange if, in many instances, time would show a like final result in Great Britain.

Do we here in America wish to profit by our past experience, or return to one of the most unfortunate episodes in our local financial history through a little different channel? At the same time, do we wish also to add to the strength of local political machines by transforming independent, self-respecting American workingmen into an army of municipal employes, which must follow the dictation of some local boss? This should not come unless there be some great compensating advantage not yet apparent from European experience with municipal ownership and management of public utilties.

Manufacturers at New York State Convention.

Heywood Bros. & Wakefield Co. [illegible] reversible type. Bertram Berry.

Consolidated Car Heating Co., Albany, N. Y. Exhibit of car heaters, heating [illegible] heating equipment of the Brooklyn Rapid Transit cars, models of train line trailer connectors. This company announced that it sold 30,676 heaters between Mar. 1 and June 24, 1905. Cornell S. Hawley, general sales agent; S. B. Keys, district manager.

Ham Sand Box Co., Troy, N. Y. Exhibit of sander for electric motor cars. This company announces that it is now equipping the work cars of the Boston & Worcester Ry. The type of box shown has a capacity for one barrel of sand, using either wet or dry, and is designed to be placed under the platform. W. H. Kilbourn.

Ohio Brass Co., Mansfield, O. Exhibit of overhead materials and electric railway fittings, together with samples of "all wire" bonds and the Nicholls-Lintern track sander. N. M. Garland, manager New York office; R. M. Campbell.

Westinghouse Electric & Manufacturing Co., Pittsburg, Pa. Represented by F. B. Erwin and Q. W. Hershey.

Peerless Rubber Manufacturing Co., 16 Warren St., New York. Exhibit of rubber matting, step treads, valve and other packings. W. J. Courtney.

Hale & Kilbourn Manufacturing Co., Philadelphia and New York. Exhibit of types of "Walkover" seats with grab handles. S. A. Walker.

National Brake Co., Inc., Buffalo, N. Y. Exhibit of Peacock hand brake. In less than a year this brake has been fitted to cars on 250 roads. Wm. D. Brewster, secretary; F. D. Miller.

Lorain Steel Co. Working exhibit showing the ease and speed with which the hard steel center can be removed and replaced from a 9-in. Lorain "Guarantee" frog. E. B. Entwisle, chief engineer; H. F. A. Kleinschmidt, superintendent track welding department; Randolph Clitz, New York office.

Yale & Towne Manufacturing Co., New York. Hoists and triplex chain blocks. Wm. Hazleton.

Power Specialty Co., New York. Model showing the construction of the Foster patent superheater. E. H. Foster, vice-president.

Pennsylvania Steel Co. and Maryland Steel Co. John C. Jay, jr.

The Atlas Railway Supply Co., Chicago, Ill. Exhibit of sample joints for standard sections and high girder rails adapted for suspended or supported joints and the "Atlas" special joint for obtaining a smooth surface after the receiving rail is worn or dished. J. G. McMichael, president.

Machado & Roller, New York. Sage direct-reading ohmmeter and the Roller direct-reading bond tester; the latter is manufactured by the Whitney Electrical Instrument Co. for which this firm is general selling agent. Thos. F. KcKenna.

Goldschmidt Thermit Co., 43 Exchange Place, N. Y. This company made a practical demonstration of its method of cast-welding rail joints and exhibited sample joints and the detailed parts of the molds and tools. R. F. Kelker, jr., engineer.

Continuous Rail Joint Co. of America, Newark, N. J. Exhibit of "Continuous" rail joints for standard practice, together with step and insulated and other special types of joints. B. M. Barr, W. A. Chapman.

Carnegie Steel Co., Pittsburg, Pa. Exhibit of portion of track and ties showing this company's steel crosstie which has an I section; also the Duquesne rail joint as applied to A. S. C. E. standard and other sections. N. M. Hench, Fred Deming. Fred Brunt.

Electric Storage Battery Co., Philadelphia. The company's exhibit comprised a complete cell type R-71 illustrating the details of construction, also a complete battery and booster panel for the control of a regulation battery, and several types of small cells including a car lighting cell. F. L. Kellogg, R. C. Hull.

Harold P. Brown, New York. Exhibit of the Brown plastic plug rail bond, the Brown plastic under fish plate rail bond and the latest type of Brown bond, which is a combination of the amalgamated and soldered types. Julius Alsberge.

Mayer & Englund Co., Philadelphia. This company exhibited a very complete assortment of overhead fittings, cash registers, car fittings and the several types of its well known protected rail bonds. H. E. Beach, New York representative.

Dossert & Co., New York. Exhibit of [illegible]tors for use with stranded conductor or solid wire. H. A. Bristol.

O. M. Edwards Co., Syracuse, N. Y. Exhibit of window fixtures, vestibule platform, trap doors and models of sash fixtures and operating devices. O. M. Edwards, Geo. G. Norris.

The Schoen Steel Wheel Co., Pittsburg. Exhibits of solid forged and rolled steel wheels in the different stages of construction, from the slab or raw material which is hydraulically forged into a wheel and finished by rolling into standard M. C. B. or street railway wheels. W. M. Johnson, vice-president; N. B. Trist.

Crouse-Hinds Co., New York. Working exhibit of "Imperial" arc head lights and samples of guy anchors. Frank Buchannan, A. F. Hills.

General Electric Co., Schenectady. Exhibit including G. E. 80, 40-h. p. motor for railway use, air compressor governor, track bonds, line material for ordinary trolley and for catenary construction, armature coils in process of insulation, samples of mica and a mutoscope, exhibiting moving pictures of an electric-steam train race on the New York Central test track and other pictures of moving cars on the Balston line. The company was represented by T. Beran, manager New York office; H. G. Grier, New York; J. C. Calisch, Buffalo; H. H. Crowell, Syracuse; W. Gibson Carey, Schenectady; E. M. Kinney, Schenectady, and F. H. Gale.

Traction Equipment Co., Brooklyn, N. Y. Exhibit of rheostats, illuminated car signs and sander marble. Chas. V. Rapelje.

Lord Electric Co., New York and Boston. Exhibit of Thomas soldered rail bonds, and the American Ventilating Co., exhibiting its patent car ventilators. Henry M. Shaw, general manager.

The Sterling-Meaker Co., Newark, N. J. Exhibit of registers, conductors' punches and car fittings. George E. Willis, sales manager.

The Root Track Scraper Co., which has been merged with the Kalamazoo Railway Supply Co., Kalamazoo, Mich. Exhibit of the Root spring track scraper and flanger, together with its hand wheel connection for manipulating the scrapers from the platform. F. N. Root, manager scraper department.

The Recording Fare Register Co. Exhibit of four styles of fare registers and improved types of New Haven trolley wheels and detachable harps. M. DeF. Yates, president; F. B. Kennedy, secretary.

Curtain Supply Co., Chicago. Exhibit of models of Forsythe & Burrows roller tipped fixtures for closed cars and cable fixtures for open cars; also the Keeler "Pinch Handle" and "Eccentric" fixtures which are now owned and sold by the Curtain Supply Co.; also models of Keeler car curtains. A. L. Whipple, general sales agent.

Tramway Progress in the United Kingdom.

The petition of the London Southern Tramways Co. for extending its lease 42 years and for power to electrify the existing horse tramways from Norwood to Vauxhall and from Camberwell to Brixton, has been rejected by the Parliamentary Committee.

The annual report of the London County Council for its tramway system for the year ending March 31st shows receipts from horse traction, £133,799; expenses, £134,328; deficit, £529. The receipts from electric traction were £548,296, the expenses £365,497, showing a surplus of £182,799. No less than 164,818,560 passengers were carried, the number of car miles run were 14,081,397, and the average fare per passenger, .97d. After meeting the debt charges for the year, amounting to £136,963, and transferring £35,000 to renewals reserve fund, a net surplus of £7,054 remained, and was carried to appropriation account. The cost of electric traction was 7.49d per mile run, while that of horse traction amounted to 10.23d.

Plans for constructing 17 miles of new tramways at an expenditure of £403,876 have been adopted on the recommendation of the Highways Committee. The lines will run from Camberwell Green to Lordship Lane and the Crystal Palace Road, from Lordship Lane to Forest Hill, from Grove Vale to Peckham, from New Cross Road to Rushey Green, and from Greenwich to near the Blackwall Tunnel.

The select committee of the Wellingborough House of Commons has rejected the tram-roads and electricity supply bill promoted by the British Electric Traction Co.

Application is being made for a provisional order to construct further lines in the Durham district, embracing Seaham Harbour, New Seaham, and Murton Colliery, a very populous district.

The extension of the tramways from the terminus at East Bournemouth to Christchurch via Southbourne has been commenced by J. G. White & Co., and it it expected that the first section of the line will be completed in August.

Two plans are under the consideration of the Folkstone Corporation for the construction of tramways from the harbour through Cheriton to Shorncliffe Camp and Hythe. The Traction & Power Securities Co. proposes to construct lines with overhead trolley, while the National Electric Construction Co. favors the Dolter surface contact system, which, it will be remembered, is about to be introduced at Torquay. A strong objection to the trolley system is being made by land owners and it is, therefore, not unlikely that Folkstone will find it necessary to wait a little longer before it gets its tramways.

The circular route from the Harrow Road to Hastings via Silver Hill and Bohemia on the one side, and by way of Ore and Mount Pleasant on the other, is now well under way. The paving of Queen's Road with wood blocks is delaying the work materially, but it is hoped that the system will be in operation during the summer.

The work of reconstructing the lines of the Birmingham tramways for electrical operation is making good progress, and the electrified lines will shortly be extended to Moseley and Balsall Heath and Sparkbrook.

The Sunderland District Electric Tramways, Ltd., have contracted with the Durham Colliery Electric Power Co. to supply its current at ¾d per unit. This the tramway company considers will effect a saving of ½d per unit on the minimum cost if it had to provide its own installation.

Mr. R. Birkett, A. I. E. E., of Burnley, has been appointed tramways manager and electrical engineer of the Southend-on-Sea Corporation.

One of the latest additions to the tramway system in the metropolitan suburbs has been made at Walthamstow, where 11 miles of single tracks have been opened between that point and Leyton, Chingford, Woodford, and Tottenham. It is expected that this will lead to a great deal of excursion traffic in Epping Forest, especially during the summer.

Plans are under consideration for constructing a light railway from Robertsbridge Station to Pevensey, connecting two railway systems. The line would be about 15 miles in length. All the parishes through which the railway would pass, except three, have declared in favor of the scheme.

The first year of electric traction at Leicester has resulted in an immense increase of traffic. The cars have carried about 21 million passengers during the 12 months, which is about double the number formerly carried by the old horse cars. It may incidentally be mentioned as a source of gratification to the tramway management that there has not been a single fatal accident on the whole system.

The annual report of the Leeds Tramways system for last year shows a gross profit of £131,741, an increase of £5,195 over the previous year. The earnings per car-mile run were 11.05d.

"Peacock" Brakes in Canada.

The National Brake Co., manufacturer of the well known "Peacock" brakes, has recently closed a contract with the Canada Brake & Supply Co., of Toronto, which is the owner of the "Peacock" brake patents for the Dominion of Canada, and which has been manufacturing and supplying these brakes to the street car companies in this territory, whereby the latter company will manufacture and handle the Canadian business under the name of the National Brake Co., with headquarters in Buffalo. Mr. E. C. Rutherford, who has been the representative of the Canada Brake & Supply Co., has been retained by the National Brake Co. in a similar capacity.

The Portsmouth, Dover & York Street Ry. has recently published a convenient folder, showing its time tables for the summer schedule, on the inside of which is a map of the system.

June Meeting of the Ohio Interurban Railway Association.

The June meeting of the Ohio Interurban Railway Association was held in the assembly hall of the Hotel Breakers, Cedar Point, Sandusky, O., June 22nd, the meeting being called to order at 10:30 a. m. by Vice President Bicknell. The minutes of the May meeting were read and adopted. Four new members were elected to the association and a letter was read expressing the regrets of President Spring at his inability to be present at the last meeting of the season. Mr. A. A. Hilton, of the Griffin Car Wheel Co., Chicago, forwarded a catchy poem which was read by Secretary Coen and then expressed his regrets at not being able to be present.

The subject for discussion was "Freight vs. Express on Electric Roads." A paper was to have been presented by Mr. Harrie P. Clegg, of Dayton, on this subject, but due to his inability to be present the subject was discussed in an informal way.

Mr. F. D. Carpenter, of the Western Ohio Railway Co., opened the discussion, taking the position that electric roads as now built and operated are not properly equipped to handle heavy freight at freight rates. The advantages which they enjoy over their steam competitors are in a measure due to the fact that they operate frequent trains with no layovers, passing through the center of the cities served. If freight trains are operated passenger traffic must be hindered not alone on account of the lack of room on the tracks for the different classes of trains, but because very few roads have generating equipment of sufficient capacity to furnish current for the heavy freight locomotives. The question of handling package express is a different one and does not offer the disadvantages that freight trains do, therefore the speaker was in favor of continuing the express traffic.

Mr. I. L. Oppenheimer, general superintendent of the Ohio River Electric Railway & Power Co., advocated the operation of both freight and express trains, and described the situation on his line. This road has 12 miles of track from Millport to Racine, over which are transferred between 11:30 p. m. and 5 a. m. standard freight cars in exchange with the Hocking Valley railroad. For hauling these trains this company uses a 17-ton locomotive equipped with two G. E.-57 motors. The grades of the line are such that this locomotive can handle two cars in a train without trouble or can by "sandwiching" handle a train of four loaded freight cars. This business may be classed on a switching and not a tonnage basis. The electric company does not own any of the freight cars transferred, but acts as a feeder for the Hocking Valley road which furnishes all cars and initiates the business. There are eight sidings along the electric road at which cars are loaded for foreign shipment. For transferring these cars the electric company receives from $2 to $5 per car, depending upon the distance of the siding from the steam railroad connection. The longest haul is 8.5 miles, for which a switching charge of $5 is made. The time consumed in making this run is 2 hours for the round trip of the locomotive and two cars. On account of lighting business it is necessary for the power house to be in operation 24 hours a day, so the cost of current for the added night operation is thus partially lessened. It was stated that the freight business is more profitable than the passenger business and that during the month of January last the freight earnings per car mile were 10.86 cents. This company is planning to operate 100 coal cars of its own that will be interchanged with those of the Hocking Valley steam road. It also does a package express business which is limited so as not to conflict with the freight traffic. The ordinary charges for handling packages are from 10 to 25 cents for packages weighing less than 50 lb., depending directly upon the distance they are carried. The conductors are provided with tags for marking this class of business and receive and register the money accepted and also issue a receipt to the shipper. For regular shippers, such as town merchants and supply men, a special rate of 10 cents per 100 lbs., with no consignment taken under 50 lbs., is offered to any point on the line. The company files all records of the business of each shipper, turning in a monthly bill to him.

Mr. Carpenter stated that in studying the question of heavy freight operation, he has been advised by attorneys that if an electric road advertises itself as a freight carrier it must accept any and all the freight offered by intersecting lines. This he thought would open the way for a steam competitor to swamp an electric freight road by offering it too much freight.

Mr. D[illegible] Ohio roads are [illegible] it profitable. He cited the case of the [illegible] Co., which was built [illegible] at Toledo. [illegible] for freight operation and at the completion of the power house equipment the company will bid strongly for an extensive freight traffic. It has already handled orders for building material in large [illegible] that the average gross receipts received by this company for its freight traffic varied between 80 and 120 cents per car mile.

Mr. Coen stated that under ordinary circumstances the carload traffic should be profitable. In 1899 [illegible] line which is now a part of the Lake Shore [illegible] package business for grocers and storekeepers. This had the advantage over the "old line" express companies that all packages were delivered more quickly and directly from a car in front of places of business. At this time this traffic was handled by two cars and during the 12 months the average gross earnings per car mile were from 12 to 14 cents, from which should be deducted all operating expenses. In September, 1903, the freight traffic was discontinued and a package express business started. During May, 1905, the earnings had increased from 15 to 27.1 cents per car mile over those of the previous year. These amounts are net except that there must be deducted the cost for running the cars at approximately 10 cents per car mile. It was stated that the change from the handling of freight to express has shown an advantage in the receipts of from 10 to 12 cents per car mile operated, and in 1903 the electric package business on the Lake Shore Electric system earned $5,000, in contrast with the earnings for 1904, which were $17,000.

Mr. J. R. Harrigan stated that the Columbus, Newark & Zanesville Electric Railway Co. does not handle freight in carload lots, but runs one express car for package business, this car making two round trips each day and receiving all the business it can handle. The rates charged are midway between those of its steamboat and express company competitors. To do a heavy freight business and exchange standard cars with intersecting steam roads it would be necessary for this company to change all special work and increase the radii of all curves. The speaker stated that the steam railroad connection which his road has had was recently removed and that he did not believe under present operating conditions that the handling of heavy freight cars would be profitable on his line.

Mr. Theodore Stebbins spoke of the freight and express conditions on the Appleyard properties, saying that with the exception of passenger returns approximately 10 per cent of the business could be called express and 90 per cent freight traffic. This company gives practically no wagon delivery and charges a small amount more than the competing express companies on the steam lines. There is practically no wagon or terminal expense except a slight amount for clerks and the men who load and unload the goods. The speaker believed if proper judgment were used as to what class of goods were accepted that the freight business could be made profitable if all cars were filled before being taken over the line. His company receives from 32.5 to 35 cents per car mile for freight business.

Mr. W. H. Abbott stated that on an average of once a month he is called upon to examine and submit a report as to the probable amount of freight business that could be obtained by some proposed electric line. In his opinion this amount depends very greatly upon the equipment with which the road is fitted to care for such traffic, and if a road is built to handle freight then the figures as to the amount of business which can be initiated and the receipts derived from handling this business favor heavy freight traffic. He does not, however, believe that it is profitable to undertake the handling of freight unless the road is so equipped that the cars can be hauled in trains, and neither should a road attempt the freight business unless it has 600 kw. for the disposal of the freight train alone. He believes that nearly all trolley roads will eventually handle freight, stating that many of the new roads are being designed for handling freight and for offering other auxiliary service in order to help out the passenger receipts.

Mr. Pomeroy stated that he believes there is room on all roads or parts of those roads for the operation of some freight and express business, stating that the amount of business done and the

classes of goods handled are peculiar to each line, therefore each company should solve its own problem. On his line the milk traffic has been found exceptionally profitable. This traffic amounts to 500 to 600 cans per day.

After a vote of thanks of the association had been tendered to the management of the Cedar Point resort, the association meeting adjourned. At 1:30 a course dinner was enjoyed by the members and their guests. The afternoon was enjoyably spent at the many pleasure resorts scattered throughout the Cedar Point grounds.

The management of the Lake Shore Electric Ry. furnished a special car for the transportation of those making the trip from Cleveland to Sandusky and return.

Logansport Park Train.

To meet the demands of special park traffic at Logansport, Ind., the Ft. Wayne & Wabash Valley Traction Co. makes use of two 15-bench open motor cars each drawing four trailers. The motor cars are 45 ft. long and equipped with four G. E. 67 motors. One of the trains will carry 500 persons. The economy of operating these cars in trains is readily aparent in the reduction of wages, two motormen and ten conductors being required instead of a motorman and conductor on each of the ten cars.

5-CAR TRAIN AT LOGANSPORT.

We are indebted to Mr. E. C. Folsom, superintendent of transportation, for the photograph from which the accompanying engraving was reproduced.

Improved Tramway Terminal Plans for London.

The committee of the House of Commons, which was appointed to consider the London County Council's tramway bill, by the provisions of which it was proposed to connect the Westminster and Blackfriars termini by electric tramways over the two bridges and along the Victoria Embankment, last month gave its decision in favor of the scheme. The lines will form a loop and there will be no necessity for the confusion which has existed hitherto at the termini, caused by switching the cars for the return journey. Sanction of the plan, however, is dependent upon the widening of Blackfriars Bridge, which committee believe to be imperative. The same committee also authorized the construction of a subway from the west side of Waterloo Bridge to join that from Holborn to the Strand, but deferred dealing with the clause providing for a connection between the tramway through the subway and the lines on the embankment. The position of the line rails and the stopping places near the bridges would be subject to the approval of the committee, while the District Railway, which alleged that its tunnel beneath the roadway on the embankment would be injured by the tramways, would be protected by a special clause.

This is a very important decision as the scheme has been very strenuously opposed, especially by the Corporation of London, and is a great triumph for the advocates of extending the South London tramways to the city side of the river. It will now be possible to make physical connection with the County Council's tramways running to the north of London as soon as public opinion can be educated up to the point.

Trolley Talk.

The first issue of a new publication called "Trolley Talk," issued by the Oakland Traction Club, Oakland, Cal., has made its appearance and promises to be one of the most interesting and attractive of the many monthly publications issued in the interest of street and interurban railways and their employes. Besides a few interesting articles concerning Oakland, a short story and a poem, many items of interest are considered under the departmental heads of "Current Events," "The Kicker," "Personals," etc. Time tables, information regarding employes' associations and benevolent societies and notes of interest regarding the service are also included in the publication. The purposes of the publication are well set forth in its editorial notes, of which the following is an extract:

"'Trolley Talk' is not an 'organ.' It is only the mouth harp of a number of citizens having a common interest and engaged in a live business. It is neither scientific, political, nor religious. It does not aim to be 'a journal' or 'a magazine.' It has a simple homely creed for its motto. 'Live white, and play fair.' By this standard it is willing to be measured and by this standard it will judge others in public and private life. It aims to represent and reflect the views of a substantial, sober, industrious body of citizens who are vitally interested in the growth and prosperity of Oakland. As the trolley is the symbol of a live modern urban civilization, the men who run the trolley cars feel that they are intimately related to this great agency, which contributes so largely to the health, wealth and happiness of our city. They are in daily touch with every element of our population. The grafter, the criminal, the workman, the business man, the preacher, the professor, the women and children daily intrust their safety to 'the boys in blue' of the trolley cars."

"Transit Tidings" for July, published by the United Railroads of San Francisco, has introduced a rather novel idea in the publication of the programs of the Golden Gate Park band concerts for the month of July.

A tri-county trolley baseball league has been formed through the assistance of the Portsmouth, Dover & York Street Ry., and the Dover, Somersworth & Rochester Street Ry., and a schedule has been arranged between teams representing the following towns along these lines: Dover, Somersworth and Portsmouth, N. H., and Kittery, Me. This is something new in the traffic producing line and should meet with success.

Funeral Car Service on the Metropolitan.

The Metropolitan West Side Elevated Railway Co., on Monday, June 19, 1905, put in effect a funeral service to the Concordia and Waldheim Cemeteries. The plans of the company regarding the service are set forth in a letter reading as follows, which has been addressed to the various undertakers in the city by Mr. H. M. Brinckerhoff, general manager:

"The growth of cities like Chicago has brought about such a vast increase in the area covered by residence districts as to require the location of cemeteries at considerable distance from the homes of plot owners. The method of reaching these cemeteries by carriage has therefore become one of not only great expense, but great physical exertion on the part of those wishing to go to the cemetery, and also making the period covered from the house to the cemetery and return for business men often prohibitive.

"Feeling that the comfort and convenience of the public would be greatly increased under circumstances of this kind by a direct railroad communication, the Metropolitan West Side Elevated Railway Co. proposes instituting a private funeral car service to Waldheim and Concordia Cemeteries, with the intention later of extending to other cemeteries situated west of the city, provided the service proves acceptable to the public.

"In taking this matter up it is the intention of the company to give special attention to every detail pertaining to the comfort, convenience and safety of its patrons. A number of new motor cars have been assigned for this service, arranged to receive the casket in the forward end of the car, this portion being screened off from the remainder of the car by portiers, leaving a seating capacity of 34.

"It is proposed to receive funerals at Laflin St. Station on the main line, located between Jackson Boulevard and West Congress St., where an elevator for handling the casket will be placed. Similar arrangements will be made at Hoyne Ave. Station on the Douglas Park line, near 21st St., and at the Fifth Avenue Terminal. Other stations will be equipped in the same manner if the service proves sufficiently popular.

"Sidings have been arranged for at Concordia and Waldheim Cemeteries so that the car can be run on the siding and the funeral party may disembark at their leisure, the car remaining there until their return. The time from Laflin St. to the cemeteries will be about 30 minutes, and from Hoyne Ave. on the Douglas Park line, to the cemeteries, about 40 minutes in each direction.

"We believe that this saving in time and the comfort and elegance offered by the rapid, smooth running of a high class electric car over the well laid roadbed of the Metropolitan system, delivering the party directly at the special receiving gate at the cemetery, will appeal to those now accustomed to the tedious and uncomfortable method of reaching these cemeteries by carriage.

"I enclose card giving the rates and particulars of this service, which we will be prepared to put into effect on Monday, June 19, 1905. For any further information please call up Harrison 3775, or West 879.

"I trust that this method of handling funerals to these cemeteries will meet with your approval, and assure you that we will be glad to receive any suggestions as to improvements from time to time for this service."

The rates are for a funeral car seating 34 persons, limited to 45 persons, $30; additional cars seating 48, limited to 60 persons, $10 each. Payment in advance at the general office of the company, 1001 Royal Insurance Building, or to the agent at the station where the train leaves is specified.

The funeral car now in service is one of the new motor cars recently built for this company by the Jewett Car Co. All of the advertising signs, etc., have been removed from the interior, a carpet placed on the floor, standards for supporting the casket placed at one end and portieres hung across the car to separate that end from the rest of the car. The portieres and carpet are of very dark green, almost black, in color. No alterations in the car were required, excepting the arrangement made in one window on each side near the front of the car, through which the casket is taken into the car. These windows are quite large, the lower sash being 35 in. wide by 27 in. high. Slight changes were necessary in the frames of these two windows. The inside window stops were removed and as it was desired that the window slide up and down as normally when the car is in regular service, grooves were cut in the window casing and two pins fixed in each sash stile which, sliding in the grooves, hold the sash [illegible] when raised. One of these pins [illegible] the sash and the other [illegible] [illegible] tance above the lower position of the bottom pins horizontal grooves are cut in the window casings, so that on slightly raising the sash the [illegible] about the top pins, be raised to a [illegible] held by a catch.

LAFLIN ST. STATION, SHOWING [illegible]

When the window is thus opened there is placed [illegible] frame with two steel rollers 2 in. in diameter, over which the casket is pushed into the car. The ends of the roller frame are notched to fit over the window sill and the outer stop and when in place the frame is thus held securely.

At the two stations mentioned, Lafln St. and Hoyne Ave., elevators have been erected and a truck, which can be run out on the sidewalk to the curb to receive the casket, conveys it to the elevator. When the station platform is reached, the truck is wheeled out to the car and as the bearing surface of the truck is at the level of the window sill, it is very easy and convenient to transfer the casket from the truck to its supports in the car.

The management is endeavoring to interest the [illegible] of the city in this work, and it is hoped that such opposition as had been encountered in some other cities on the part of the undertakers and liverymen will not be found here. The rates fixed are about one-half the average bill for carriage hire to the cemeteries served.

A Pleasant Outing.

The members of the Suburban Press Association and editors of the local publications along the South Shore line of the Old Colony Street Railway system enjoyed a very pleasant outing on Tuesday, June 13th, at which time they were the guests of Mr. Robert H. Derrah, general passenger agent of the company. The trip was made in a special observation car, starting from Hyde Park and running through Milton, Brockton and intervening towns to Nantasket, where the party were entertained at dinner at the Nantasket Point hotel. In the evening the party was entertained at Paragon Park. This trip along the south shore of Massachusetts Bay is one of the most attractive of the Old Colony and Boston & Northern systems and differs from anything else in eastern Massachusetts. Just before reaching Nantasket the line runs for some distance through the Old Colony woods, unequaled for sylvan scenery, terminating at Nantasket, which has one of the finest beaches in the country. These numerous trips given to the press representatives in the territory served by the Old Colony and Boston & Northern systems are not only proving most delightful, but very interesting and instructive, in that it gives the newspaper men an opportunity to become well acquainted with the territory traversed and the many attractive landmarks and villages of historical interest, the history of which Mr. Derrah knows and presents in an interesting and attractive manner.

Mound's Park, near [illegible]
I. U. T. Co.

Personal.

MR. GEORGE H. PEGRAM has been appointed chief engineer of the Interborough Rapid Transit Co. and of the Rapid Transit Subway Construction Co., succeeding S. L. F. Deyo.

MR. H. L. WEBER, formerly city engineer of Richmond, Ind., has been appointed chief engineer of the Ft. Wayne & Wabash Valley Traction Co., with headquarters in Ft. Wayne, Ind.

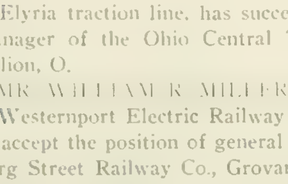
MR. T. C. CHERRY, of Cleveland, O., formerly with the Lorain & Elyria traction line, has succeeded Mr. William Akins as general manager of the Ohio Central Traction Co., with headquarters at Galion, O.

MR. WILLIAM R. MILLER, superintendent of the Cumberland & Westernport Electric Railway Co., Cumberland, Md., has resigned to accept the position of general manager of the Danville & Bloomsburg Street Railway Co., Grovania, Pa.

MR. N. B. PORTER, lately associated with the South Baltimore Steel Car & Foundry Co. and the Ryan-McDonald Manufacturing Co., has been appointed general sales manager of the Continental Car & Equipment Co.

MR. CHARLES MURDOCK, of La Fayette, Ind., secretary and treasurer of the Richmond Street & Interurban Railway Co., has been appointed general manager of the Indianapolis & Eastern Railway Co., to succeed Mr. J. W. Chipman.

MR HENRY E. REYNOLDS, who for the past 21 years has been associated with the Old Colony Street Railway Co., has been promoted from the position of purchasing agent to that of assistant general manager of the Old Colony and the Boston & Northern Street Railway systems, a newly created position. Mr. Reynolds has worked his way up gradually from a conductor to his present position starting with the old Brockton Street Railway Co. as a conductor, then cashier, bookkeeper, assistant treasurer and treasurer. At the time of the consolidation of the many street railways south of Boston, into what is now known as the Old Colony Street Ry., he was appointed superintendent of the Quincy and Hyde Park divisions of the company, where he remained until July, 1903, when he was appointed assistant general superintendent of the entire system with headquarters at Brockton. In 1904 he was tendered the position of purchasing agent of the Old Colony and Boston & Northern Street railways, which he held until his present appointment. The two companies operate over 850 miles of track north and south of Boston extending from Nashua, N. H., and along the Merrimac Valley and the North Shore, through the entire State of Massachusetts to Providence and Newport, R. I., serving 22 cities and 66 towns. Mr. Philip M. Reynolds, who has been in the employ of the companies for some time, will succeed Mr. Reynolds, as purchasing agent.



HENRY E. REYNOLDS.

MR. GEORGE H. THOMPSON, member of the American Society of Civil Engineers and the Institute of Civil Engineers (Great Britain), and associate member of the Institute of Electrical Engineers, has opened an office in the Park Row Building, New York City, for the practice of consulting engineer.

MR. R. H. HAYWARD, sales engineer of the General Electric Co., has resigned to become general manager of the Galesburg & Kewanee Electric Railway Co. Mr. Hayward graduated from the Massachusetts Institute of Technology in 1897 and has been engaged ever since by the General Electric Co., first in its testing department and later in the engineering, railway and sales departments.

MR. E. G. CONNETTE, vice-president and general manager of the Syracuse Rapid Transit Co., who was reported to have resigned to accept the position of general manager of the Consolidated Street Railway Co. of Worcester, Mass., will remain in his present position at Syracuse, the directors of the company having refused to release him from his contract. This is certainly quite a compliment to Mr. Connette and is a proper appreciation of his services.

MR. CHARLES H. HACKETT, superintendent of the Jacksonville (Ill.) Railway Co., has resigned and has been succeeded by Mr. W. B. Krotz, chief train dispatcher of the Illinois Traction Co. at Springfield.

MR. S. B. THOMPSON, of New York City, has been appointed superintendent of motive power of the Indiana Union Traction Co. to succeed Mr. J. L. Matson, who has resigned to accept a similar position with the Chicago & Milwaukee Electric Railroad Co.

MR. J. E. STARKEY, of St. Paul, Minn., has been appointed commercial agent of the Indiana Union Traction lines, with headquarters in the Traction & Terminal building, Indianapolis, Ind. In addition to his duties as commercial agent, he will handle all picnics and other parties desiring special cars.

MR. HENRY C. PAGE, general manager of the Berkshire Street Railway Co., has resigned to accept the position of superintendent of the Springfield Street Railway Co., Springfield, Mass. Mr. Page entered street railway service as a conductor on the old Boston & Lynn R. R. and was promoted from time to time, until he resigned to become general manager of the Newberryport & Amesbury road, which position he resigned to become superintendent of the Salem Division of the Lynn & Boston road. For two years prior to his association with the Berkshire Street Railway Co., Mr. Page was general superintendent of the Boston & Northern division of the Massachusetts Electric Companies. Mr. Page was born in Booneville, Mo., June 19, 1863.

MR. GEORGE R. WADSWORTH has resigned his position of resident engineer on the New York Central railroad to join the staff of J. G. White & Co. as assistant to the construction superintendent. Mr. Wadsworth was graduated in 1898 from the Massachusetts Institute of Technology in civil engineering. Since graduation he has been continuously employed on the New York Central railroad, first being assigned to the office of division engineer at Albany, after which he worked in various capacities, ultimately being appointed assistant engineer. After having performed several classes of work, Mr. Wadsworth was appointed resident engineer of the Hudson District in charge of the contract work from Motthaven to Croton and it is this position which he leaves to join the J. G. White & Co. forces.

MR. PAUL D. SEXTON, who on June 17th succeeded Mr. George Higginson as secretary and treasurer of the Metropolitan West Side Elevated Railway Co., came to Chicago from Boston, Mass., and entered the service of the company at the time of its organization as Mr. Higginson's assistant. Previous to this he was employed in the auditing department of the Kansas City, Ft. Scott & Memphis road at Kansas City, Mo. Mr. Sexton's education was begun in the East, he having to leave Harvard University before he graduated on account of ill health. For the next few years he traveled around the world, taking a trip of nine months through the Arctic regions, was shipwrecked in the South Sea Islands, was one of the first white men to cross the Philippines and had considerable other such experiences as are met on such a trip. It is quite a coincidence that Mr. Sexton was appointed to his present position on the 11th anniversary of his employment with the company.

MR. FRANK C. RANDALL has resigned the position of vice-president and general manager of the National Electric Co. to become district manager for the Allis-Chalmers Co., with headquarters in New York City. Mr. Randall, who has been closely identified with street railway supply interests for a number of years, began his business career in his father's office, who was an importer of special grades of iron and steel. This position he resigned to take up railroading, becoming first the "performance of engines" clerk and later chief clerk of the motive department for all divisions west of Willimantic of the New York & New England railroad. He was afterwards chief clerk of the motive department of the Boston & Lowell road and held this position until the consolidation of the road with the Boston & Maine R. R. He then entered the shops of the Tripp Manufacturing Co. and rose first to the place of foreman and later to that of superintendent of the works. He left this position to become eastern sales agent for the J. G. Brill Co. and was later transferred to the West with headquarters in Chicago. Six years later he accepted the position of eastern sales agent for the Christensen Engineering Co. and later became general sales agent for that company and its successor, the National Electric Co., finally becoming vice-president and general manager of that concern.

MR. C. P. WRIGHT, general manager of the Standard [illegible] Shoe Co., Aurora, Ill., and Miss Ada H. Allen were married June 27th.

MR. H. N. RANSOM, formerly associated with the [illegible] Electric Co., has joined the force of the General Electric Co. Mr. Ransom's present headquarters are at Schenectady.

MR. E. L. FULLER has been elected vice-president and general manager of the New York & Long Island Traction Co., the property recently purchased by the New York Interborough and the Pennsylvania interests. Mr. Fuller will continue to serve as vice-president and general manager of the New York & Queens County Railway Co., with headquarters in Long Island City, N. Y. Mr. Fuller was in St. Paul prior to 1893, when he became assistant superintendent of the West Chicago Street Railroad Co. In 1899 he resigned his position of general superintendent to become president and general manager of the Interstate Railway Co., Philadelphia, which position he resigned in 1903 to go to Long Island.

MR. W. H. EVANS has been appointed master mechanic of the lines of the Indianapolis Traction & Terminal Co., with headquarters at Indianapolis, Ind.

MR. W. S. WRIGHT, for many years manager of the Wheeling & Elm Grove Railroad Co., Wheeling, W. Va., has resigned to enter upon his duties as president of the Jewett Car Co., Newark, O.,

W. S. WRIGHT.

which position he has held since the reorganization of the company some time ago and which now demands his personal attention. Mr. Wright has been prominent in Wheeling traction affairs for several years, having become associated with the management of the Wheeling Traction Co. in 1892 and appointed general manager shortly afterwards. When the Wheeling & Elm Grove railroad was reconstructed for electrical operation he was made manager of the property, which position he has retained for the past six years. In addition to his duties as president of the car company, Mr. Wright will devote considerable attention to the development of the devices which he has invented for electric railway car equipment. Prior to his leaving for Newark the employes of the Wheeling & Elm Grove Railroad Co. presented him with a very handsome solid silver punch bowl, ladle and tray and accompanying service of cut glass. He is succeeded as manager of the railway company by Mr. L. S. Kirker, general superintendent City Railway Co., Wheeling, W. Va., who will direct the management of both properties.

Obituary.

MR. F. M. HAINES, second vice-president and general manager of the Northern Texas Traction Co., died at his home in Ft. Worth, Texas, June 1st, having been stricken on May 1st with typhoid fever. Mr. Haines was one of the best known civil and electrical engineers in the Southwest, having built several electric lines in that territory, including the interurban line he managed. Mr. G. H. Clifford, secretary and treasurer of the company, has been appointed acting manager of the company in charge of affairs until Mr. Haines' successor is appointed.

MR. E. E. NAUGLE, president and general manager of the E. E. Naugle Tie Co., Chicago, who was killed in the recent accident to the Twentieth Century Limited at Mentor, O., was born in southern [illegible] station agent on the Cotton Belt, Chicago & Northwestern and the [illegible] built the Tennessee Central R. R., the Forest River branch of the Wisconsin Central R. R. and the Chicago & Northern Pacific Ry., the Southwestern Division of which is now under lease and operated by the Suburban Railroad Co. of Chicago. In 1900 the firm's name was again changed to the E. E. Naugle Tie Co. and its at[illegible] be looked after by his brother, Mr. A. T. Naugle, who has been associated with him for several years as secretary of the firm.

The Montreal Street Railway Benefit Association.

The report of the Montreal Street Railway Benefit Association for the fiscal year ended April 30, 1905, and submitted at the second annual meeting of the members, held on Thursday, June 15, 1905, discloses some interesting facts concerning this most commendable development among street railway employes. During the period above mentioned 611 members were disabled through sickness or injury; 2,864 prescriptions were used; 692 visits were made by physicians to disabled members and 4,026 consultations were given by physicians to disabled members.

The statement of revenue and expenses during this period is as follows:

Revenue.	
Surplus from 1904	[illegible]
Fees and dues from members	8,800.00
Fees, dues, donations and expense of management from company	[illegible]
Picnic	[illegible]
Interest	[illegible]
Total	$28,199.13
Expenses.	
Sickness, medicine, death, burial, etc.	$14,610.75
Management expenses	4,239.66
Surplus 1904 and 1905	[illegible]
Total	$28,199.13

During the year the members of the various sick committees did effective work; a picnic was given under the auspices of the association, which netted a profit of $1,316.42; and the membership of the association was increased to 1,700, which necessitated an increase in the medical staff and opening medical offices in the various divisions of the company's system.

The association was organized Oct. 1, 1903, and was incorporated May, 1904. The initiation fee is $1 and the dues are 50 cents per month, for which the following benefits are received: In cases of disablement after first six days, 60 cents per day for 90 days and 30 cents per day for the next 90 days; free medical attendance and free medicine; 20 per cent discount on all medicine, etc., required by members of the family; a life insurance policy of $500 and $50 towards cost of funeral expenses; and a pension when one is superannuated and too old to work.

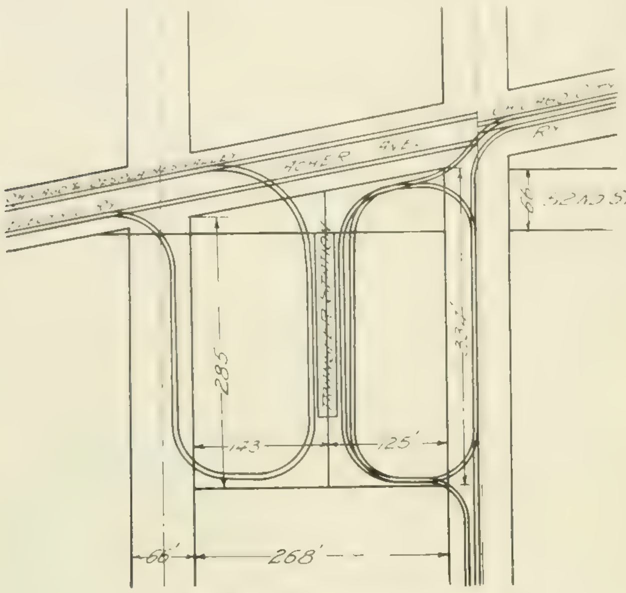
Concessions have been sought for the construction of an electric railway between Cologne and Dusseldorf. It is proposed to so connect the traction systems of these two cities that a service can be offered having 10 minutes headway and making the run in 40 minutes. The cost of building the line is estimated at $6,240,000.

The passengers and crew of a car on the line of the Chicago & Milwaukee Electric Railroad Co. were held up at Winnetka, June 24th, by two masked men. The car was signaled at the Winnetka station about 10 o'clock p. m. and when the car came to a stop two men boarded the car and with leveled revolvers relieved the passengers of $65 and a gold watch and chain.

Archer Ave. Terminal of the Chicago & Joliet Electric Railway Co.

The increased traffic between Chicago and outlying territory and the demands for modern facilities have led to the construction of a joint terminal station for the Chicago City Railway Co.'s Archer Ave. line and the Chicago terminus of the Chicago & Joliet Electric Railway Co. line, at 48th and Archer Aves. The building is now under construction and is expected to be completed the latter part of this month.

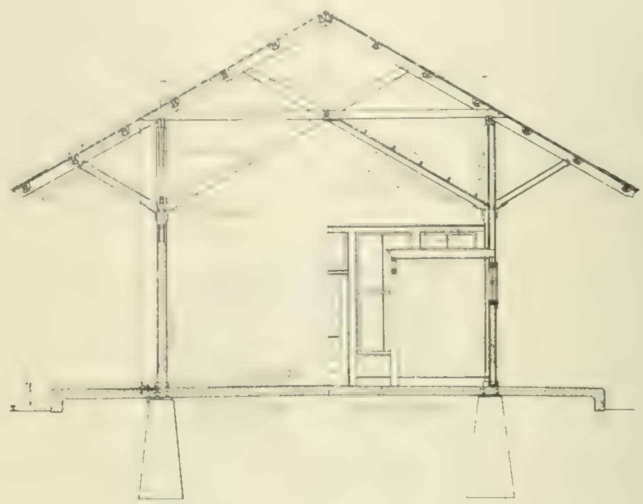
As may be seen from an accompanying plan, the station is located at about the center of a tract of land 268 ft. wide by 334 ft. long, the tracks of the Chicago City Railway Co. entering from the east and making a circuit on that side of the station, while those of the Chicago & Joliet line enter from the opposite direction and make a circuit on the west side of the station. These tracks are laid 2 ft. 2 in. from the concrete platform, and the eaves of the roof project over the car so as to protect the passenger entering or leaving the car in inclement weather.



TRACK AND STATION LAYOUT.

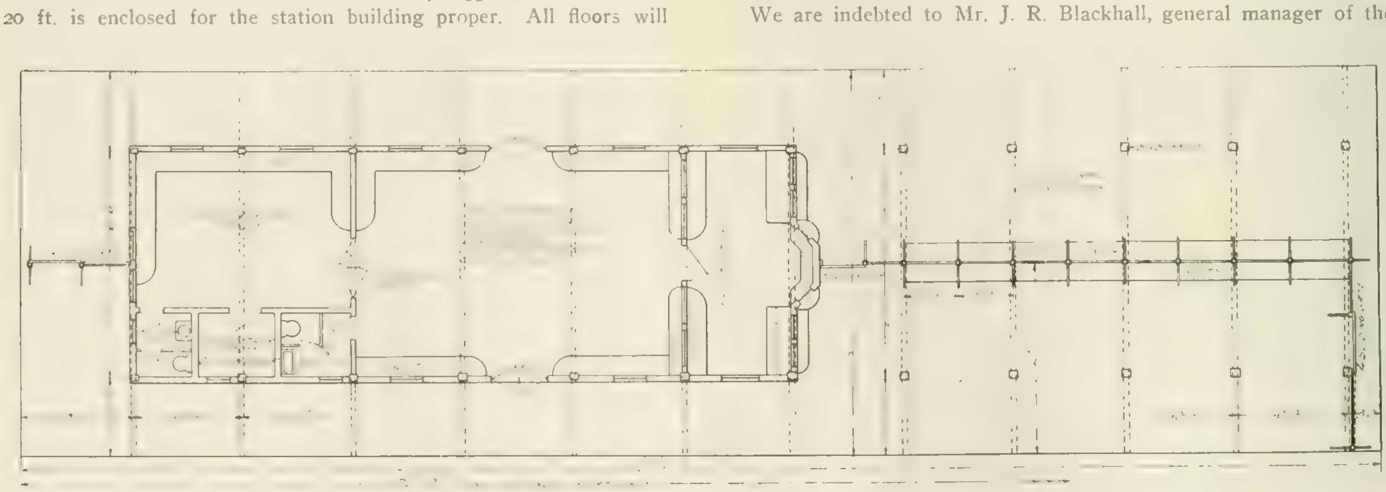
The floor of the station under roof is 124 x 35 ft., of which 60 x 20 ft. is enclosed for the station building proper. All floors will be of concrete, 6 in. thick, composed of one part cement, three parts sand and five parts broken stone, laid on a bed of factory cinders. Extending beyond the north end of this concrete platform for a distance of 49 ft. and enclosed by a cement curb is a cinder platform for the convenience of unusually large crowds. From each end of the building a fence is built in the center of the platform to each end, sliding gates being provided so that passengers may pass from one side to the other. These gates are stationed in front of the ticket office windows, the object being to induce the passenger to purchase a ticket before entering the car. On each side of the fence seats are provided for the accommodation of passengers. The accompanying floor plan of the building shows the arrangements made for the ticket office and fruit stand in its north end, the general waiting room in the center and the ladies' waiting room and toilet rooms in the south end.

The details of the roof over the platforms are shown in the accompanying sectional drawing. All joists, rafters, studding and secondary timbers are of Norway pine, while all exposed exterior lumber, including the platforms and porches, are of dressed white pine. The interiors of the waiting rooms are of yellow pine and varnished; all exterior woodwork, iron work, fence, etc., are painted. The posts supporting the roof rest on concrete piers, 6 ft. 4 in. deep, and are properly bolted and set in cast iron shoes. The roof boards are of 1⅛ x 5½ in. white pine and the shingles are of cedar. The ceilings and walls of the waiting rooms, fruit stand, etc., are ceiled with ⅞-in. matched yellow pine for oil finish. The plumbing and fixtures are of the latest design, the cistern and motor pump room being under the floor between the two toilet rooms.



SECTION THROUGH BUILDING AND DETAILS OF ROOF.

We are indebted to Mr. J. R. Blackhall, general manager of the Chicago & Joliet Electric Railway Co., for the drawings and data concerning this terminal.



FLOOR PLAN, CHICAGO & JOLIET ELECTRIC RY. TERMINAL.

The Ft. Wayne & Wabash Valley Traction Co. is extending its Soldiers' Home line at Lafayette from its present terminus to Battle Ground, which will make this suburban line 16 miles long. The route is along what is known as the River Road, a very beautiful and popular drive.

Stuart Automatic Block Signal.

The following description explains the operation of the Stuart automatic block signal, which has been patented recently by Mr. E. C. Folsom, superintendent transportation Ft. Wayne & Wabash Valley Traction Co., and Mr. Robert Stuart, of Logansport, Ind. This signal was installed for trial on the Ft. Wayne & Wabash Valley interurban line near Logansport and has been in operation for several months, the number of cars passing over the

TRACK AT END OF BLOCK.

block being about 40 each way daily. The results are reported to be very satisfactory. One of the great advantages of this signal system, which will appeal to all railway men, is the fact that the electrical contacts are actuated by the wheel of the car and not by the trolley wheel. By using the car wheel in throwing the switch a positive mechanical action is insured and there is no danger of failure to operate by reason of the trolley leaving the wire at a critical point. The car may operate through the block at full speed without danger of injuring the contact devices.

The principle and details of operation of the signal can be best understood by reference to the diagram, Fig. 1. A and D are the two "disconnectors" and B and C are the two "connectors."

The disconnectors and connectors are actuated by the wheels of the car and levers which the wheels strike are heavy forgings so that they will withstand rough treatment. For each device two levers are joined by a pin and the outer ends secured to two ties by bolts, the holes in the levers being enlongated to permit the required movement about the bolts. Attached to the junction of the two levers is a heavy rod supported in bearings fastened to adjacent ties. This rod leads to a covered box on the far side of the track. [illegible] In both [illegible] terminal connected to the track rail as a ground. (These terminals are indicated as a, b, c and d in the diagram.) In the connectors the rod has [illegible] engaged the connector rod is held over in a position to make contact between terminals [illegible] nector C. The solenoid M is enclosed in the same box as the circuit terminals b and f.

The wiring to connect the terminals e, f, g and h with the signal lamps, solenoid and trolley [illegible]

Fig. 2 shows the contact operating device.

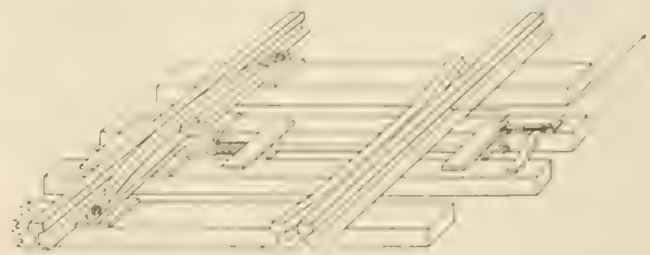


FIG. 2.

Now suppose no signal lamps to be burning, the conditions shown in Fig. 1. Let a car approach from the north. On striking disconnector D, the contact is made between d and h, completing a circuit from the trolley wire through wires 11, 10 and 9; this has no effect since the dog k is not engaged with the rod of C. Were this engaged the contact at D would actuate the solenoid and break the circuit through C. The contact at D is a momentary one only.

The car continues and on passing connector C contact is made between c and g (the dog k engages the rod and makes the contact a permanent one) and a circuit through wires 8, 7 and 6 completed so that the white lamp W at the north end of the block and the red light R' at the south end of the block are lighted, protecting the car and indicating that the block is occupied by a south-bound car.

On leaving the block passage over B completes a circuit through 12, 11 and 10 and actuates the solenoid N, breaking contact c and g and extinguishing the signal lamps and releasing the solenoid M so that the b-f contact would be permanent were the dog l not withdrawn when the car passes over A and completes the circuit through 5, 6 and 7. Passage of the south-bound car over A extinguishes all lamps.

A north-bound car while within the block causes a white light to show at W' and a red light at R.

It is apparent that when a car approaches the block, there will be one of these three indications: 1. No lights, indicating clear block. 2. White light, indicating car in block moving in same di-

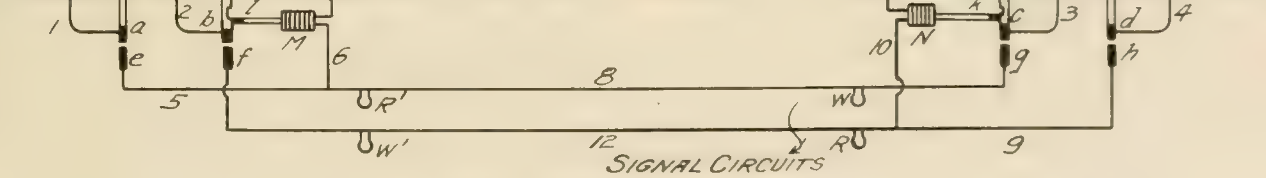


FIG. 1. DIAGRAM OF STUART SIGNAL.

CONTACT AND SOLENOID.

rection. 3. Red light, showing car coming through block in opposite direction.

If desired pilot lamps may be placed outside the block so that the conductor can see that the signal system is working, without having to look out the cab window.

The Eagle Park Swing.

A very attractive and comfortable substitute for the usual park bench is the lawn swing and the pleasure and benefit it gives to its occupants without the excitement of danger strongly appeals to those who do not enjoy the more strenuous devices of the summer park. A swing that withstood the use and experience of some time and has proved its safety, strength and comfort is the Eagle steel lawn swing, a product of A. Buch's Sons Co., of Elizabethtown, Pa. The frame of the swing is made of high carbon steel,

PARK SWING.

hardwood only being used for slats in the seats and platform, and the frame is well braced and rigid. The seats swing easy and free and clear of the frame and its level swinging motion eliminates all tilting; the seats may be arranged for sitting up straight, like a reclining chair, or thrown perfectly flat for a couch. A canopy and side and end curtains are provided for the further comfort of the occupants and a convenient table to be placed on the platform between the seats to be used for various purposes, as cards, lunch, sewing, etc. These swings are built in four regular sizes for verandas and lawns, including heavy swings built especially for public places and parks.

The Municipal Council of Bordeaux favors the preliminary project recently submitted by Messrs. Orbal & Lagueyte for electrically equipping and standardizing the gage of the freight and passenger line between Bordeaux, Beychac and Caillau.

New England Railway Club.

The June outing of the New England Street Railway Club took place Thursday, June 29th, at Lake Quinsigamond, Worcester, Mass., with about two hundred members in attendance. Through the courtesy of the Boston Elevated Railway Co., the Boston & Worcester Street Railway Co., the Worcester Consolidated Street Railway Co. and Mr. F. H. Bigelow, manager of the "White City" at Lake Quinsigamond, the party was taken from Boston to Lake Quinsigamond and admitted to the "White City."

One of the features of the occasion was the ride from Boston to Lake Quinsigamond and return, via the Boston & Worcester Street Ry., the party having the pleasure of riding in a special three-car train of electric cars. An excellent dinner was served at the Tatassit Club, on an island in Lake Quinsigamond, and the outing was one of the best in the history of the club.

Course in Electric Transportation at Brooklyn Polytechnic.

The Brooklyn Polyechnic Institute has announced an evening course of instruction in electric transportation under Prof. Samuel Sheldon, head of the department of physics and engineering. The course will commence October 10th and extend to April 24th. It will include a series of lectures by leading electrical engineers identified with the electric traction industry, and a series of laboratory tests.

Mr. C. O. Mailloux will deliver 15 two-hour lectures on electric train movement, treating of the subject from the physical, mathematical and engineering standpoints. Prof. Samuel Sheldon will deliver 15 two-hour lectures on alternating currents, illustrated by occasional experiments, and 15 two-hour lectures on mechanics and heat. Under Prof. Sydney Ashe there will be 20 two-hour laboratory tests on alternating-current generators and motors. Lectures will also be delivered by Messrs. H. A. Lardner, A. H. Armstrong, W. S. Barstow, H. G. Scott, W. L. Bliss, J. S. Doyle, John F. Calderwood, Dr. F. A. C. Perrine and R. Burnham Moffat, Esq., of the New York bar, each lecture extending over two hours. These will include lectures on power house location, design and operation; selection and maintenance of motor equipment, and legal points as to franchise organization, eminent domain and liability.

Kalamazoo Railway Supply Co.

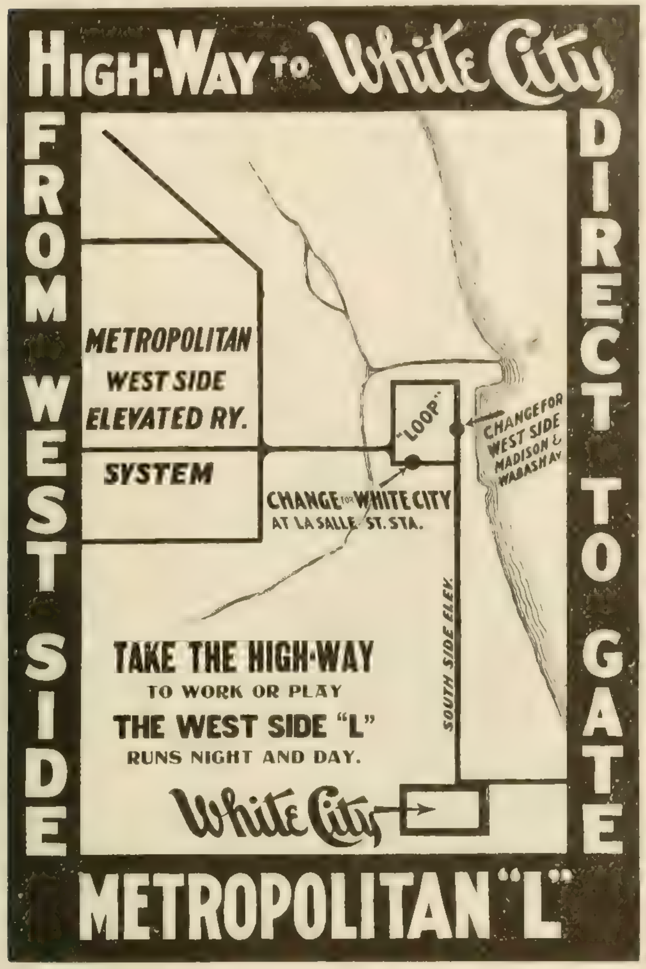
Mr. H. J. Haines, who formerly for several years was manager of the Kalamazoo Railway Supply Co., has again become connected with that concern as manager. The company is extending its works, putting in new machinery and equipment, nearly all the machines being driven by independent motors. The company has taken over the business of the Root Track Scraper Co., and Mr. Fred Root will have charge of the scraper department. The company reports that the Root scrapers are in use on over 100 street railways and that it is contemplating bringing out some new designs. The company also reports that its jack and car business is growing, the Kalamazoo jack having been adopted as standard on a large number of roads.

Sterling Varnish Co.

That the efforts of the new management of the Sterling Varnish Co., of Pittsburg, to render prompt and efficient service to its customers is appreciated is shown by the continually increasing demand for this company's products. The reorganization of the Sterling Varnish Co. was completed June 30th. On that date the offices of secretary and treasurer were combined and Mr. Henry C. Todd, formerly treasurer, was elected to both positions. The other officers of the company will remain as before, Mr. James Todd, president, and Dr. Walther Riddle, vice-president, to be in immediate charge of the manufacture of the company's products, and Mr. Arthur Hartwell, formerly sales manager of the Westinghouse Electric & Manufacturing Co., general manager, and in charge of the direction of all the company's affairs except the manufacture. Mr. H. Lee Bragg has resigned his position with the company.

Advertising Poster.

The Metropolitan West Side Elevated Railway Co. [illegible] 28 x 42-in. poster showing how to reach the W[illegible] the [illegible] line of the Metropolitan. This is printed [illegible] words "Metropolitan West Side Elevated R[illegible]



A CHICAGO POSTER (ORIGINAL 42 X 28 IN.)

"White City" and the transfer points on the loop, which are noted. We believe that the general manager of the company, Mr. H. M. Brinckerhoff, is responsible for the poetry.

The Miniature Railway.

Of all the many attractions that have been installed at parks, summer resorts and fairs, none are perhaps more popular or so well patronized as the Cagney miniature railways; especially is this true

THE MINIAT[illegible]

of the installation made by the Cagney Bros. Miniature Railroad Co. along the Pike and about the grounds of the L[illegible] P[illegible] chase Exposition. The locomotives use steam which is kept at 100 lb. pressure, and burn real coal, which is carried in a miniature tender. At the St. Louis fair eight miles of track were constructed and 24 trains operated, each train consisting of a locomo-

[illegible] miniature railways at such places as the St. Louis fair, the Port- [illegible]

Ft. Wayne & Wabash Valley Contract.

[illegible] has just been awarded to the Westinghouse Companies, Pittsburg, Pa., by the Fort Wayne & Wabash Valley Traction Co., of Fort W[illegible] three-phase and two-phase apparatus, the former for railway and the latter for lighting service, will be built by the Westinghouse Electric & Manufacturing Co. and the steam turbines by the Westinghouse Machine Co.

[illegible] 1,500-kw. turbo-generator units, delivering 375 volts, three-phase, 25-cycle current to rotary converters; two 1,500 and one 500-kw. turbo units, delivering 2,300 volts, two-phase, 60-cycle current to step-up transformers for the lighting system. Four rotary converters; seven 375-kw., fifteen 75-kw. and three 150-kw. oil-insulated self-cooling transformers; four switch-boards for 125, 550, 600 and 2,300 volts; and low equivalent lightning arresters, choke coils, disconnecting switches are included in the equipment. The steam turbine equipment is to be of the standard Westinghouse-Parsons type, operating under 150 lb. steam pressure, a moderate vacuum and with dry saturated steam. Many distinctive features will be embodied in the arrangement of the new power house, now building.

The Fort Wayne & Wabash Valley Traction Co. controls all the city lines in Fort Wayne and Lafayette, Ind.; the Logansport Street Railway Co. and the Logansport, Rochester & Northern Traction Co. in Logansport; the Fort Wayne & Southwestern Traction property from Fort Wayne to Wabash; the Wabash River Traction Co. and the Wabash-Logansport Traction Co., operating from Wabash to Logansport, and the electric lighting plant in Fort Wayne.

The Muncie, Hartford City & Ft. Wayne electric railway recently cut express rates to make them as attractive to shippers as freight rates on steam roads.

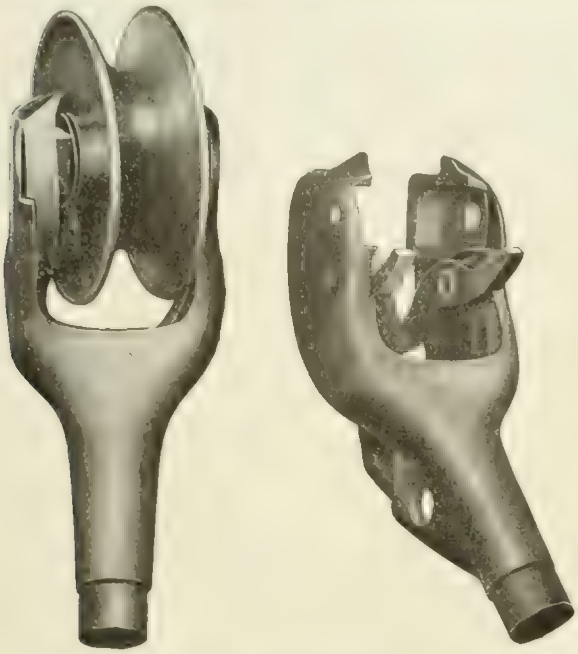
Arrangements were completed whereby the Indianapolis, Columbus & Southern Traction Co. established a United States mail service each way daily between Columbus and Indianapolis, effective July 1st.

The Dayton & Troy Electric Ry. is preparing to issue a complete list of names and addresses of parties adjacent to its line who desire summer boarders. Information will be given as to the number of persons that can be taken care of and rates per week.

A Rhode Island court has just decided that the owner of cows which were made sick by licking paint from electric railway poles was entitled to damages for the loss of milk which resulted. The defendant's proof that the owner of the land had allowed the poles to be placed, and that the owner of the cows knew of the bovine fondness for fresh paint, did not avail.

The Liberty Trolley Harp.

The Liberty Bell Co., Bristol, Conn., manufacturer of the well known "Liberty" products, has placed upon the market its "Liberty" trolley harp, the accompanying illustrations of which clearly indicates its economy and utility. In this harp the wheel is permitted to turn freely in making curves, an improvement that avoids grinding contact which unduly wears out both the wire and the



LIBERTY TROLLEY HARP

wheel. The company claims for it the following advantages: A greater saving to the overhead system; the trolley seldom gets off, therefore preventing to a much greater extent bent poles and slack or broken stays; it increases the life of the wheel from 50 to 100 per cent; wheels can be exchanged very quickly without tools and loss of time to interfere with the schedule; wheels may be quickly reversed to insure more even wear and durability, and the durability of the harp is far in excess of any other.

Westinghouse Belted Type Rotating Field Alternators.

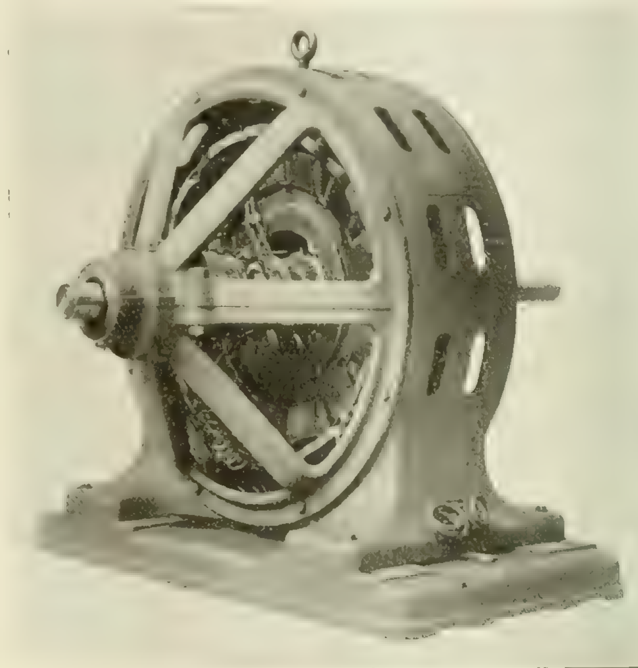
A line of belted type, self-contained, rotating field, alternating-current generators has recently been placed on the market by the Westinghouse Electric & Manufacturing Co. The machines are built for single, two and three phase circuits, in sizes from 30 to 200 kw. The single phase generators are manufactured for 220, 440, 1,100 and 2,200 volt circuits at 7,200 alternations, and besides these the polyphase machines are wound for 6,600 volts and both 3,000 and 7,200 alternations. In this type of generator the armature is stationary, a construction which facilitates the insulation of its windings, and provides that the field current instead of the armature current pass through the brushes and collector rings. Alternators of this type are therefore especially adapted to high voltages or large current output.

The frame of the stationary armature is cast in one piece with slots machined on the inside for holding the punchings which receive the windings; these are composed of wire, strap or bars, depending on the size and voltage of the generator. Open slots are used in machines up to 75 kw. with coils held in place by hard fiber wedges. In the larger machines partially closed slots are used. Horizontally split brackets which carry the bearings are bolted to this cast iron frame. The bearings are generous in their dimensions and are self oiling, with oil rings and an oil gage on each. All generators have bed plates with large foundation areas and suitable belt tighteners. These generators may also be arranged for direct connection to an engine or water wheel.

The fields of the smaller generators are of cast steel with pole caps of the same material. The poles of larger sizes are laminated and keyed or dovetailed to a cast iron spider. The field coils are composed of square wire so wound as to expose the maximum surface. In the generators having laminated poles heavy brass wedges, which hold the field coils in place, retard any shifting of the field between the poles, and thus practically eliminate pumping between the generator and any rotary converters or synchronous motors which may be connected in the system and insure satisfactory parallel operation of two or more generators.

Every means has been utilized for the rapid dissipation of heat from all parts of the machines. Open spaces in the laminated field register with those in the armature, and during operation air is drawn in through the field spider and forced out through the stationary core and windings. Excellent regulation is obtained by properly proportioning the armature and field windings in preference to saturating the magnetic field.

The single phase generators have compensating field windings supplied with rectified alternating current. A commutator on the



BELTED-TYPE ROTATING FIELD ALTERNATOR

shaft adjacent to the collector rings has its brushes connected to the secondary of a series transformer in the armature circuit and its segments to the self-exciting field coils. The compensating winding is so designed that the generator can be adjusted for a practically constant voltage from no load to full load or for an increase in voltage.

World's Largest Turbines for Brooklyn Road.

The Brooklyn Heights Railroad Co. has recently closed contracts with the Westinghouse Companies, Pittsburg, Pa., for two 7,500-kw. turbine type generating units for increasing the present power house equipment in Brooklyn. These units will be the largest generating units of the turbine type in the world. With the guaranteed overload capacity of 50 per cent above rating, the turbines will be capable of developing 16,000 brake h. p. and about 10,500 brake h. p. on normal load. The turbines will operate on dry steam at 175 lb. pressure and a vacuum of about 28 in. Three-phase, 25-cycle current will be generated directly at 11,000 volts for distribution to the line.

It is of interest in this connection that the second and third largest turbine generating units in the world are also of the Parsons type, the former built abroad and the latter by the Westinghouse Companies at Pittsburg. The Brooklyn Heights contract is especially significant from the fact that the company had already contracted about a year ago for a Westinghouse-Parsons turbine unit of the largest capacity then built, 5,500 kw. The building of the new machines will mark an important step in the development of power station apparatus.

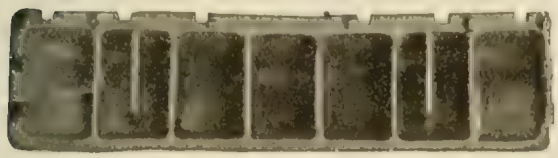
Buda Car Replacer.

The car replacer illustrated, which is made by the Buda Foundry & Manufacturing Co., of Chicago, and only recently offered to the railroad trade, has a number of points of superiority that numerous tests seem to have thoroughly demonstrated. One of the important features to which the manufacturer calls special attention is the groove that protects the flange by allowing the tread of the wheel to first engage the replacer preparatory to mounting. This construction, which makes it possible for the tread, and not the flange of the wheel, to first grip the replacer, is shown in the illustration.

The increase in the friction thus secured, over what would be possible if the flange only were presented, is readily apparent, and the great force ordinarily necessary and the shock to the equipment are thus obviated, and injury to the wheel flange or to the replacer avoided. Again, there is overcome the tendency to shove the replacers out of position, and also the spinning of wheels in the attempt to secure, on the flange alone, sufficient friction to start the ascent, as is especially the case of very heavy equipment.

Another desirable point in the Buda replacer which will doubtless meet with considerable favor, is the reduction of the pronounced and abrupt arch at the ends. Reference to the illustration will show how thin the approach has been made, at the same time this has been done without sacrificing the strength required at the points mentioned.

The inner replacer shows for itself how the wheel is



UNDER SIDE OF REPLACER.

BUDA REPLACER IN POSITION.

forced toward the rail. Repeated experiments have shown that it is not possible for the wheel to travel over the top of the replacer and drop on the opposite side—the deflection has been proved positive and absolutely complete in each instance. During the entire rerailing operation there is no shock whatever and the resultant saving to the equipment as well as the economy in the time required leads the manufacturer to feel that it has a replacer which will meet with great success.

The demand for strength has also been met and tests made by the Hunt Bureau of Tests demonstrated that the Buda replacer will sustain a load more than two and one-half times as heavy as any locomotive now in use. This is accomplished by the proper distribution of metal and not by using any undue amount. A cut is shown of the under side of a replacer which illustrates its construction. Convenient carrying handles are provided which are shown near the end. Another style has center handles. The replacers are made in two sizes, the No. 1, for 60-lb. rail, weighing 150 lb. a pair; the No. 2, for 100-lb. rail, weighting 200 lb. a pair.

Brill Cars for New York.

The New York City & Interborough Railway Co. placed an order on July 7th with the J. G. Brill Co. for 10 of its patented semi-convertible type of cars to be operated in the Burough of the Bronx and to connect with the cars of the subway system, which will soon be running through the lately completed tunnel under the Harlem River. The cars will measure 28 ft. over the bodies, 38 ft. over vestibules, 7 ft. 11½ in. wide over sills, and 8 ft. over posts at belt. The length of the platforms is 5 ft. The improved method of raising the sashes into pockets in the side roof known as the "grooveless post" method is called for in the specifications. The vestibule entrance will have Brill folding gates instead of doors. The cars are to be mounted on the Brill No. 27-G-1 short-base double-trucks. The Brill Co. has furnished much of the rolling stock for the Boroughs of Manhattan and the Bronx but these are the first cars of this type to be ordered for this system. It is noteworthy that the large number of orders recently placed for [illegible]

New York Central Plans.

The rumor has been current [illegible] of a deal between the New York Central and the Clark syndicate, owning the Rochester Railway Co., and several suburban lines, to the effect that the Central was negotiating with the Clarks for all the railroad interests controlled by the latter in Rochester and vicinity. It is now learned on what seems to be most reliable authority that the sale of the Clark interests to the New York Central has been practically completed. This is the most important corporation deal that has ever been put through in Rochester, and its effect on the prosperity of the city and on the public of western New York is apparent at a glance.

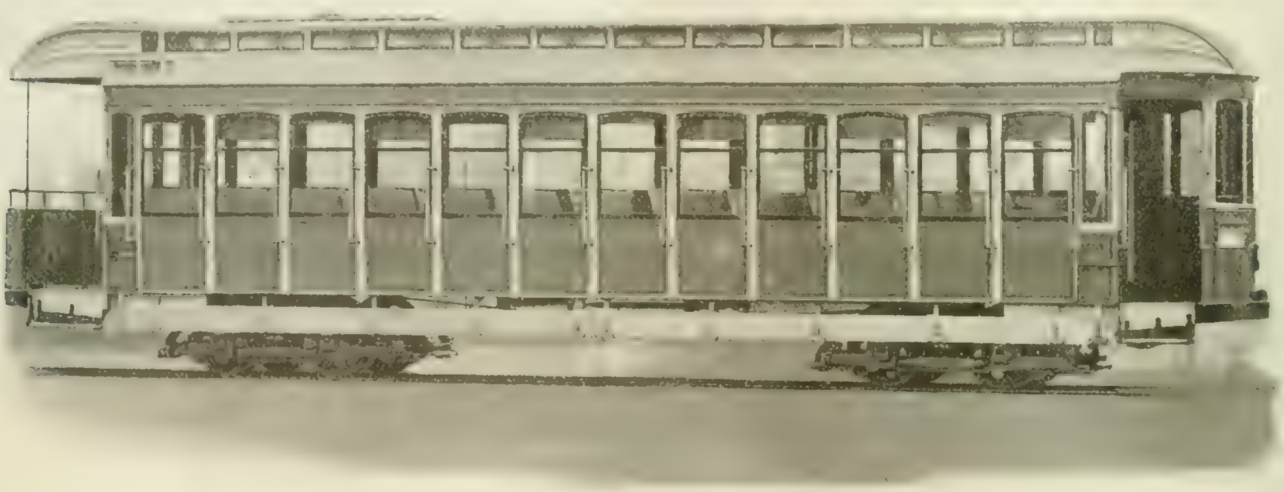
The Clark syndicate has been working for five years to acquire control of all electric interests centering in Rochester. First the Rochester Railway Co. was acquired; this now includes four valuable leased lines—the Charlotte road, the Sea Breeze road, the Summerville road and the Sodus road. Later the Rochester Gas & Electric Co. was acquired by the Clark syndicate and a holding company organized to control the railroad system and the lighting system of the city. More recently, on the death of the principal owner of the Rochester & Eastern road, Mr. Comstock of Michigan, the transfer of this suburban line, running from Rochester to Geneva by way of Canandaigua, was made to a syndicate in the interest of the New York Central. The New York Central, as a corporation, cannot, of course, buy any electric roads, but control is acquired by the organization of a syndicate composed of men who are affiliated with the New York Central.

Contracts Let for the Construction of the Fairmont & Clarksburg Traction Line.

The new board of directors of the Fairmont & Clarksburg Traction Co. have organized by electing the following officers: President, S. L. Watson; vice-president, C. W. Watson; general manager, A. L. Linn, jr.; secretary and treasurer, Smith Hood. The contracts for building the road have been let to Joseph Fuccy and the Ferguson Construction Co., of Fairmont, W. Va. The road has been financed and nothing will prevent the completion of same and the connecting of Fairmont and Clarksburg by Dec. 1, 1905, except the inability of the company to procure rights of way between Gypsy and Adamston. A new power station and the necessary substations are to be constructed at once. The president and general manager have been authorized to locate and contract for these. The New England Engineering Co. is making plans and specifications for their construction.

A Novel Type of Car for Cleveland.

[illegible] pleted for the Cleveland Electric Railway Co. by the G. C. Kuhlman Car Co. The railway system of Cleveland is laid out in such [illegible] permit a design with the entrances on one side only. This arrangement permits the use of a type of car which is convertible on the entrance side and has fixed panels on the opposite side, a design of car which has the advantage of not requiring a running board on one side, thereby increasing the space between passing cars, a most valuable feature on lines which traverse narrow streets. It also prevents passengers [illegible] side of the car which many are prone to do when there is only a guard rail. The J. G. Brill Co's. convertible system is used and on the closed side the ordinary drop sash arrangement has been adopted. A type similar to this but for trailer service was built for the railway company by the Brill company a year ago and after thoroughly demonstrating the value of having one side convertible the present order was placed. An interesting feature of the new type is the [illegible] seats



OPEN SIDE OF CLEVELAND CAR WITH RUNNING BOARD UP

on the convertible side and movable longitudinal seats on the other, probably the most practical of all the plans which were ever conceived to make an aisle car convertible to one with continuous transverse seats, and still be self-contained. The longitudinal seats are arranged in sections of a length suitable to be brought around to a transverse position and connected with those on the opposite side to form continuous seats for five passengers each. The movable seats are simply lifted around when it is desirable to change the car from one type to the other, and are held rigidly in a transverse position by strong catches. The cricket legs and back supports of the movable seats correspond to those of the seats on the convertible side of the car.

The Brill No. 27-F truck upon which the cars are mounted is the standard type of the Cleveland lines and is a short-base double truck with equal size wheels. Like all other trucks of its class, it carries the car body too high to be used under open cars with a single step or running board at the side. Therefore, to adapt the style of car shown in the illustrations to this type of truck and make the same division of height from the track to the car floor at the side entrances as at the platforms, a double step is used which is a modification of the Brill Narragansett type—an angle iron is used for the sill with the upper step on the outwardly extending lower flange. This arrangement prevents the upper step from projecting beyond the posts and keeps the width over all within the limits required in city service. The sliding panels and sashes of the convertible side are the regular style used with the convertible car and are stored in pockets in the side roofs when the car is opened by a simple arrangement of trunnions and runways. The sliding panels are brought down to rest upon the steps of the angle iron sill when the car is closed and the step openings in the car floor are covered by metal plates or covers which fold against the back of the steps when the car is opened. Trunnions at the corners of these covers move vertically in slots in the sides of the post brackets and horizontal flanges on the brackets form a secure resting place for them when they cover the steps. The covered plates can be opened or closed from the outside of the car when the panels are raised or from the inside when the panels are lowered.

A very appropriate feature is the use of the semi-accelerator patented doors. This arrangement brings the door close to the platform steps so that persons standing on the platform are not apt to obstruct the passenger from step to door. It also enables the conductor to assist passengers to better advantage as he will stand near the step instead of at the center of the platform. The motorman's cab formed by a longitudinal partition at the center of the front platform is an excellent feature and made possible by the use of the semi-accelerator doors. Another desirable feature is the [illegible] position of the grab handles on the posts on the convertible side of the car. The handles are so placed that a passenger leaving the car will only see the one at the left and therefore by using it is made to face toward the forward end of the car.

The dimensions are as follows: Length over end panels, 35 ft [illegible], over vestibules, 45 ft [illegible] end panels over vestibule, front end, [illegible] rear end, 5 ft.; width over sills, including plates, 7 ft. [illegible] in.; width over posts at belt, 8 ft. 2¾ in.; height from floor to ceiling, 8 ft. 6¼ in.; from under side of side sills over trolley board, 9 ft. 6¼ in.; from track over trolley board, 12 ft.; sweep of posts, 1¾ in.; center to center of posts, 2 ft. 9 in.; thickness of corner posts, 3⅝ in.; of side posts, 2¾ in. on closed side and 3⅜ in. on convertible side; side sills, 4¾ x 7¾ in. on closed side and 2½ x 7¾ in. on convertible side; end sills, 4¾ x 7¾ in.; sill plates, closed side, 8 x ⅝ in.; sill angle iron, convertible side, 8 x 6 x ⅞ in.; length of seats on convertible side, 36 in. and of movable seats, 53 in.; width of aisle, 33 in.; weight of car body, 21,664 lb., and of car and trucks, without motors, 33,564 lb.

Climax Rolled and Corrugated Joints.

Among the well known products of the Best Manufacturing Co., of Pittsburg, Pa., the Climax rolled and corrugated joint for high pressure steam lines is one of the latest this company has placed on the market. In this joint pipe fits against pipe so that there is no leakage between pipe and flanges and the joint is not affected by expansion and contraction as is often the case with flange and pipe made up solid. There is no threading required that might weaken the pipe, no screwing, shrinking or expanding that might bring undue strain on the flanges, and no piening that tends to crystallize the pipe. There are no rivets that invite leaks and the flanges are swivel, which is quite an advantage in erection. The benefit claimed for corrugation with the use of Climax flanges is that it insures the flanges coming square and thereby removing danger of cast iron flanges breaking when bolting them together. The company also furnishes Climax flanges made of cast gun malleable iron and semi-cast rolled steel.

Instructions for Installing Stombaugh Guy Anchors.

W. N. Matthews & Bro., 219 North Second St., St. Louis, Mo., have recently issued an interesting and useful pamphlet containing instructions for installing Stombaugh guy anchors, for which product it is well known. This information should be of interest and value to our readers and we therefore reprint these instructions which are as follows:

For installing 5 and 6-in. anchors without rods, attach a piece of galvanized strand or wire, 7 or 8 ft. long, to the eye of anchor, then pass the wire through the hollow pipe of wrench. Key the anchor firmly to the wrench, draw the wire tight and clamp it firmly, flush with cross of wrench (see Fig. 1). If this is not done the wrench will slip off the key when in the ground. Now screw the anchor in at the angle that the guy wire is to run as far as ground conditions will permit. When installed at greatest depth possible, pull out the wrench and attach the guy wire to the strand attached to anchor.

For installing 5 and 6-in. anchors with rods, key the anchor firmly to the wrench. Drive a wooden or metal wedge into the eye to keep the wrench from slipping off the anchor (see Fig. 2), and screw the anchor in at the same angle as the guy wire is to run as far as ground conditions will permit. When in as far as possible, pull out the wrench and attach guy wire to eye of rod.

For installing 8, 10 and 12-in. anchors with rods, place the bar or other lever in the eye of anchor (see Fig. 3), and screw it in as far as ground conditions will permit, always at the angle that guy wire is to run. When anchor is set, attach guy strand to eye.

In installing 8, 10 and 12-in. anchors in very hard ground, clamp a lever to the rod by means of a chain, a foot or so above the ground. As the anchor is screwed down the lever can be moved up. In setting all Stombaugh guy anchors in hard ground the work will be much easier if a hole is made with a crow or digging bar or wood auger with a long shank. This makes the path of the anchor easier. A little water poured down this hole before starting the anchor will help considerably where the ground is hard and dry. The anchor will start easier if a few spades of earth are removed at the angle desired to set the guy. If a man stands on the helix of the anchor when starting until the point bites the ground it will assist. The greater the depth that Stombaugh guy anchors are installed, the greater the strain that they will hold. These anchors will hold a greater strain if a hole is scooped out so that the anchor can be bored in deeper.

FIG. 1

FIG. 2

FIG. 3.

The Havana (Cuba) Central Railway.

The Havana Central Railway Co. [illegible] order with the [illegible] Schenectady, N. Y. [illegible] work of interurban [illegible] covering an extensive [illegible].

The system [illegible] eight outside [illegible] miles of track and rolling stock for passenger and freight service over the entire system.

The power house in Havana [illegible] 25-cycle, three-phase alternating current generated by two 2,000-kw and one 1,000-kw. Curtis steam turbine generators at 2,200 volts and stepped up through air blast transformers to the line voltage. The transmission lines will parallel the various lines of the railway to the sub-stations where step-down transformers supply low voltage to rotary converters furnishing 600-volt direct current to trolley lines and feeders.

From Havana one branch will run south east through Cuatro Caminos, Lomas de Candela, Guines, Providencia to Rosario a distance of about 40 miles. Sub-stations will be located at Cuatro Caminos, Lomas de Candela and Providencia. A second line will run from Havana 17 miles south to Bejucal with a sub-station on the line at Santiago de las Vegas. A third line southwest from Havana to Mariel will have a length of 37 miles and branch lines running north and south of El Carmelo, Santiago de las Vegas and Tuira de Melena amount to about 30 miles in addition. Sub-stations on the line to Mariel will be placed at Marianao, Hoyo Colorado and Guanajay and at San Antonio Melena.

The rolling stock for passenger service will consist of twenty-four 30-ton cars to seat 50 passengers and equipped with four GE-74 motors geared for a maximum speed of 40 miles per hour. The freight service will be handled by ten 40-ton General Electric locomotives equipped with four GE-55 motors geared for a speed of 17 miles per hour when hauling a 300-ton train.

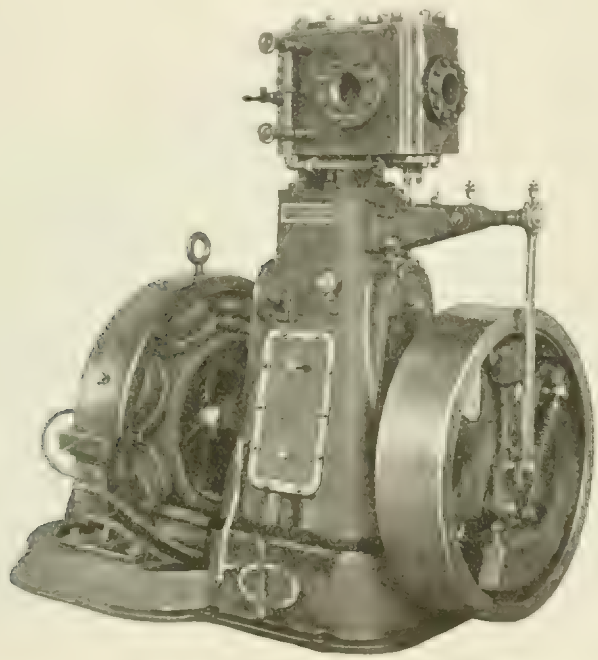
The entire system will have double overhead trolley both in Havana and on the interurban lines. The high potential transmission lines will be designed for future use of a potential of 30,000 volts to provide for extensions. The transformers in the Havana power house and in the sub-stations are also suitable for use on the increased potential.

It is expected that the entire system will be in operation inside of 18 months and that portions of it will be giving service before that time.

Sturtevant 25-kw. Generating Sets.

The B. F. Sturtevant Co., Boston, Mass., is manufacturing various [illegible] generating sets ranging from 3 to 100 kw. [illegible] the accompanying illustration showing the company's 25 kw. set. This set consists of a Sturtevant 9x8-in. single, vertical, enclosed automatic engine, direct connected to a Sturtevant 9-100 M. P. 8 compound wound generator; the engine operates at 350 r. p. m. with 90 lb. steam pressure at the throttle.

The vertical single engines are designed for continuous operation at high speed. Relief valves of large diameter, adjustable to open automatically at any desired pressure, are provided at each end of the cylinder. The piston is cored out and provided with internal ribbing. The guides are cast in one piece with the frame; the connecting rod is of forged steel, and the crank shaft of open hearth steel, forged in one piece. The cylinder is lagged in Russia iron and is separated from the frame by a watershed partition, so as to prevent water from the piston rod stuffing box reaching the interior of the frame. The engine shaft is coupled to the generator shaft. Forced lubrication at from 10 to 20 lb. pressure is employed for the interior bearings, which serves not only to deliver oil to all bearings, but to also maintain under pressure a film of oil between the two bearing surfaces, thereby reducing the friction and increasing the mechanical efficiency of the engines. The engine is mounted on a sub-base of neat design, and access to reciprocating parts is obtained through openings normally closed by oil tight plates on the sides and ends.



STURTEVANT 25 KW. GENERATING SET.

The generators are multipolar; the field frame is of soft gray cast iron, with pole pieces of wrought iron. The field coils of this size generator are made in two separate sections, the compound winding forming one, and the shunt winding forming the other. They are made of double cotton covered wire, thoroughly shellaced, taped, reshallaced and baked before being mounted on the pole pieces. The armature is of the barrel wound, toothed, hollow drum type, with a core of annealed soft steel and spider of cast iron. The core is divided into two or more sections, allowing space for air ducts for ventilation, and all laminations are machine slotted before being mounted on the spider. The armature winding is of either the coil or bar wound type; if of the former, the coils are formed of double cotton covered wire, shaped and thoroughly taped before being mounted, and if of the latter, they are made of solid copper bars before being mounted, after which they receive several baths of insulated shellac and are thoroughly baked. The brush holders are made of composition throughout and are what is known as the self-adjusting, socket type, shunted brush holders. The commutator is made of forged copper and is mounted with the armature to form a single unit. The heat rise of the generator will not exceed 40° C. above the surrounding air as measured by a thermometer for a 4-hour full rated load run, and an overload of 25 per cent can be carried for a period of two hours without the temperature rise exceeding 50° C. above the surrounding air. A momentary overload of 100 per cent can be carried without flashing.

The "Albany Grease" Trade Mark.

The value of a trade mark depends largely upon its character and the quality of the goods back of it. That of Adam Cook's Sons, 313 West St., New York City, who are the only makers of "Albany" grease, has an individuality peculiarly its own, and which has served to fasten the lubricant it advertises upon the memory of all having to do with the smooth and safe running of machinery. As some one has already said, "the trade mark forms a link between the manufacturer and the consumer, guaranteeing to the consumer that the goods bearing such mark are made by the same manufacturer as the goods which he previously purchased under the same mark." The trade mark is therefore a guarantee of quality, and when the quality is of the highest, the importance of the trade mark is far reaching and its consideration a matter of some interest.

It is safe to say that there is scarcely an engineer in active service who does not know "Albany" grease and its familiar trade mark. The mark was first used in 1868 and was designed by two lithographers in the employ of Weed, Parsons & Co., of Albany, N. Y., under the instructions of Mr. Adam Cook, the original owner of Adam Cook's Sons.

The figure of a boy sliding down a plank which is the prominent feature of this trade mark should be studied in connection with the letters "O-EZR-IC," and these have been the cause of much speculation among users and buyers of the product. Their meaning is, however, decidedly simple and to the point, signifying "Nothing easier I see" than to slide down the plank smoothly and without friction when Albany lubricating compound is applied. This applies to machinery of every description. When "Albany" grease is used the machinery runs smoothly and without friction.

At times the letter "O," which in the trade mark represents the word "Nothing," has been confused with the numbers or consistencies of "Albany" grease as manufactured by Adam Cook's Sons, and as published in their circular. This should not be. There are seven numbers or grades of the product, running from 0 to No. 3 and X to XXX, number 0 being the softest consistency in which the grease is made and XXX the hardest. The use of various grades depends upon the climate in which the grease is to be used and the work it is to do.

During the 37 years that this trade mark has been before the public it has been continuously used by the manufacturers on all their business stationery and in every advertisement put out by them. It is also to be found a prominent feature on all packages which leave their warehouse and stands for what its users claim is the cheapest, cleanest, and altogether the best lubricant manufactured.

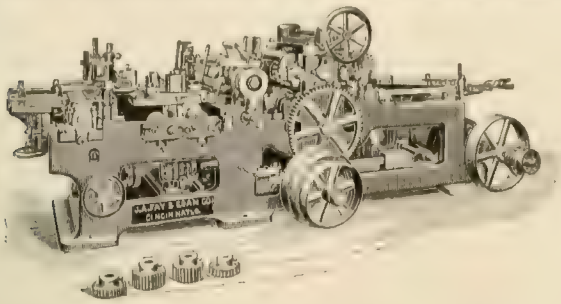
Adam Cook's Sons guarantee "Albany" grease to save from one-half to three-quarters of the cost of lubricating by oils, and have on file thousands of testimonial letters received in the ordinary course of business correspondence which prove their assertions to be correct. Engineers that have used it know that it will assure a clean engine room and no hot bearings, whether the machinery on which it is used is slow or fast running, large or small. To prove all they claim, Adam Cook's Sons will send a suitable grease cup with a sample of "Albany" grease to test, free of charge.

To Prevent Trouble with Sleet.

One of the interurban roads in Iowa reports that greasing the trolley wire has been found to prevent sleet from adherring to it and that operation in winter is greatly facilitated by taking this simple precaution during the winter months.

J. A. Fay & Egan No. 133 Molder.

A new inside molder which has been designed for car work by the J. A. Fay & Egan Co., 250 W. Front St., Cincinnati, O., and which is illustrated herewith, has a capacity for lumber 6 in. thick and 12 or 15 in. wide. The frame is of a new type, square, open, ribbed inside, strong and rigid. The four steel cylinders are slotted on four sides, and their pulleys taper-fitted. The upper head is double belted, and mounted on a housing, raising and lowering on ball bearings, and operated by crank. The pressure bar of this head is also carried on this housing, raising and lowering with it, and also has vertical adjustment, and to and from the head. The



chip breaker of this head is in sections each independently adjustable, and all press close to the cut. The lower head is at the feed-out end, and is made single or double-belted, and its frame is vertically adjustable. The pressure bar before this head, also the table after the head, adjusts vertically and horizontally. Both heads are easily accessible. The side heads are of improved construction, and are fitted with many devices and improvements for facilitating operation and promising fine work. There are four feed rolls, the upper sectional, and either smooth or fluted rolls can be easily inserted. The feed is driven by either cone pulleys, tight or loose pulleys, or by binder. Speed furnished as desired.

Electric Railways in Japan.

In reply to an inquiry regarding the electric railways in the consular district of Kobe, Japan, the American consulate submits the following information:

The Hanshin Denki Tetsudo Kabushiki Kaisha (Osaka & Kobe Electric Railway Co.), with headquarters at Osaka, began operation April 12, 1905. The line is 19 miles long and is operated by electricity with the overhead trolley. The officers of the company are: President, S. Toyama; secretary, treasurer and general manager, S. Sugimura.

The Kioto Electric Traction Co., Kyoto, began operation Feb. 1, 1895, and now has 16½ miles of track operated with the overhead trolley system. The officers of this company are: President, Bumpei Takagi; treasurer, H. Furuya; secretary, G. Iwahashi; general manager, T. Ido.

Large Order Cars for Baltimore.

The J. G. Brill Co. has just received an order for 200 of its patented type of semi-convertible cars from the United Railways & Electric Co., of Baltimore, Md. The order calls for 160 cars to be mounted on the builders' No. 27-G-E-1 truck, which is a short-base double truck with solid forged side frames, and 40 cars are to be mounted on the builders' high-speed type, No. 27-E-1, which also has solid forged side frames. The cars are all to be 30 ft. 8 in. over the bodies and will have 5-ft. platforms. The 160 cars mounted on the short-base trucks are for city service and will have Brill portable vestibules, and the 40 cars mounted on the high-speed trucks will have stationary vestibules and will be run on a division extending for some distance out of the city. The semi-convertible window system will include the recent improvement which eliminates the sash trunnions and runways formerly used and simplifies the method of connecting each pair of sashes. The general plan of the lower sash carrying the upper into pockets in the side roofs is preserved. The arrangement has come to be known as the "grooveless post semi-convertible." The decks are to be the standard monitor type and the seating plan consists of transverse seats with reversible backs and longitudinal corner seats accommodating four passengers each.

New Publications.

[illegible] STREET RAILWAY INVESTMENTS [illegible] McGraw Publishing Co., 114 Liberty St., New York [illegible] edition [illegible], price $5.00. This is the well known [illegible] pages of statistical matter, being 53 pages larger than the edition of 1904. This increase has been due in part to the addition of reports from new roads, but more largely to the fact that many roads have furnished a statement of earnings this year, from which such figures have not heretofore been obtainable. Among the new features in the manual for 1905 is an increase in the index, which is bound in the back of the book. Heretofore only the names of companies reported have been included in the index. This year the index has been enlarged to include the names of all underlying companies which have bonds outstanding, even though the company may not have at this time any separate corporate existence. This enables investors to refer readily to the report of the company which now operates the road of any former company. As usual, the introduction to the book contains a summary of the gross receipts for the last two years of the principal companies reporting. As there have been many consolidations during 1904, this table is not an exact index of the growth of the business, as the figures in a number of cases represent receipts for a larger amount of trackage. Nevertheless, the increase is such a steady one as to indicate a substantial gain in street railway earnings for the past year.

SIR HENRY BESSEMER, F. R. S. An autobiography; 400 pages, cloth, gilt top; 16 shillings net; 51 plates and numerous illustrations; publishers, "Engineering," 35 and 36 Bedford St., Strand, London, W. C. On an early page of this volume the author tells us he makes no claim to literary merit. He, certainly, was without training in the art of writing, but the happy gift, which characterized all his mechanical work, of instinctively selecting the simplest and best means of attaining a given end, did not desert him here. He wrote just as he talked, and infused into his writings the charm of his conversation. The 85 years of busy life which had been allotted him, had in no measure dimmed his memory, or even paled his enthusiasm: and in his autobiography he lived over again the ambitions of youth, the struggles of manhood, the bitterness of injustice, the pleasure of appreciation, and the satisfaction of success. The world, as it recollects Bessemer, only knew him as the triumphant inventor, but in this volume we tread with him the thorny road to success, and more than that, he shows us the seamy side of the inventor's career. Unfortunately, this autobiography is not complete; even a chapter of the history of the steel process is wanting—that recording its brilliant success in the United States. Sir Henry laid down his pen only a year before he died, but his self-told story goes no further than the episode of the Bessemer Saloon Steamer, in 1872. After that incident was closed he retired into private life, but not to a life of idleness. He had many occupations: the beautifying of his home; the installation of a large diamond-cutting and finishing plant; his telescope and observatory; his method of cutting and polishing optical lenses; his solar furnace; all these and other things kept him very busy, and formed not the least interesting part of his long life. It is unfortunate that he has left no consecutive record of this period; but he did leave many drawings, letters, and other documents referring to it, and from these has been prepared the supplementary chapter which concludes the present volume.

MOODY'S MANUAL OF RAILROADS AND CORPORATION SECURITIES; 2,600 pages, size 7 x 9 inches; the book is 4 in. thick and weighs over 12 lb. It contains over 3,000,000 words and covers the entire field of corporation investments. There are ten sections to the volume and each section has been prepared by its own special experts, who have made it their entire work to make the book complete and up-to-date in every possible sense of the word. The increases in information over the 1904 edition are about as follows: In steam railroads, 80 per cent increase; in electric traction companies, 56 per cent; in gas and electric light company statements, 49 per cent; in water supply companies, 80 per cent; in telephone, telegraph and cable companies, 32 per cent; in industrials, 21 per cent; in mines, 48 per cent; in banks and financial institutions, 90 per cent. The growth in the size of page over the last edition is 30 per cent; the growth in the size of the volume is 35 per cent, and the growth in actual quantity of contents is more than 80 per cent. There is no growth in price. Since the publishing of the first edition, which appeared in 1900, the growth in pages has been over 140 per cent; the growth in the size of this volume over the first edition is 100 per cent; the increase in quantity of contents as compared with the first edition is over 800 per cent; and the increase of the current edition in circulation over that of 1900 is over 400 per cent. The book now circulates all over the world and will be found in the leading banking institutionss and in the hands of investors as far away as South Africa, Australia and Japan. Its European circulation is increasing with remarkable rapidity, and throughout the United States the book is looked upon as the standard of its class by all progressive bankers, brokers and men of affairs. Its circulation in the Wall St. district is claimed to be probably double that of any of the other railroad or investment manuals. This large circulation is due to several causes, the chief being that the book is not confined to one or two particular lines, like steam or electric railroad statistics, but covers all fields of interest to the dealer or investor in securities, and does this with even more accuracy, comprehensiveness and enterprise than those books which make a specialty of a particular line and merely skim over or entirely ignore equally important fields of investment. Another reason for its great success and rapidly increasing circulation is that a person can secure all the information obtainable at a cost of $10, this being the price of the book; whereas under the old plan of buying a railroad manual for railroads, a street railway manual for street railway securities, and a mining manual for mining stock, it was necessary to invest anywhere from $20 to $40 in miscellaneous publications, and even then not be able to get the information wanted with any kind of accuracy or uniformity. The growth and development of Moody's Manual during the past few years is enabling the financial community to do away with these old inconveniences. The book is becoming more and more to be looked upon as being as necessary a feature in the average banking or brokerage office as is the ticker or the telephone. The volume is published in two bindings, one being full Russia leather at $12 per copy, and the other red cloth at $10. Express charges are prepaid in the United States, Canada and Mexico.

INVESTORS' MANUAL. Pamphlet of 124 pages, 9¾ x 12¾ in. Published by the Economist Publishing Co., 189 La Salle St., Chicago. This publication is made up of such descriptions of corporations whose head officer or manufacturing plants are in or near Chicago as will suit the needs of investors. The financial plan of each corporation is given and the liabilities, capital stock, bonds, etc., are tabulated. A concise history of each corporation is printed, together with any special features that may be included in the articles of incorporation. Those parts of the franchises that have to deal with the value of the property, are printed and a description of the properties given. The report on each corporation concludes with a statement of the location of the main office, the date of the annual meeting, a list of the directors of the corporation and the officers in charge of operation. The data describing the electric lines are accompanied by a complete set of full page maps, showing the location of the surface and elevated lines in and about Chicago. A statement of the operation receipts and expenditures for the last fiscal year is included for each road reported. The publication includes a list of the officers and directors of the Chicago banks, a table of Chicago bank statistics, with totals for 12 years, complete to March 14, 1905.

A general list of industrial and miscellaneous companies throughout the United States is given, in which list is printed the name of the president, capitalization, yearly rate of dividends, earnings, stock transfer, office registrar and date of annual meeting of each company. Following this is a list of the railroads of the United States, in which the more important are grouped as to their general classes of traffic and the smaller lines arranged alphabetically. For each of these roads is given the mileage operated, capitalization, equipment, receipts, expenses, traffic, earnings, etc., per mile, percentage of operating cost to taxes and a comparison of gross earnings and net earnings extending over a period of 10 years. For a large number of the steam railroads a statement is given of the mileage owned and operated and the funded debt which has a claim upon this mileage.

The book concludes with a list showing the range of quotations of different railway and industrial stocks for the last four years and a list showing the range of prices of Chicago securities on the Stock Exchange for 11 years. A complete index of the companies forms a part of the publication.

EARTH AND ROCK EXCAVATION. By Charles Prelini, C. E., 357 pages, 167 illustrations and numerous tables, price [illegible], net. Published by D. Van Nostrand Co., New York. The author of this book introduces the subject with a description of profiles and cross sections, explaining their use in a brief way. He next discusses several methods for calculating the quantities and costs of earthwork of different classes. Following this subject is a description of the subject of overhaul and an explanation of the use of Bruckner's curve and Lelanne's curve. Rock excavation is thoroughly discussed by a description of the tools and methods for handling rock without blasting and a description of blasting and the several standard methods for drilling the rock preparatory to the blast. The next portion of the book is devoted to earth excavation, describing the hand and power tools used in the handling of earth, such as steam and animal drawn elevating graders, road scrapers, continuous digging machines, trench machines and the different styles of intermittent digging machines, including steam shovels and excavating buckets. Then follow several chapters describing the transportation of excavated materials on level roads and industrial railways. Methods for handling excavated materials on inclined roads and by elevators are described. Then follows descriptions of methods for transporting excavated materials by aerial ways, such as cableways with automatic dumping carriages and telpherage systems. The detailed parts in various machines for excavating and hauling, such as chains, ropes, buckets, engines and power transmission are considered in detail. Then follow a number of general rules for organizing and directing excavation work so that economical results may be obtained. The book concludes with a discussion of shrinkage and the cost of excavation work illustrating the latter by brief but interesting descriptions of the large canals of the world. The cost for earthwork is a generous portion of the total construction cost of many large undertakings, and it would seem that this book should be welcomed by those in charge of such work and be found of use to them for reference as to general earth handling methods.

THE TECHNOLEXICON OF THE SOCIETY OF GERMAN ENGINEERS (short report on the state of work, June, 1905). In the compilation of this universal technical dictionary for translation purposes [illegible] that was commenced in [illegible] laborators at home and [illegible] now 2,700,000 word cards [illegible] added the hundred thousand of cards that will result from the working out of the original [illegible] The contributions have been called in since Easter, 1904, and most of them have already come in. [illegible] in-chief will be pleased to give any further information wanted. Address: Technolexicon, Dr. Hubert Jansen, Berlin (NW. 7), Dorotheenstrasse 49.

THE MECHANICAL TRANSPORT OF AIR.—[illegible] difference between the transportation of a solid and that of fluid lies in the fact that while as a rule the former must be carried, the latter merely flows, as its very name indicates. Such flow is obviously toward the point of least resistance. In nature areas of high and low density create such pressure differences as to induce air movement upon a stupendous scale. But in the process of artificial movement through prepared conduits, as in systems of ventilation the distances are usually small and the pressure slight. In fan practice such pressure seldom exceeds one ounce per square inch where large volumes are to be kept in motion and distances are measured in hundreds rather than in thousands of feet. The science of air transportation presents many puzzling problems, in the solution of which experience bears a large part. Much help has been given by the publications of blower manufacturers, most prominent and oldest among which is the B. F. Sturtevant Co., of Boston, which has for years published in its extensive series of catalogues many tables and much information relating to the subject. Its treatise on Mechanical Draft (a volume of 400 pages, for which a merely nominal charge is made) is particularly noticeable for its comprehensive treatment.

THE ENGINEERING WORLD. Published monthly by the Engineering World Publishing Co., Chicago. Size, 8¾ x 11¾ in.; 24 pages reading matter; price, $1 per year. This publication is issued in the interest of the Engineering Agency, a reliable bureau

for technical men and employers, and in addition to a list of positions wanted and vacant, contains articles of interest to engineers, construction news and a review of general scientific progress.

THE IRON AGE DIRECTORY, 1905; 308 pages; size, 4 1-3 x 6¾ in.; price, 25 cents; published by the David Williams Co., 232 William St., New York City. This is a directory of manufacturers and the larger mercantile houses advertising in the Iron Age. The contents of this edition are considerably greater than any yet issued and its now larger scope will be more highly appreciated as an essential part of the requirements of the purchasing department of railways.

MELINE'S NEW TIME BOOK FOR MOTORMEN AND CONDUCTORS. Pocket size, 3¼ x 6¾ in.; bound in waterproof cover; price, 50 cents, postpaid; published by H. C. Meline, 928 Second St., Des Moines, Ia. This book is published to fit a long-felt want among street railway employes, and the pages are ruled so as to give the following information: Date, car number, line, hours, rate and amount. One month to each page, of which there are 48, which makes the book cover a period of four years. The book also contains 24 pages of accident reports in a condensed form, to be used when accidents occur and thereby provide desirable material for taking notes immediately. The remaining 48 pages are ruled memorandum leaves, in addition to which are time tables covering all hours that cars on the various systems over the country are operated.

CLARKSON BULLETIN, Vol. II, No. 2. Issued quarterly by the Thomas S. Clarkson Memorial School of Technology; book of 80 pages; paper cover. This issue includes the usual school calendar, description of the courses of instruction, requirements for admission and degrees conferred, and a description of the Clarkson summer school.

THE ENGINEERING REVIEW, 1905. Published annually by the Engineering Societies of Purdue University. Pamphlet of 94 pages; size, 6 x 9 in.; bound in paper; price, 50 cents. This is the first issue of what promises to be a valuable publication, the contents being of interest to the engineering world. The editorial staff of the publication include the advance students of the engineering classes, with an advisory committee consisting of the professors of experimental, civil and electrical engineering. Among the articles included in this issue of interest to the electrical engineer may be mentioned the following: A Sub-station and Its Operation, by H. J. Lawson, '05; Progress in Electric Railroading, by W. S. Hall, '05; Preservation of Railroad Ties, by F. C. Hoffman, '05; Testing an Electric Car, by H. T. Plumb, associate professor of Electrical Engineering; and the Framing of Passenger and Freight Cars, by C. A. Seley, M. E., Chicago, Rock Island & Pacific Ry. Besides reading matter the book contains a list of the faculty of the university, the editorial board of the paper, a table of contents, and a few views of the grounds and buildings at the university.

"STIRLING," A BOOK FOR STEAM ENGINEERS. Book of 248 pages; 7½ x 10¼ in.; 60 figures; 63 tables and numerous full-page illustrations and diagrams. This book is published by the Stirling Co., manufacturer of water-tube safety boilers for stationary and marine use, superheaters, bagasse furnaces and conveyors, chain grate stokers, steel stacks and breechings. The general offices of this company are in the Trinity Building, New York City, and its works are at Barberton, O., with sales offices in the largest cities of the United States and other countries. This work was edited by the engineering staff of the Stirling Co., and will form a valuable part of any engineering library, containing as it does the accurate description of water-tube boiler construction and the results of boiler study along some entirely original lines.

The earlier part of the book describes the history and the details of construction of the Stirling water-tube safety boiler, explaining its features of design, which insure strength, safety and freedom from expansion and contraction. Several pages are used in defining fuel efficiency and the efficiency of capital invested. Following this is a discussion of water-tube vs. fire-tube boilers, stating the advantages and disadvantages of each type and their adaptability for special classes of work. The subject of heat, its measurement and characteristics are considered. Air is also treated in a similar manner as is water. These discussions are of a technical nature and accompanied by various tables. The next portion of the book is devoted to a study of the effects of impurities in boiler feed water and methods for doing away with these.

Following this the next general portion of the book considers the

subject steam, defining the several different kinds of steam and their characteristic properties. Accompanying these definitions is a table of factors of evaporation and a table of the properties of saturated steam. The quality of steam and the method for measuring this by means of calorimeters are given, as are tables and formulæ for the flow of steam through pipes and orifices. An interesting section on superheated steam and the Stirling superheaters is included, as are cuts showing the different arrangements of superheaters, both in the boiler and independently fired.

Then follows a treatise of the subject of combustion, beginning with the chemical analyses and combinations necessary for combustion and including a discussion of the different American coals and their proximate analysis and calorific value. There are also similar discussions and analyses of other fuels, such as wood, straw, bagasse, natural gas and petroleum products. There is also included a discussion of the comparative values of oils and coal for firing purposes. Methods are given for determining the heat value of solid, liquid and gaseous fuels. The methods of burning fuels to the best advantage next receive attention, describing in detail the best plans for firing with the different fuels and illustrating the results by logs of several tests. A description and illustrations of the Stirling chain grate stoker are included in this portion.

The next general section considers the utilization of waste heat and describes in detail the methods for burning gases from coke ovens, blast furnaces, etc. This is followed by a treatise on stacks and draft, presenting the necessary formulæ and curves for the design of stacks and the approximation of their losses.

Following this subject are instructions and illustrations of methods for the analysis of flue gases. Steam boiler efficiency is defined, and a discussion is given supplemented with curves and various formulæ. Next is considered the horse power rating of boilers and the instructions for conducting boiler trials as laid down by the American Society of Mechanical Engineers. This interesting book concludes with a discussion of the principles of steam piping, drainage systems, valves, boiler and steam pipe covering, boiler cleaning, specifications for boiler setting and some timely remarks as to the care and management of the Stirling boiler, together with a complete subject index of the entire book.

The White Mountains.

Beautiful Scenery and Wonderful Works of Nature.

The White Mountains of New Hampshire are famous the country over as America's most beautiful summering section. The awe-inspiring and wonderful scenery; the magnificent grandeur of these "Crystal Hills"; the numerous handiworks of nature—interesting ravines; high mountain cliffs; wonderful, gorgeous, towering peaks; the marvelous profile in rock of the "Old Man" in Profile Notch and the figure of the White Horse of North Conway. There is something new to see every day in the mountains. The hotels range from the most palatial and sumptuous hostelries in the country to delightful boarding houses and cosy cottages and camps. Visit the mountains on your vacation! You will then realize the magnificence of New England scenery. A beautiful portfolio containing choice half-tone reproductions of the handsomest mountain scenes, entitled "Mountains of New England," will be mailed to any address by the General Passenger Department, Boston & Maine Railroad, Boston, upon receipt of 6 cents, and a descriptive book, profusely illustrated and containing a detailed description of the mountains, will be sent upon receipt of 2 cents in stamps; also a colored "Bird's Eye View of the Mountains as seen from the Summit of Mount Washington," will be sent upon receipt of 6 cents in stamps; or the whole for 14 cents.

Advertising Literature.

THE OPERATION OF SIGNALS is the subject of a recent pamphlet published by the Lintern Car Signal Co., 312 Electric Building, Cleveland, O., in the interest of its products. The description is illustrated with numerous diagrams and drawings.

"THE MACHINE TOOL AND THE MOTOR" is the subject of a recent publication of the F. Bissell Co., 226 Huron St., Toledo, O., and shows some modern practice in machine tool operation with "Northern" motors, for which this company is district sales manager.

THE WHEEL TRUING BRAKE SHOE CO., Detroit, Mich., is distributing a circular in the interest of the Wheel Truing Brake Shoe, which it claims to be a successful device preventing the necessity of sending rolling stock having untrue and flat wheels to the repair shop because it performs its work while the car is in service.

"SHORT JAUNTS FOR BUSY PEOPLE" is the subject of a recent publication of the passenger department of the Chicago & Northwestern Ry. Besides the usual map and time tables, the pamphlet includes illustrated descriptions of the many popular and pleasant summer resorts along its lines among the lakes of Wisconsin.

THE W. H. BLAKE STEAM PUMP CO., Hyde Park, Mass., is distributing catalog No. 25, describing and illustrating its products, which include its horizontal air pump and jet condenser; surface condenser with air circulating pump; twin vertical air pump and jet condenser and vertical cross compound air pump and jet condenser.

THE JULY NUMBER OF THE PUBLICITY MAGAZINE, devoted to the interests of the Jones stoker, contains some pertinent and interesting remarks regarding automatic stoking, as well as descriptions and illustrations of many recent installations made by the manufacturer, the Under-Feed Stoker Co. of America, Marquette Building, Chicago.

THE NATIONAL BATTERY CO., Buffalo, N. Y., in Bulletin No. 1, illustrates and describes in an interesting manner the installation of its product, "Unit Accumulatorss," in the central exchange of the Frontier Telephone Co., of Buffalo. The "Unit Accumulator" is a new storage battery which has met with no mean degree of success, having been patented only Jan. 11, 1905.

THE NEWTON MACHINE TOOL WORKS, Philadelphia, Pa., is distributing catalog No. 41, which briefly describes and illustrates the company's new rotary planing machines. These machines are now made of one general design in varying sizes, having cutter-heads from 26 in. to 100 in. in diameter over tools, and may be either plain, portable, on circular sub-base, or mounted on long bed to face off both ends of the work, simultaneously.

THE GENERAL ELECTRIC CO. has recently issued the following publications in the interest of its various products: Price List No. 5137, superseding No. 5135, Fan Motors; Flyer No. 2152, Concentric Diffusers and Adapters; Supply Catalog No. 7588, Repair Parts of GE-74-A Railway Motors; Bulletin No. 4407, Types EC and ES Field Rheostats; Bulletin No. 4410, Type C, Form P Circuit Breakers for Continuous Current Circuits; Bulletin No. 4411, Mercury Arc Rectifier.

THE AMERICAN STEEL & WIRE CO. has recently issued two interesting publications, the "American Fence Bulletin" and a "Treatise on the Use of Sulphate of Iron and Copper in Water Purification." The former is the first issue of a paper which will be issued frequently by this company in the interest of those who either want to buy or sell fence. The latter is self-explanatory and contains reports of the United States government experts on experiments conducted at Anderson, Ind., in February, 1905.

THE TWO-PLATE TYPE OF THE "CHLORIDE ACCUMULATOR," designed and manufactured by the Electric Storage Battery Co., Philadelphia, is described and illustrated in bulletin No. 92. This type was designed to meet a demand for a storage battery cell of small capacity, occupying a minimum amount of space and of a form readily installed. The installation of "Chloride Accumulators" for the Carnegie Steel Co., at Youngstown, O., is described and illustrated in Bulletin No. 95. The carbon regulator for automatic booster control is described in Bulletin No. 93. Bulletin No. 94 treats in a similar manner the company's "Exide" battery.

TYPE B INTEGRATING WATTMETERS, manufactured by the Westinghouse Electric & Manufacturing Co., are attractively illustrated and described in folder No. 4047. This is a new integrating wattmeter for single-phase 7,200 and 16,000 alternations for two and three-wire circuits. Circular No. 1103 is devoted to a description of the Westinghouse direct current series arc lamp and No. 1109 to the Westinghouse single-phase railway system. The company has just recently issued for distribution at the Lewis & Clark Exposition a very attractive publication which illustrates and describes briefly the lines of apparatus manufactured by the company and refers to the apparatus on exhibit there.

STREET RAILWAY REVIEW

Vol. XV | AUGUST 15, 1905 | No. 8

Electric Railways in and About Spokane.

In the state of Washington there are but few electric lines in operation. These western lines have, however, been constructed in a thorough manner, and although the passenger revenues are small compared with those of lines in the more densely populated districts of the east, yet the freight traffic that they enjoy brings sufficient revenue to warrant the expenditure for first-class roadbed and equipment.

When, in 1880, the Northern Pacific R. R. reached Spokane, its population was 300. This has rapidly increased to a population of 65,000, as given by the school census for 1904. In 1889 the city was practically destroyed by fire, but has been entirely rebuilt with a type of construction which compares favorably with that of any city west of Chicago. The rapid increase in population has necessitated corresponding activity in all forms of construction work. Spokane is a distributing point for over 150 towns within a radius of 200 miles. Examination of this tributary country shows that its products are gold, silver, copper and lead from the north and east and wheat and farm products from the south and west.

Three trans-continental steam railways enter Spokane with their through business, and there are 14 branch lines which radiate to serve the tributary country. The Spokane River, which flows from east to west through the center of the city, furnishes available water power, a large capacity of which has been developed and is now used for industrial purposes.

Washington Water Power Co.

All of the water rights of the Spokane River available for the city of Spokane are owned by the Washington Water Power Co., which also owns and operates the urban railway system of Spokane and the 17-mile interurban line between Spokane and Medical Lake. The Washington Water Power Co. is a consolidation of the light, power and railway compan[illegible] organized [illegible] Spokane's development. The Spokane Electric Light & Power Co. was organized in 1886, the name being changed [illegible] to the Edison Electric Illuminating Co. At this time the Edison plant consisted of one No. 12 [illegible]-ampere generator and a [illegible]-light machine, which is stated to be the first installed west of the Mississippi River. In 1889 the Washington Water Power Co. was formed and made a contract to furnish [illegible] to the Edison company. This plant was started in operation December, 1890, with four pairs of generators in service.

BIRD'S EYE VIEW OF SPOKANE FROM CUT ON SPOKANE & INLAND RY.

The plant was designed, however, for 16 pairs of Edison direct current machines and 24 pairs of 50-light arc machines. The original plant had two penstocks, 7 ft. in diameter. When put in operation there were six pairs of 10-in. and two pairs of 15-in. Victor turbines, with additional valves for two pairs of 10-in. and two pairs of 15-in. turbines. In 1897 a pair of 10-in. turbines was thrown out and two pairs of Leffle 23-in. turbines installed. In 1903 another pair of 10-in. turbines was taken off the line.

A 10-ft. penstock was completed in 1899 and two others of the same diameter were added in 1903. In June, 1903, there were installed two 4,000-volt, 2,250-kw., G. E. alternators, each driven by 40¼-in. Stillwell-Bierce & Smith-Vaile turbines, and also a 750-kw., 550-volt direct-current generator and a 750-kw., 300-volt generator, driven by a 33-in. S. Morgan Smith wheel. One of these generators supplies railway current for Spokane and the other supplies the Edison lighting system. At the same time there were installed three motor generator sets and two 200-kw., 1,500-volt lighting generators supplying the three-wire distribution system. The old apparatus in use comprises a considerable number of 125-volt, 50-kw. machines for lighting service and several D-62 Edison machines. The transformer equipment of this station is designed for raising

[illegible] nection the transmission potential will be either 45,000 or 60,000. Local business is cared for by 2,300-volt transformers. In the [illegible] and in delta on the low tension side.

The penstocks from the dam to the power house are about 550 ft. in length, the fall from the dam to the wheel being 45 ft. and

SPOKANE RIVER FALLS, NEAR POWER HOUSE OF WASHINGTON WATER POWER CO.

the fall from the wheel to the tail race 23 ft., giving an effective head of 68 ft.

The Washington Water Power Co. transmits current to the Coeur d'Alene mines, the distance being 80 miles to the first sub-station and 101 miles to the last. There are eight sub-stations, five of which were put in service in 1903. At the sub-stations current is stepped down to 2,300 volts. The transmission line is No. 2 medium hard copper, with the wires placed at the vertices of an equilateral triangle 42 in. on a side. Poles are 35 ft. long and

COEUR D'ALENE TERMINAL OF COEUR D'ALENE & SPOKANE RY.

spaced 125 ft. apart, except in Burke, where 65-ft. poles have to be used in order to meet local conditions. Burke is in a gulch so narrow that there is only room for two rows of houses and a roadway. This roadway is occupied by two railroads, two telegraph companies, one telephone company, one electric light company and the Spokane-Coeur d' Alene transmission line. Sixty-five-ft. poles are necessary to get this last line above the other wires. When trains pass on either of the railroads the inhabitants have to get inside their houses.

The street railways operated by the Washington Water Power Co. comprise 67½ miles of track. The standard construction is 60-lb. T-rails in 60-ft. lengths, laid on fir or tamarack ties 6 in. x 8 in. x 7 ft. In paved streets the concrete beam construction is used with 70-lb. 7-in. T-rails, the beam being 15 in. wide at the top, 10 in. at the bottom and 9 in. deep, of concrete, consisting of one part portland cement, three parts sand and six parts stone broken to pass through a [illegible] ring. The concrete beams are placed at such a depth as would bring the rails one inch below grade. The rails are then put in place, shimmed up to grade and grouted with concrete, consisting of one part cement, two parts sand and three parts broken stone. Granite paving blocks are placed each side of the rail, with a flange way of 1½ in. All of the track was welded by the Falk joint process.

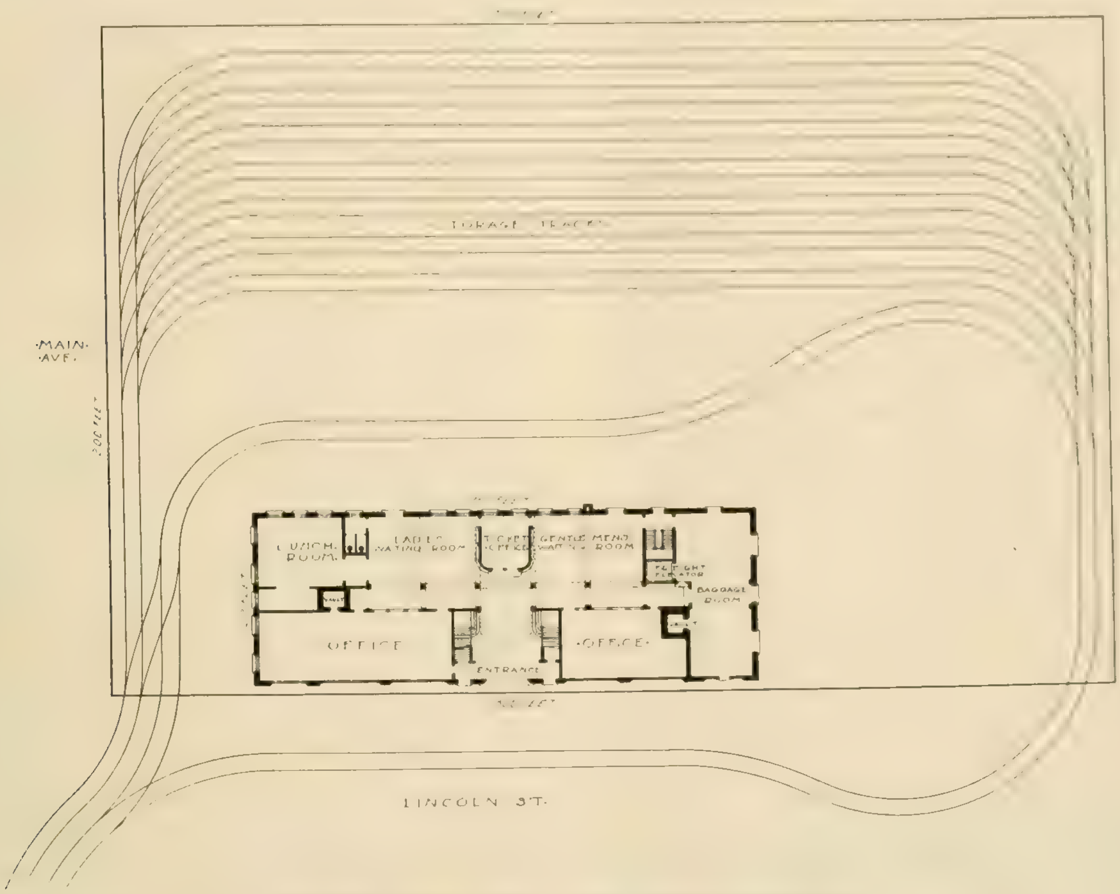
The rolling stock comprises 70 motor cars, 39 of which are the Brill convertible or semi-convertible type, equipped with GE-67 motors and National Electric Co. air brakes. These cars are mounted on Brill No. 27 trucks. The rest of the equipment consists of cars of the California type, mounted on Brill maximum traction trucks, with GE-800 and GE-52 motors.

The company employs about 150 trainmen and about 25 men in the carpenter, painting and forge shop forces. In the train service, the day men work 11 hours straight in the morning or afternoon with a dinner relief, or swing runs, which are from 5:30 to 11 a. m. with a layoff until 6 or 7 p. m., when they go on to complete their runs. One lay off is given to trainmen each week, and if a

man is called upon to work that day he is paid at the rate of time and one half.

The system has some ten lines, nine of which are from three to three and one half miles in length, and the other, known as the Hillyard line, is six miles long.

The company has a park about two miles from the center of the city. Baseball is one of the attractions. There is a natatorium with a pool 40 x 80 ft. and 80 dressing rooms. Only soft drinks are served in the park. Music is provided on Sundays and holidays and a dancing pavilion is one of the attractions in this connection. During the park season, which lasts from the first of May until the end of September, a great many picnics are held there, there being tables, swings for children and other picnic furniture provided. No charge for admission to the park is made. The attendance is greatest on Sundays, when there are usually in the neighborhood of 8,000 persons. To insure that fares are collected on the return trip passengers buy tickets, which are collected as they pass through turnstiles to board the cars.



BUILDING PLAN AND TRACK LAYOUT, SPOKANE TERMINAL CO.

The officers of the Washington Water Power Co. are: President, H. M. Richards; secretary and purchasing agent, H. L. Bleecker; treasurer, H. E. Perks; manager, D. L. Huntington; railway superintendent, G. P. Lumsden; master mechanic, T. P. Kelly; electrician, J. B. Fisken.

Spokane Traction Co.

The Spokane Traction Co. controls the Spokane & Montrose Motor Railroad Co. and also has city franchises. The company has 17 miles of track, comprising a loop of six blocks in the center of the city, a line running north to Corbin Park, 1¾ miles; a line south to a partially developed district on the bluffs known as Manito Park addition, and four miles extending east to the city limits, and the Montrose narrow gage line, originally operated by dummy. Current for operating the line is furnished from the plant of the Washington Water Power Co.

In paved streets the track construction consists of 70-lb. T-rails, 7 in. high, in 60-ft. lengths, cast welded by the Falk process and laid on concrete stringers 14 in. wide by 10 in. deep. After the rail is in position 3 in. more of concrete is put in place around the base. Inside the rail a granite block strip is laid with 1¼ in. flange way. Outside the rail [illegible] laid. In unpaved streets [illegible] ties spaced 18 in. center to center [illegible] about a mile on the Corbin Park [illegible].

Fifteen motor cars [illegible] mounted on [illegible] stock.

The officers of the Spokane Traction Co. are: President, Jay P. Graves; vice-president, A. L. White; secretary, Clyde M. Graves; treasurer, H. B. Ferris; manager, B. J. Weeks; purchasing agent, C. M. Graves; superintendent, H. D. [illegible]; [illegible] A. L. White.

Coeur d' Alene & Spokane Ry.

Thirty-four miles east of the center of Spokane, at that point where the Spokane River leaves Lake Coeur d' Alene, is the mining town of Coeur d' Alene. The town [illegible] has a population of about 4,000.

There has now been in successful operation for some time past the Coeur d' Alene & Spokane Ry., connecting these two cities. This line follows the valley of the Spokane River, crossing the river about midway between the two cities, at which point the Washington-Idaho state boundary line also intersects the course of the river. The total length of the line, including two miles of city track is 34 miles; for 22 miles of this distance the electric line has a private right of way, varying from 60 to 200 ft. in width. The alignment and profile of the track and the construction of the roadbed allow the operation of passenger trains at high speeds and are conducive to economical handling of freight traffic. Rails of 60-lb. A. S. C. E. section with steam railroad standards for ties and ballast construction are used. The joints are bonded with Brown plastic bonds. Current is supplied to the cars through a single figure-8 trolley wire supported 22 ft. above the track by span construction. Current is purchased from the Washington Water Power Co., and transmitted at 22,000-volts, 3-phase from the generating station at Spokane to two rotary converter sub-stations, where, after being converted to railway current it is fed to the trolley through a system of No. [illegible]

This road offers both passenger and freight service, which are

conducted as on steam lines. The rolling stock includes 9 combination cars, 11 passenger trailers and two motor cars for handling express. These are all of Brill manufacture and were illustrated in the "Review" for June. The passenger schedule provides for nine trains each way daily; this passenger schedule is increased to meet the demands of the traffic, which sometimes requires twice this number of trains.

Three electric freight trains which carry passengers are also operated daily. A limited passenger train leaving Spokane in the early morning and returning from Coeur d' Alene late in the afternoon makes the run in 65 minutes, which is 20 minutes faster than the schedule of passenger trains.

The shops and barns are located at Coeur d' Alene; near these is a terminal depot and freight yard, an exterior view of which accompanies this article.

The officers of the Coeur d' Alene & Spokane Ry. Co., Ltd., are F. A. Blackwell, president; R. F. Blackwell, first vice-president and general manager; Jay P. Graves, second vice-president; C. P. Lindsley, secretary; William Dollar, treasurer; Ira H. Shallis, assistant secretary and auditor; J. C. White, chief engineer; E. H. Belden, general counsel; Waldo G. Paine, traffic manager.

Spokane & Inland Ry.

Construction work is now in progress from Spokane south on an electric railway which it is intended shall eventually serve all the rich territory lying between Spokane and Lewiston, Ida. Mr. Jay P. Graves, who was instrumental in promoting and bringing into successful operation the Coeur d' Alene & Spokane Ry., and who is president of the Spokane Traction Co. and manager of the Granby mines and smelter, is promoting this extensive electric railway undertaking, which will make tributary to Spokane a territory as yet undeveloped along electric lines. Associated with him as directors of the company are Messrs. F. A. Blackwell, F. Lewis Clark, John Twohy and Alfred Coolidge. These men have been closely identified with many of the more successful enterprises which have helped to build up Spokane and the adjacent country.

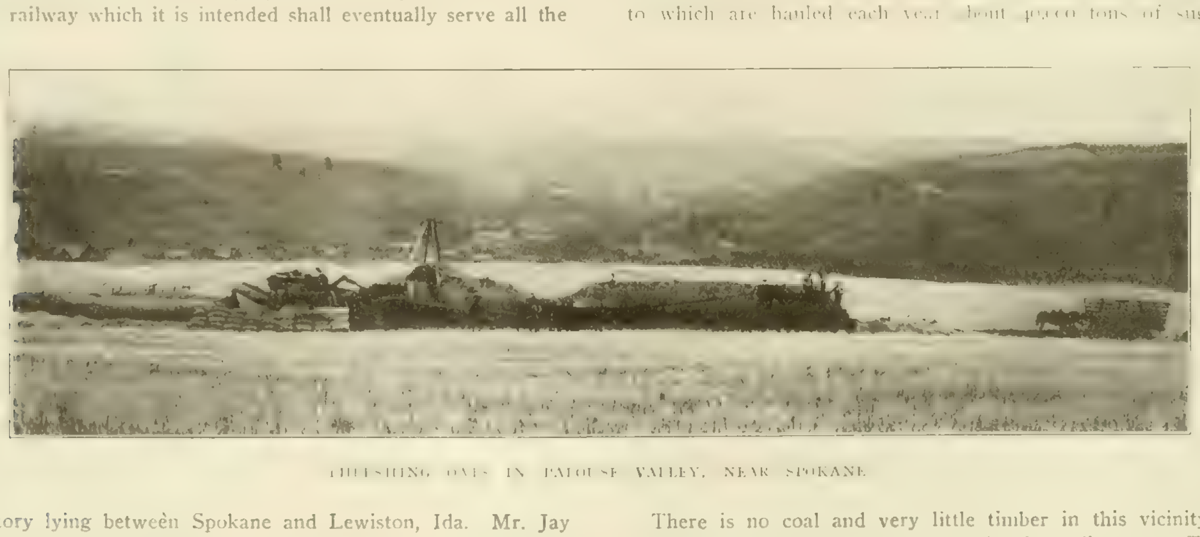
The Spokane & Inland Ry. was granted its charter Dec. 17, 1904, and is authorized to issue 35,000 shares of capital stock at $100 each. The accompanying map shows the location of the route of this line as it has been decided upon and is now being built between centers of the city of Spokane and Waverly. From Waverly south two general locations, either of which may be built, present themselves. The easterly one, if built as outlined, would serve the towns of Oakesdale, Garfield, Palouse, Colfax, Pullman and Moscow. The westerly route from the junction point shown would pass through the following towns: Rosalia, Thornton, Colfax, Pullman and Moscow. The former route is 110 miles long and the latter 100 miles long. The territory tributary to these two lines, which careful study has shown to be the most feasible routes, is now occupied, as may be seen from the map, by trunk and branch lines of the Northern Pacific Ry. and the Oregon Railroad & Navigation Co. At the present time these steam lines operate very few trains, and the schedule of these is inconvenient for those desiring to do business in Spokane. From Moscow to Spokane the Northern Pacific runs two 4-car trains each way daily. These are well patronized. The fare charged by the steam lines in Washington is at the rate of 3 cents a mile, and it is proposed to establish a rate of 2 cents a mile for the competing electric lines.

The principal product of this territory is wheat, and it is stated that crop failure is unknown. At Waverly is a sugar beet factory, to which are hauled each year about [illegible] tons of sugar beets

There is no coal and very little timber in this vicinity, so that fuel is high priced and must be hauled long distances. The timber belt on the north, ends 10 miles south of Spokane. It is anticipated that the distribution of fuel will prove a profitable source of revenue for the electric road. At Pullman is located the Agricultural College and School of Science, with over 1,000 students enrolled, and the State University of Idaho, located at Moscow, only 13 miles away, has about 750 students.

Careful estimates place the probable traffic of this line at 1,300 passengers per day from Spokane to tributary points in the so-called Palouse country. Ultimately, when the Spokane & Inland Ry.

MAP OF SPOKANE & INLAND RY.



THRESHING OATS IN PALOUSE VALLEY, NEAR SPOKANE

reaches the Snake River, which is a tributary to the Columbia River, flowing to the Pacific, the line would enjoy a [illegible] interchange of passengers and freight with the boat lines. From Spokane through to the Snake River the country to be served by this proposed electric line presents attractive inducements for such a roadbed and equipment as will be able to furnish shipping facilities for exporting the great quantities of farm products and importing manufactured goods.

The construction of a satisfactory roadbed on either of the routes outlined does not present any serious engineering features. The

HARVESTERS BINDING WHEAT IN PALOUSE VALLEY.

total difference of elevation between Spokane and Moscow approximates 450 ft., and it is thought that a ruling gradient of 105.6 ft. per mile can be established. The roadbed will be built with a view to double tracking it at some future time. Steam railroad construction will be standard, with 70-lb. A. S. C. E. rail and 7 x 7 in. x 8 ft. ties. It is proposed to build the track work so that trains can be operated safely at a speed of 50 miles per hour. Power will be furnished to the new line from the generating station of the Washington Water Power Co., in Spokane. It is planned that the railway company will later build its own power plant on a satisfactory location that has been acquired about eight miles below Spokane on the Spokane River. It has not been decided yet whether the standard direct current system of distribution or some

ROCK CUT ON SPOKANE & INLAND RY.

type of single-phase alternating current distribution will be used for the operation of the cars. With the former there would be about five rotary converter sub-stations located approximately 20 miles apart, with storage batteries at each and other storage batteries half way between these sub-stations.

It is planned to have the rolling stock comprise two steam locomotives, four 2-car passenger trains, seven 3-car trains, nine electric freight locomotives, 29 box cars and 39 flat cars. The passenger trains will consist of one motor car equipped with four 125- [illegible] It is proposed to [illegible] tives and operate these at night.

The car barn, repair shops and freight sheds at Spokane will be built upon land [illegible] property [illegible] economical shipping and transfer facilities. A terminal in Spokane for the passenger traffic of the Spokane & Inland Ry. and the Coeur d' Alene & Spokane Ry. is illustrated herewith. This building will be up to date in every detail and will present a pleasing appearance. Near the passenger [illegible] will be built seven car storage tracks and a loop around the terminal to aid in the making up of trains.

West Penn Railways' Trade Mark.

The [illegible] the West Penn Railways Co., contains the following, under the title "Our Insignia":

"Steam railroads for the greater part have a distinctive design which appears on schedules, advertising matter and frequently on rolling stock. Almost everyone recognizes the dome of the Capitol at Washington as the emblem of the B. & O., while the Pennsylvania railroad has chosen the Keystone as its trade mark, the Maltese Cross of the Big 4, the railway track running into the setting sun of the Southern Pacific and the triangle of the Chicago & Alton are all well known designs. Quite a number of electric railways have adopted a trade mark, and the design here is the one chosen by the West Penn Railways.

"The names of the three counties of Fayette, Allegheny and Westmoreland being inscribed on the triangle representing the strength and solidity of that portion of the state, while the name of the West Penn Railways appears on the encircling ring, representing the splendid facilities for travel throughout the enclosed counties furnished by the West Penn Railways."

Street Railway Claim Agents' Association.

The American Association of Street Railway Claim Agents, which was organized at the St. Louis convention last year, is making preparations for the coming convention at Philadelphia, and its secretary, Mr. B. B. Davis, Columbus, O., has sent on the following circular letter regarding the meeting:

"In the week of September 24th the American Street Railway Association will hold its meeting in Philadelphia, Pa. It is essential that the American Association of Street Railway Claim Agents should meet at this time and place. To that end permission has been secured from the Philadelphia Rapid Transit Co. for the use of its office rooms for that purpose, and the association will meet in room No. 1048 Land Title Building, Broad and Chestnut Sts., on Tuesday, September 26th, at 11 o'clock a. m. The secretary will be at this office on Monday, September 25th, between 9 a. m. and 2 p. m., to receive any claim agents or representatives. It is important that we have as large an attendance as possible."

The program on this occasion will be a simple one, and besides the usual reading of the minutes of previous meetings, reports of the secretary and treasurer and election of officers, will consist of papers on accident claims and methods of fakirs, concluding with a general discussion of the subject of claims. It is hoped that the claim departments of the various members will be represented and participate in the discussion. The adjustment of accident claims is a vital one, and the benefits of an exchange of ideas and experiences along these lines are of value to all railway companies.

The Chicago & Joliet Electric Railway Co. purchased 40 acres of woodland known as the Dellwood, one mile south of Lockport, Ill., and will expend a large sum of money converting it into a park.

Recording Special Work and Special Work Renewals.

Anyone who has anything to do with the track department of an electric railway property will appreciate the importance of keeping the fullest account of special work and special work renewals. If proper records, conveniently arranged for reference, are not kept so as to show the location and details of all pieces of special work on the system, the work of the track department is unnecessarily com-

FIG. 1. KEY INDEX MAP OF SPECIAL WORK LOCATIONS.

plicated and annoying delays in the routine operation of the department will often arise.

The records of one well known company are particularly well organized in this respect, and the following description of this system of records contains a number of suggestions of interest and value.

In the first place the company's entire track system is divided into sections, and a key-map, as shown in Fig. 1, is made of each section. This indicates the locations of every piece of special work in the sec-

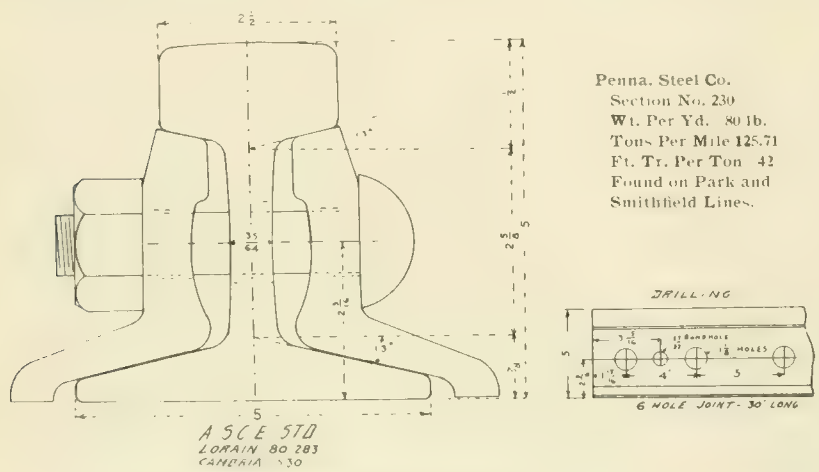


FIG. 3. DETAIL SHEET.

tion for which it is drawn. Each location is given a number, and each special work location is thereafter known by that number in all departments. All detail sheets are numbered to correspond to the numbers on the key index map. The maker's blue-print, all subsequent renewal prints and other data regarding each location, bear this location number. The original prints and all subsequent prints are folded and placed in envelopes bearing the proper index number, location name, drawing number, etc., and are then filed in a cabinet, which is indexed for reference by means of a card system.

Detail sheets, as shown in Fig. 2, are made of each separate piece of special work, and these are intended to show rail sections in the work, connecting sections, paving, curb-lines, joints, sewer and water-mains and manholes, radii of switches and curves, and all other necessary information.

In connection with the detail sheets, rail section sheets are also made up (Fig. 3), showing the various rail sections in use, together with information as to drilling for joints and bond-holes.

Blue-prints of index and detail sheets are bound in book-form with fastening clips. Rail section sheets are bound also, but are kept under separate cover from special work sheets. The detail sheets for each section are, of course, bound in a book by themselves, with the key-index map for that section on top, so that for ordinary reference to any particular piece of special work it is necessary only to determine the location number from the index map, and then turn immediately to the detail sheets in the book. If information is required that is not given on the sheets reference is made to the records in the cabinet.

The column-headings, shown in Fig. 4, represent the blank form used by the track and roadway department in making up requisition for special work renewals, and Fig. 5 is the form for keeping records of work asked for and work received.

The Cambridge Rapid Transit Developments.

The Boston Elevated Railway Co. has informed Mayor Daly of Cambridge, Mass., that it cannot accept the recent legislative subway act unless it is changed to provide a two-track instead of a four-track subway. At the time the bill passed the legislature a provision was attached that it should not become law unless accepted by the company's directors within two months thereafter, and it was also believed that the subway could be built for $5,000,000. Since the passage of the act the engineers, officers and directors of the company have been over the whole question with the utmost care, and it is their unanimous opinion that the cost of the proposed four-tracks subway would be at least $7,000,000, exclusive of equipment of the subway, of rolling stock and of power. Mr. George A. Kimball, engineer for the Boston Elevated Ry. estimates the cost as $7,900,000, and has consulted with Messrs. William Barclay Parsons and George S. Rice of New York and also Mr. Howard A. Carson of Boston in regard to the matter, as well as with Mr. Lewis S. Hastings, city engineer of Cambridge, whose estimate is $6,333,800.

In view of these considerations, which place the estimate of cost $2,000,000 higher than was at first expected, the road states it cannot accept the act, bearing in mind proper service for the public, fair treatment of employes and reasonable returns to stockholders. The present standard of service cannot well be lowered; the wages of uniformed employes have been increased by a large amount during the past two years, and the following increase in fixed charges is anticipated by the company during the next three years:

The annual interest upon $7,500,000 of 4 per cent bonds issued May 1, 1905; the rental of the Washington St. tunnel, about $27,000; and the increased cost of operation involved in the extension of the elevated road to Forest Hills. The company recognizes the necessity of rapid transit to Cambridge, but cannot see its way clear to undertake additional burdens which are not necessary for safety and convenience of the whole service. It believes that an elevated railway is far preferable to any underground route, both from the standpoint of the company and the traveling public, and that the cost would be much less. Nevertheless the company will accept the act of 1905, provided it is amended to provide for a subway of sufficient size for two tracks instead of four.

An Attractive Electric Railway Folder.

An elaborate railway folder has been issued by the Puget Sound Electric Railway Co., of which Mr. W. S. Dimmock is general manager, containing 16 pages of time tables, and views taken along their lines. The cover is in red and green, with a beautiful half-tone of Mount Tacoma in the center. There are 17 half-tones in the folder, six of which are views of Tacoma. The wharves, Point Defiance Park, Spanaway Park, Spanaway Lake, Wright Park, Stellacoom, and a bird's-eye view of the city are shown. Maps of Tacoma and Seattle are shown, as is also a map of the territory over which the electric railway runs. Points of interest in the two cities are described, and time tables of the railways with which the electric cars connect are given.

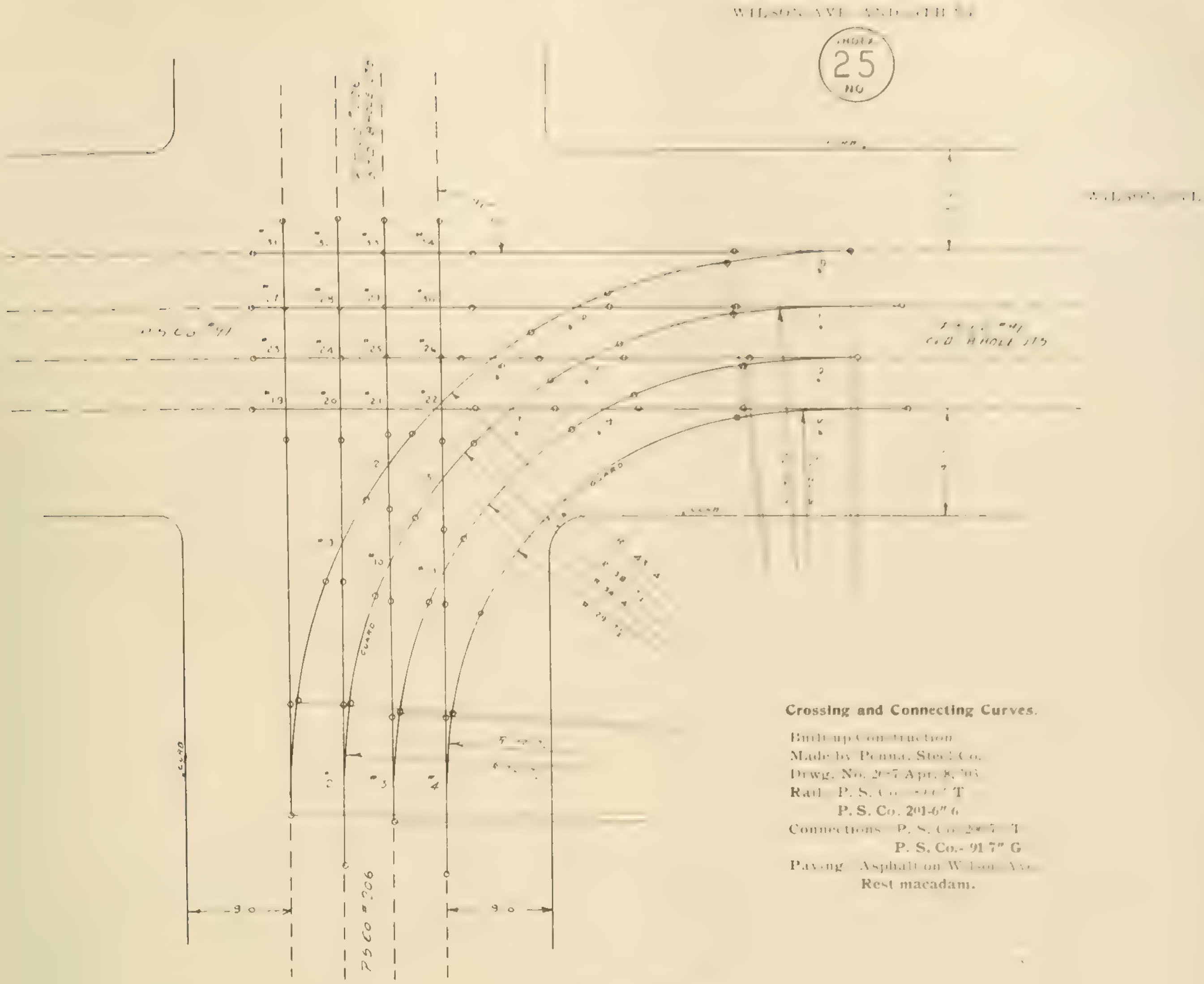


FIG. 2—DETAIL SHEET.

SPECIAL WORK REQUISITION

DATE, FEBRUARY 27, 190[illegible]

Location	Index No.	Make and Orig. Drwg. No.	Frogs	Switches	Mates	Curves	Combined Pieces	Rail Section	Connects with	Switch Tongues	Complete Crossovers	3 Way Frogs	Remarks
Salem and Polk	4[illegible]	P. S. C. 2497-4	No. 10 14 1[illegible]	No. 24	No. 3	None	No. 5 Sw. & Mate	PS Co. 20[illegible] 6 in. T	P. S. Co. 20[illegible] 6 in. T	None	None	None	

FIG. 4—SPECIAL WORK REQUISITION.

SPECIAL WORK ACCOUNT

DATE, JULY [illegible] 190[illegible]

Index No.	Location	Work	Style	Order Nos P. S. Co.	Order Nos Maker	Date of Orig. List	Drawing No.	Date Rec'd	In Stock	Where	Date Placed	Cost	Cost Labor	Renewals or New Work
1927	Anapamu and Douglas	Frogs	L. S. Co. Hard Cent.	1728	P.S.Co. 3840	Feb. 10-03	27968	July 17-03	July 24-03	Market St.		[illegible]		Renewals

FIG. 5—SPECIAL WORK ACCOUNT.

Some Methods Used in Car Barn Construction With a View to Fire Protection.

In the "Review" for March, 1901, an article was published on precautions against losses by fire, in which was included the practice in several of the larger cities. With the development of street and interurban railways there has been corresponding progress in the construction and protection of car houses, and some of the methods used in recently constructed buildings should be of interest. While good watchmen are almost unanimously considered the best safeguards against conflagrations, there are many practices which in event of fire will confine the damage to limited area.

Recently there has been considerable attention given to the adaptation of automatic sprinklers for car barn service. From the standpoint of the street railway manager there has to be considered whether an installation of this character will result in such a reduction of insurance rates as to warrant the initial expense. So far as we know, the underwriters in general have adopted no fixed rule on this point.

An extensive installation of sprinklers in some barns would present a more or less serious problem in that it would be difficult to dispose the necessary overhead piping in such a fashion that it would not be struck by trolley poles of the cars when they are shifted in the barn. Also in northern latitudes, if a sprinkler system is installed that requires the pipes to be filled with water normally, a serious expense for heating the barn is involved that might more than compensate for any more saving in insurance premiums. This question of sprinklers is quite important, and we purpose going into a more extended discussion in a future issue and contenting ourselves now with a review of the methods adopted in connection with a number of buildings recently constructed by leading street railway companies.

Baltimore.

The shop and car house buildings of the United Railways & Electric Co., of Baltimore, are virtually fireproof in construction, but elaborate precautions have been taken to prevent the spread of fire among the cars and materials. The employes have been drilled in the use of hose, fire signals, etc., and hose stands connected direct to city mains are placed a few feet apart all through the buildings. All large supplies of oil and varnish are kept in a separate building; in the shop a small room has been partitioned off for mixing purposes and for keeping small quantities of such supplies as are in constant use. This room has a terra cotta roofing, and a large chimney passes up through this and through the main roof, it being the theory that flames and heat will pass up this chimney in case of fire in the room. Traps are also provided to the sewer system under the building, so that in event of fire the burning material can be flushed down through a trap and extinguished.

Wareham, Mass.

The car house of the New Bedford & Onset Street Railway Co. at Wareham, Mass., is a brick building adjoining the power house. A 1,000-gallon underwriters' fire pump is placed in the annex of the boiler room and supplies the hydrant system in the yard and the sprinkler system in the car barn. The pump is arranged with suction from the condenser well, and draws water from a large tank in the yard, which in turn is supplied with water from the river. A small tank is also located on the roof of the car barn, so as to make sure of there being pressure at all times in the sprinkler pipes, the flow of water to the hydrants and sprinklers being controlled by valves in the yard. In addition to this sprinkler system in the roof, sprinkler pipes are carried under the floor between the pits, in accordance with recommendations of the fire underwriters.

Pittsburg.

The Pittsburg Railways Co. has some seventeen car houses, the largest of which is at Homewood, where the operating building has a capacity for 50 cars and the storage building for 120 cars, with yard tracks for 125 cars additional. In 1903 the company built at McKees Rocks a car house for storage purposes, the construction of which is fire proof. The side walls and rear end walls are of brick 13½ in. thick, and the building is divided longitudinally by an 18-in. brick fire wall. The roof is of expanded metal and concrete laid on rafters of 7-in. girder rails 30 ft. long. The window sills and other trimmings are of sandstone, and the front end of the barn is closed by two rolling steel doors. The floors are paved with fire brick set on edge. The company has its own telephone exchange, and all fire alarms are reported to the telephone operator, who at once orders the nearest emergency crews to report at the proper points.

Hartford, Conn.

The operating and storage car house of the Hartford Street Railway Co. has a frontage of 250 ft. and a depth of practically 500 ft.; the building is of brick with concrete foundations for all walls. A rather novel plan of fire protection was installed at this plant, and instead of elevated tanks for water storage purposes a concrete reservoir was built underneath the bottom floor line of the repair and inspection pits extending across the building under seven tracks. In the excavation for this was laid a bed of cinders 4 in. deep, and on this a 6-in. bed of concrete. The top of the reservoir forms the floor for the repair pits, and consists of 6 in. of stone concrete supported on concrete piers strengthened by expanded metal embedded in the concrete. The rails of the car house are supported on iron colmuns resting on the concrete piers. The reservoir has a storage capacity of 100,000 gallons of water, and is fed from the city mains, the supply also being augmented by the drainage from the entire roof area of the building. The automatic sprinkling system in the roof of the building, and also standpipes conveniently located, are supplied by fire pumps which are connected with this storage reservoir. This system met with the approval of the fire underwriters, and resulted in a reduction in the fire insurance rate on the building.

Columbia, S. C.

The advantages of slow burning mill construction for street railway car houses, and the details of this construction as applied to the car house of the Columbia Electric Street Railway, Light & Power Co., of Columbia, S. C., were shown in an article by Mr. J. O. DeWolf, in the "Review" for August, 1903. Space will not permit of a detailed description of this construction here, but its advantages may be summed up briefly, as follows: Each floor is made continuous to avoid openings through which fire can travel from one floor to another. Automatically closing fire doors or hatchways separate the different floors or rooms, while the stairways, if not placed in fireproof towers, are encased by incombustible partitions. Timber in large and solid masses is used so as to expose as few projecting corners as possible to the flames and thereby better resist fire, and the entire construction interposes no obstructing timbers to prevent water being effectively applied to the fire. Besides safety against fires and facility for fighting and extinguishing them, economy of construction is its advantage.

Birmingham.

A very desirable feature was introduced in the construction of the car house of the Birmingham Railway Light & Power Co., at Birmingham, Ala., a set of fire doors being placed in the center of the building, so that in the event of fire in one end of the house, by lowering these doors the cars in the other half would be protected. The walls of the building are of red pressed brick, the roof of composition supported by steel roof trusses, the floor of rolled cinders and the pit floor of concrete. A thoroughly reliable fire system has been arranged independent of the city fire department, consisting of a 10,000-gallon tank conveniently located, with coils of hose with nozzles attached distributed at frequent intervals throughout the building. A similar system is to be found in the car shops, and employes of both the barns and shops are carefully drilled, so that should a fire break out each man knows just what he is expected to do and the usual confusion attending fires avoided.

Paterson, N. J.

The new car house of the Public Service Corporation at Paterson, N. J., is a structure of brick with slate roof supported by steel trusses. The apparatus for fire protection installed here follows the standard adopted in the car houses recently constructed by this company. In addition to the ordinary water connections there is an independent 6-in. water main, run from a 12-in. main in the street, through the entire length of the barn, from which are taken connections for seven fire hydrants. The fire hydrant adopted as standard is the 4-in. solid stream, frost proof Corey; each is equipped with a 14-in. hand wheel permanently fastened, so that the valve may be opened at any moment. Attached to every hydrant is 100 ft. of 2½-

in rubber lined hose, with couplings and brass hosepipe to [illegible] in., which is stored on hose racks placed on the wall, spanner wrenches being provided with each rack. Twenty "Underwriters'" fire extinguishers are distributed throughout the building, a 50 gallon chemical engine is provided ready for emergency service, and 16 sets of fire pails containing sand and water are placed in racks on the walls about the barn. An auxiliary fire alarm system was installed and is maintained by the New York & New Jersey Fire Alarm Co. Seven alarm boxes, which are connected to a main alarm box on the front of the building, and which are in turn wired up to the city's fire alarm circuit, are distributed around the building. Red incandescent lamps are installed over all fire extinguishers and blue lamps over fire alarm boxes, and are kept burning, so that the fire appliances may be readily located. Two electric bells are situated in the superintendent's office, one ringing in case an alarm is sent in and the other should any part of the auxiliary system get out of order. A watchman's clock system is in effect from 7 p. m. to 7 a. m., and there are 16 stations around the property from which the watchman reports every hour.

Chicago.

For the protection of the shops and car storage yards of the Northwestern Elevated R. R., Chicago, the company has recently installed in its new storage battery and sub-station building adjacent to the Wilson Ave. terminal, a fire pump, which supplies a system of piping covering the shops and yards. The pump is of the triplex type with capacity of 428 gallons per minute and is driven by a 35-h. p. direct current motor. In connection with the pump is installed an automatic control mechanism furnished by J. G. Schureman, of Chicago. When the pressure in the fire main drops below 60 lb. the automatic device closes the starting switch and the pump operates until the pressure in the main rises to 120 lb., when the motor automatically cuts out. The pump supplies five lines of hose of 140 lb. pressure. At various points about the shops and yards are placed 26 lines of 2½-in. hose. Where these are outside of buildings and would be exposed to the weather a wooden shelter house about 3½ ft. square is placed over the hose racks. By arrangement with the captain of the nearest engine house of the Chicago fire department, frequent inspections of the premises are made at unexpected times. The inspector turns in an alarm and the efficiency of the apparatus is tested each time, water being put on all lines of hose that bear on the quarters from which the alarm was sent.

A collision in Chicago between an automobile and an electric car that resulted in favor of the former occurred recently, when an automobile crashed into the rear of the car and forced it off the tracks and to the curb. The car was hauled to the barn by the wrecking crew, while the automobile, one of the big sight-seeing machines, lumbered away without having been damaged.

Electric Tramways in Lima.

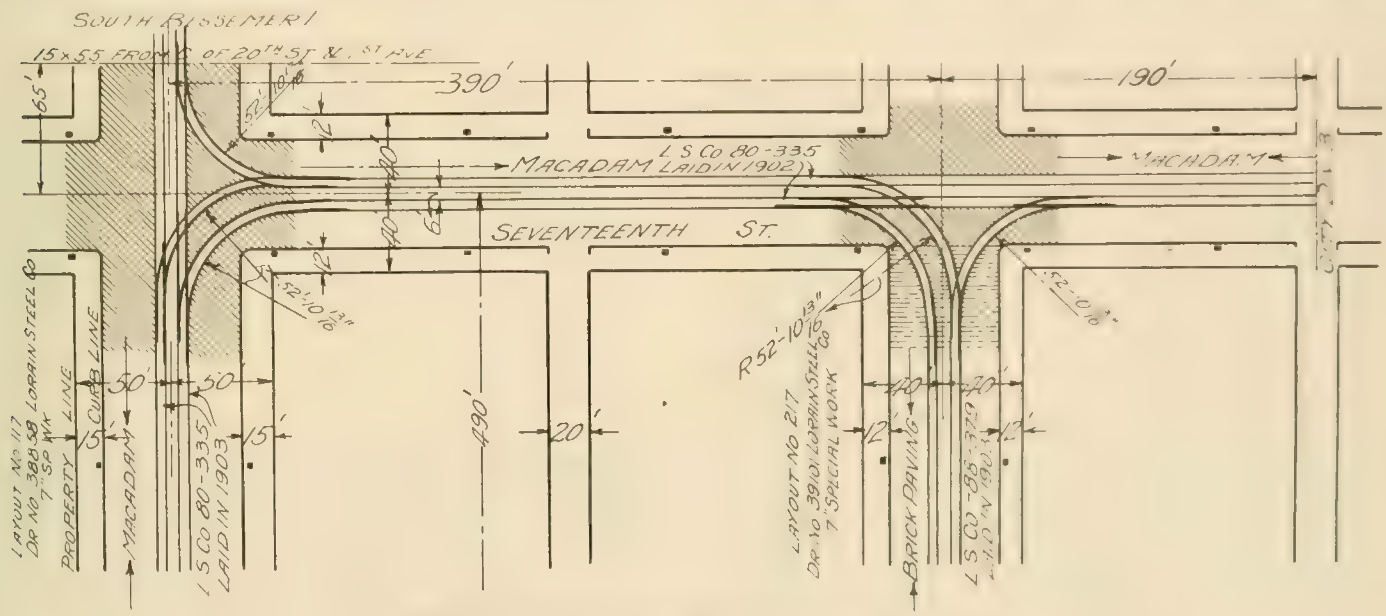
Under date of [illegible], United States Minister, Lima, Peru, writes to the Department of Commerce and Labor, as follows:

"In pursuance of the authorization of a supreme resolution of April 12th, a contract has been entered into between the Ferrocarril Urbano de Lima and the provincial council substituting overhead trolley for horse traction on all the street railways of Lima (about 16 miles in extent). The new system is required to be in operation within two years from the signing of the contract, and 5 kilometers (3.1 miles) of new road between specified points in the city must be in operation within the five following years. A new company, representing American and local capital, succeeds the old one, and the electric and other new material required has been ordered from the United States, as happened in the case of Lima's two suburban lines now in successful operation."

Birmingham Track Records.

The Birmingham Railway, Light & Power Co. has had prepared, as a concise record convenient for reference, drawings showing its tracks in plan and profile, together with pertinent data as to the class of construction, materials, pavements, character of special work, location of poles, etc. These drawings are upon sheets 46 x 17½ in., the record proper being within border lines 42 x 15½ in. The character of the pavement is indicated by section lines, macadam being shown by diagonal lines run from lower left to upper right, brick pavement by vertical broken lines, granite blocks by double sectional diagonal lines from lower left to upper right and upper left to lower right. A good idea of the character and extent of the information contained on one of these plans is given by the accompanying engraving, which represents a section about 5½ in. wide from one of the sheets.

The profile drawings are made on sheets of the same size to a scale of 50 ft. to the inch horizontally and 10 ft. to the inch vertically.



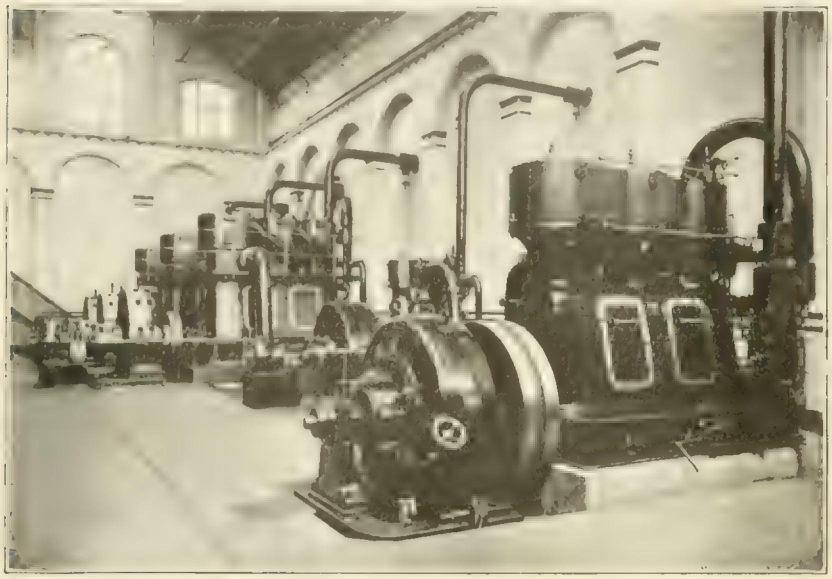
SECTION OF DRAWING SHOWING TRACKS IN PLAN WITH DATA.

"Outings For All Summer Long" is the subject of a recent folder of the Aurora, Elgin & Chicago Ry., the third-rail electric road between the Fox River Valley and Chicago. Besides the usual information regarding time tables, fares, a description of the line, etc., an unusually fine panoramic map of the route is shown in colors in the interior of the folder. This company is making an active publicity campaign in and about Chicago, which is meeting with a great deal of success. The pamphlet was published by Rand, McNally & Co., Chicago.

Exeter Corporation Tramways.

[illegible] Devonshire, has been long in securing good transportation facilities, but it now has a system of electric tramways which brings it well up to date, and shows that although a town may have many religious and historical associations, it need not therefore necessarily have no modern conveniences.

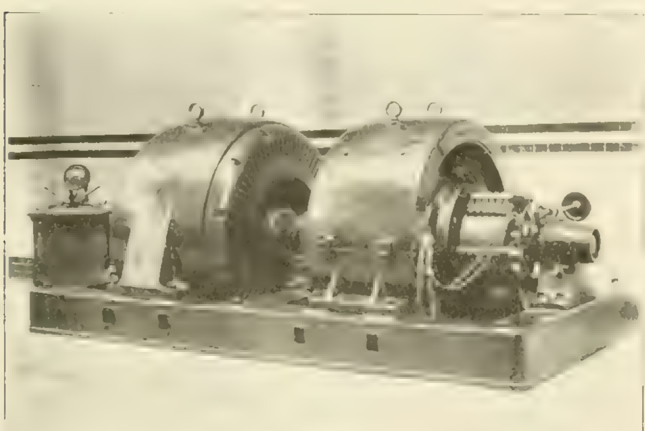
Some 25 years ago an attempt was made by progressive spirits



INTERIOR VIEW OF POWER HOUSE.

[illegible] but the scheme met with such violent opposition that by far the most useful sections had to be abandoned.

The sections built were duly opened, but as their value was so materially crippled through the exclusion of the lines from High St., the principal thoroughfare, financial failure resulted, and the company suspended operations. The undertaking was taken over by a syndicate, which very soon was compelled to abandon the service to St. David's Station (at one extremity of the line), on account of the excessive cost of working which the severe gradient of St. David's Hill entailed, and although this was the most useful section so far as the public were concerned, the unfavorable conditions under which it was run made it impossible to pay expenses.



[illegible] MOTOR GENERATOR SET.

Operation on two other sections (Heavitree and Sidwell St.) was continued, and although each of these was only about three-fourths of a mile long, they earned a fair revenue.

The syndicate owning the tramways had powers extending over a period of 21 years, and before the expiration of this time attempts were made by outside companies to enter into an agreement with the Exeter Council with the object of inducing the latter to take over the tramways and to convert them for electric traction, at the same time extending the routes throughout the whole town, but after much negotiation the scheme fell through. When the period of 21 years had nearly expired, at the November elections in 1900 the ratepayers were asked to give their views as to the future of the tramway service in Exeter, and a large majority voted in favor of an electric tramway system owned and worked by the city.

A committee was formed in 1902 to visit tramway systems in England and in France, its object being to inspect and report upon the best system to be adopted, due regard being had to the possibilities of motor omnibuses. The committee recommended that the overhead trolley system should be adopted for all the proposed routes with the exception of those running through High St. and Fore St. While a large number of residents and property owners favored a conduit system for High St., it was decided finally to have one uniform system throughout the district, and to equip all the lines with the overhead trolley.

In the negotiations which preceded the promotion of the bill for the Exeter Corporation Act of 1900, the Council promised to erect a new bridge across the river Exe in place of the existing structure, with as low a gradient as possible, and with a width of not less than 50 ft. between the parapets. The old bridge was opened for traffic in 1778, and was of stone with three arches, but it was narrow and so highly crowned that a new bridge to suit the increased traffic and to enable tramways to cross the river was greatly needed. The bridge has now been built at a total cost of £25,000. It is a handsome steel and iron structure with one span, covering 150 ft., which leaves the bed of the river free from all obstruction.

The gradient of the road on the St. Thomas side is now only 1 in 20, as compared with 1 in 10 on the old bridge, and the Exeter City side is now level where a gradient of 1 in 20 formerly prevailed, while a symmetrical appearance has been preserved in the elevation, as seen from the river, by the treatment of the ornamental fascia work.

A bill was promoted in Parliament in 1903 to give the council powers to buy the horse tramway system and to build and equip new lines in the city for electric traction. This measure met with very strong opposition in the House of Commons, many of the opponents being of the opinion that the streets traversing the central portions of the city were far too narrow to allow of electric trams, and that the introduction of electric traction would deprive the town of much of the sentimental interest which naturally is associated with an ancient cathedral city, and especially one possessing such quaint and historical buildings. The opposition failed, however, in the face of the practical needs of the district, and the bill passed through the committee without further opposition.

BABCOCK & WILCOX BOILER UNITS.

It was ultimately determined not to include the whole of the construction scheme in the first contract, but to build only the trunk lines, extending the existing horse tramways; arrangements were subsequently made with the Heavitree District Council for an extension of the lines from the main street of that suburb.

The first portions of the tramways were opened formally by the Mayor, E. C. Perry, Esq., on April 4, 1905, comprising the route from St. David's Station to Heavitree and to Blackboy Road, while the St. Thomas section received the Board of Trade certificate on Saturday afternoon, April 29th, and traffic was commenced at once without any further formality.

The contract for the permanent way and overhead equipment was given to Dick, Kerr & Co., of London and Preston. The track, which has now been completed, measures 4¼ miles in length, and comprises 2⅛ miles of double line and an equal length of single line with turn-outs. Wherever possible, double track has been laid

OPENING CEREMONY, APRIL 4, 1905.

in order to give more rapid service and to facilitate the ordinary traffic, while along a great part of Fore St., which is a straight road running sharply down to the river, interlacing track has been made use of. The gage is 3 ft. 6 in., adopted as most suitable for a city with such narrow streets as those in Exeter.

The rails weigh 90 lb. per yard and are of 6-in. girder section, laid upon a cement concrete foundation 6 in. thick, the under bed of concrete being packed up to the true alignment by fine cement concrete, averaging ¾ in. in thickness. The points and crossings were supplied by Hadfield's Steel Foundry, Ltd., of Sheffield, and are of that company's patent "Era" manganese steel, all the special work being laid out at the works before being fixed in position.

The road surface between the rails and for a distance of 18 in. on each side is paved with Welsh and Devonshire granite sets, except in certain streets in the center of the town, and in front of several places of worship, where hard wood paving has been used in preference, while throughout the whole of High St. and in parts of other streets hard wood blocks have been used across the entire road surface.

The steepest gradient is in Fore St., which runs down to the river, and varies from 1 in 11½ to 1 in 13. Another heavy gradient is on St. David's Hill, where there is a sharp curve, the fall here being 1 in 16.

The overhead equipment has no very original features. Center poles, side brackets and span wires have all been used where they appeared to be most suitable, the aim being to keep the overhead wire as near as possible over the center of the track, although the trolleys are of the swivelling pattern and capable of any reasonable amount of deviation from the center.

The lines are double insulated throughout. Section pillars are fixed at the usual ½-mile intervals, the feeder cables being of the lead-covered paper insulated pattern supplied by Siemens Bros. & Co., Ltd. They are laid in Sykes' stoneware ducts throughout. All the section boxes are connected by telephone both with the generating station on the river banks and with a car shed, and the Board of Trade test wires run to the ends of all routes. The telephone and test wires are carried in the conduits used by the feeders so far as they extend, and are then continued overhead and are attached by brackets and insulators to the poles. Guard wires are hung above the trolley [illegible] graph wires cross the road.

The rolling stock comprises 12 double-deck single-truck cars, supplied by Dick, Kerr & [illegible] have a total seating capacity [illegible] accommodated inside [illegible] are of the [illegible] on the roof [illegible] ductors on the platform. The ventilation and seating arrangements are of the [illegible] out passengers, and [illegible] with two motors [illegible] brake are provided with the Newell magnetic track brake. The cars are further provided with an electric device which automatically prevents the car from running backwards on a gradient in the event of the driving current being cut off.

The Philipson patent lifeguard is fitted to all the cars, which are also equipped with a patent folding step which interlocks with the folding gate upon the platform in such a way that the gate cannot be opened until the step is in its correct position. This device is extremely useful, but experience has shown that it is liable to derangement in practice. In order that the efficiency of the brakes should be kept up to the mark, and should be always, as it were, under inspection, stopping places have been instituted on the steepest part of some of the gradients, and as a car must always stop at these points, the brake failing to act would be at once noticed and the defect remedied.

The cars are painted dark green and gold with the city arms emblazoned on the side panels. The uniforms of both drivers and conductors are of blue cloth with red facings. The Bell Punch & Printing Co., of Tabernacle St., London, E. C., supplies the tickets used.

The power house is on a site adjoining the Exeter City Basin, close to the River Exe. It is a very handsome design, and covers a space of about 150 ft. square. It comprises boiler house, engine

POWER HOUSE, EXETER CORPORATION TRAMWAYS.

room and offices, and annexes to accommodate economizers, feed pumps, etc. The chimney is of brick, 155 ft. high, with an internal diameter of 8 ft. 6 in. The power house is used both for lighting and traction, and contains five Belliss-Westinghouse generators, of which one has been specially put down to take the traction load, while any of the others can be used for traction purposes with the aid of a rotary converter, which has been installed by Bruce, Peebles & Co., of Edinburgh. The boiler house is 102 ft. long by 55 ft.

wide, and contains six Babcock & Wilcox water-tube boilers fitted with superheaters and chain grate stokers. The total boiler capacity is about 2,700 h. p. The steam piping is on the ring system. Coal is delivered direct into chutes from a siding of the Great Western Ry., which runs beside the station, and after weighing is delivered to a gravity bucket conveyor, which carries it into the bunkers over the boilers; these hold 500 tons. Both the stokers and the conveyor are electrically driven, the motors being of the Westinghouse two phase induction type.

[illegible]

H. D. MUNRO.

The engine room has been designed with a view to future extensions and the possible use of much larger units than are now installed, and is exceedingly lofty and well lighted. It measures 102 ft. long by 45 ft. wide, and is lined throughout with glazed bricks with a floor of "Terrazzo" marble paving. A gallery runs along one side and end of the engine room and accommodates the switchboard and gives access to the offices and boiler house.

An overhead traveling crane of 10 tons capacity runs the entire length of the engine room, and is placed at such a height that it would be available in the event of much larger units being installed.

The engines are of Belliss & Morcom triple expansion pattern and are coupled direct to Westinghouse generators. These generators have a total capacity of 1,500 kw., and with the exception of the traction set, generate two-phase alternating current at 2,200 volts. The traction set has a capacity of 200 kw., and generates direct current at 500 to 550 volts.

One of the illustrations shows a 200-kw. Lacour rotary converter supplied by Bruce Peebles & Co., of Edinburgh. This was designed especially to meet the specifications of Mr. Munro, the electrical engineer, to convert the two-phase alternating current to direct current for traction purposes, so that any one of the lighting sets may be used on the tramway load in addition to the direct current unit, or in place of it. The efficiency of this machine is from 89 to 90.5 per cent at half to full load. The temperature rise is 70° F. after six hours running at full load. The machine is arranged to stand an overload of 25 per cent for two hours, or 50 per cent for half an hour. It is compound wound, and runs at 600 r. p. m. when giving its rated output.

Current from the generating sets is led by Siemen's lead covered cables in stoneware ducts beneath the floor to the switchboards on the main gallery. The lighting switchboard consists of marble panels for each alternator, and for each section of the main feeder cables. Each panel is fitted with the necessary switches, regulating apparatus, and indicating and recording instruments. A separate switchboard is used for the traction supply. Special care has been taken to give ample room both in front of and behind the switchboards, while all parts carrying high pressure current are well protected from access by unauthorized persons.

The offices comprise a room for the chief engineer on the second floor, a general office on the first floor, and test, store, and mess rooms for the staff on duty, a handsome entrance hall, lavatories, etc., while on the ground floor there is a repair shop, equipped with electrically-driven tools, and a cable room for testing the feeders and mains.

For its size the Exeter power house ranks very high among British stations, and leaves very little to be desired in the way of space, light and the arrangement of the generating sets and boilers.

The car shed is of brick with Portland stone dressings, and with glazed and buff brick facings inside. The roof is carried on steel stanchions and lattice girders, and is glazed with Rendle's "Invincible" glazing. There are three tracks at present, having accommodation for 15 cars, while provision has been made for extensions which will enable 20 more cars to be housed if necessary.

The shed contains a repair shop, smithy, paint shop, stores and mess room, while the offices comprise a committee room, general office, manager's office, conductors' room, etc. Tools are now being installed to facilitate the handling and repair of cars, pits 4 ft. 9 in. deep being constructed beneath the tracks.

Mr. W. R. P. Hederstedt, A. M. I. C. E., whose long experience in railway and tramway matters of construction and administration are well known, was retained early in the year by the Exeter Corporation as its consulting officer. Mr. Hederstedt has been responsible for putting into working form the traffic requirements, which, from results already arrived at, open up a promising prospect for the future. Although one of the principal routes had not been passed by the Board of Trade on Easter Monday, the traffic receipts for that day reached the respectable total of £100, and this figure would have been increased very materially had a longer mileage been available. Mr. Hederstedt is now acting as chief officer of the tramways.

Mr. H. D. Munro, city electrical engineer, has charge of the whole of the electrical side of the undertaking, and much credit is due to him for the manner in which the equipment of the power house and tramway scheme has been carried out. Mr. Munro has acted jointly with Mr. Thomas Moulding, the city engineer and surveyor, who designed the car shed and offices.

Letters of an Old Trolley Conductor to His Son.

Dear Jim:

You seem to have found the road to glory a trifle rough, some low joints and the ballast on top of the track instead of under it, but you are away off in thinking 50 per cent of your passengers are cranks; the trouble is the half dozen contrary critters you buck up against every day riled you till you didn't notice the 500 people who had their nickel ready and stepped lively when they got off. Some people are cranks from pure cussedness and some are born cranks and can't help it—puts me in mind of the feller who mixed sawdust with the meal that he fed his hens. He thought they would never know the difference, but they did, and when the first setting of eggs were hatched half of the brood were woodpeckers. They just naturally couldn't help it, so when your born crank gets on the car don't give him a chance to exhibit his crankiness; surround yourself with an atmosphere of unfailing good nature, use tact and judgment and he'll capitulate nine times out of ten. The chap who is a crank out of pure onriness deserves different treatment. Try the non-aricular method on him—that is, don't hear his bellowings and growlings about the service, his remarks about the kind of change you gave him, and his oponion of conductors in general. Sometimes it's pretty hard to tell the two breeds apart, for as the Village Philosopher said, "In the school of experience the lessons don't come till after the examinations," and sometimes you get into a row with a passenger before you know it, but always turn the argument to good account and resolve to avoid trouble with the next dyspeptic who gets on the car.

Then there's the smart young fellow who knows it all and tells you how the road ought to be run and what he would do if he were running it. The best way to handle him is to treat his volunteered information with courteous silence, and don't argue with him, for "you can't rivet a nail in a boiled potato," and your duty is to look after the welfare of your passengers instead of discussing the policy of the road.

Be courteous to your passengers and thoughtful of their comfort, for a road is judged by the kind of conductors it keeps, and I want my boy to be a credit to the R. & G. road. Be honest, self-reliant and courteous at all times with your patrons, and remember,

"It's easy enough to be pleasant, when life goes along like a song;
But the man worth while is the one with a smile
When everything goes dead wrong."

Affectionately,

Dad.—Trolley Talk.

Piping and Power Station Systems. IX.*

By WILLIAM L. MORRIS, M. E.

Journal Lubrication

The subject of handling engine or journal oil will next be considered. This is a subject that affords unusual opportunity for study. The great variety of oil handling systems now in use seems to illustrate a lack of knowledge of the subject because of the widely different types of apparatus employed for the same service.

A few general characteristics of oils should be borne in mind when considering this subject:

1. Engine oil never "wears out." Its value as a lubricant improves by wear, if it is kept free from all foreign materials.
2. Oil will incorporate with water under certain operating conditions and the water so incorporated will not precipitate.
3. Oil containing paraffine will become frothed by agitation. This quality can be determined by shaking a half filled bottle.
4. The better the lubrication qualities of oil, the more readily will water incorporate with it.
5. Precipitation will remove impurities which cannot be filtered out of used oil.
6. Filtration to be effective must be carried on slowly, not to exceed ¼ gallon per sq. ft. per hour.
7. The process of evaporation will alone liberate water incorporated with oil.
8. Paraffine serves no useful purpose as a lubricant, but causes gumming and retards perfect distribution in the journal.
9. Cylinder oil added to a journal lubricating system makes the oil less fluid and if engine oil is properly compounded any added fats are detrimental.

An oiling system should be purely a commercial proposition; a means of saving in the cost of operation. It should reduce the quantity of oil used and the amount of labor required for handling. The plan of piping oil to such parts of an engine as journals, pins, etc., whose rapid motion tends to throw off the oil is a useless one if no provision is made for catching the drips. An oiling system has a tendency for accustoming its operators to the use of large amounts of oil and it thus becomes practically impossible to induce an operator to regulate the flow of oil so that it will be just sufficient for lubrication and not allow any waste in drips.

Early in the design and plans for a station, the decision should be made as to whether or not an oiling system will be used so that when the machinery is ordered there can be incorporated in the design such details as will help to make an efficient and effective oiling system. Main journals, crank pins, cross heads and similar parts should be provided with oil guards, pockets, drains, etc., and it should be specified that all bearings be guarded so that when a continuous stream of oil is fed, all the surplus oil will be caught and directed into drop openings and thus returned to the system. Bearings that cannot safely be flooded with oil do not belong on an oiling system.

Under quite ordinary conditions the engine of a 1,500-kw. unit would have oil fed to it at the rate of a barrel an hour, which would be called simply, "liberal lubrication." When men get accustomed to seeing oil fed in this manner it is useless to try to induce them to feed through an oiling system at the rate of a drop a minute.

For such bearings as have no oil guards, the only practical method is to insist that these bearings be oiled by hand and thus they will use as little oil as possible and save themselves extra labor in filling. Many of the unguarded journals, such as small wrist pins, valve gears, etc., can be well and economically lubricated by using grease in compression cups. Sponge grease is quite successfully used on valve gears of extremely high temperature. Those bearings not provided with oil guards or grease cups should have an ample number of oil holes suitable for lubrication from a hand oiler.

A return oiling system should serve the following engine bearings. Main bearings [illegible] eccentrics and stationary rocker pins of Corliss engines which have drip pans under them. It should be specified that the vacuum pump be provided with oil guards and drains for these same bearings. Much trouble is occasioned by the lack of forethought when ordering machinery, because it is useless to make provision for flooding a journal with oil if there is no provision made for caring for the waste oil and thereby allowing it to discharge onto the floor. The only method left in a case of this kind is to use extremely high grade oil, fill the cups by hand and endeavor to have no drips. In this case the practical method of learning when to check the oil supply is to notice whether the oil has run down onto the floor on account of too great a supply or whether too little oil has caused a hot bearing. Such a method of feeding oil is extremely expensive, not only on account of the oil wasted, but because of the injuries occasionally caused by hot bearings and the extra labor needed to constantly watch the oil feeds. As stated before, the machinery must be fitted for an oiling system in order that the use of such a device will be justified. The running of a lot of pipes to an equal number of oil cups signifies nothing more than that it takes the place of a man carrying the oil. The economy of an oiling system does not make itself appreciable when the journals have not been provided with a means for carrying away the drips and reusing them.

It may seem all right to say, "We will take up the matter of the oiling system when we come to it." The fact of the matter is that an engineer has "come to it" with every system to be installed the moment he starts writing the specifications for apparatus. He should by all means lay out all the diagrams for the entire plant before ordering anything.

Various systems are in use for delivering oil to engine bearings and returning drips to drip tanks. One system is the same as that shown in Fig. 57 for cylinder oil. The tanks, pumps, pump governors and distribution main, also the method of taking steam from two sections of the main header, are the same; the only difference is that the pressure used is not as high as that in a high pressure cylinder oil piping system. The same objections arise in handling engine oil as have been stated regarding the use of cylinder oil; that is, the pressure varies to such an extent that it changes the quantity of oil fed to the journals.

The system shown in Fig. 56 is also applied in using engine oil, the ability to maintain a constant pressure is gaged by the sensitiveness of the air compressor controller. Such a system necessarily gives a perceptible variation in the oil discharge whenever the air lines are used for other service besides supplying the oil tank. It is quite unnecessary to measure the quantity of engine oil used in a return system, because it is difficult to effect any perceptible saving when drips are returned. An operator may run 10 barrels through the system during his shift and the shrinkage on this amount during its circulation may not exceed two gallons. A very complicated system would be required if it was necessary to have such a large storage capacity and care for such volumes of oil and then be called upon to measure the loss of but two gallons. In practice this has not been considered at all essential. The chief requirement for an engine oiling system as before mentioned is that it may be thrown out of service on a moment's notice and some hand system substituted without necessitating the stopping of the engine or in any way endangering the journals. The system should be merely a convenience, readily dispensed with when necessary.

There are many styles of oil cups or feeders used to control the amount of oil fed to an engine. The style most commonly used, due possibly to the fact that it was originally used in hand oiling and was furnished with the engine, is the regular pattern sight-feed glass oil cup with the hole drilled in the top for a pipe nipple to attach the oil piping to the cup. A valve is placed in the line to the cup for regulating the flow to the cup the same as the regulated flow from the cup to the bearing. The necessity of

[illegible] feature because it requires very frequent regulation of the valve, and if not closely watched the oil will spill over the top or the [illegible] empty. [illegible] conspicuously. This style of cup requires constant watching of the feed and much manipulation of the valves.

A second style is that of the closed glass-body pressure-cup with one hand regulating valve. This cup requires less attention than the first style and it has only one half as many valves to shut off when closing down the system. The glass, however, is under pressure and a slight crack in it will cause a bad leak, and for the same reason, the joints at the ends of the glass must be securely made. These cups can be filled by hand by closing the valve in the pipe supply and removing the plug.

The third style is merely a regulating valve, there being two forms, hand closing and self closing. The hand closing valve can be set for the desired feed, so that when shutting down the machine and turning over the cam or other device this closes off the oil flow but retains the set for feeding. This style of valve is made by one manufacturer in conjunction with a regular glass sight

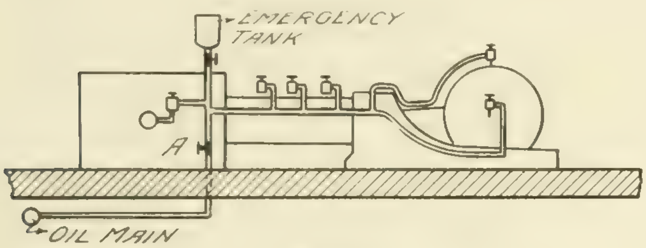


FIG. 59

feed cup, making a separate device of each up to the drop, sight glass. Automatic or self closing feeder valves are either of the diaphram or the piston form. An objection to the diaphram form is that it requires a very high pressure on the oil lines to operate, usually about 60 to 80 lb. when the copper diaphram is old and hardened. The piston form with a leak port to the journal works on as low as a 15-ft. head, making this type very satisfactory for use with gravity systems

Self closing valves are arranged to discharge oil to the bearings by opening the one oil main valve, thus allowing the pressure to open the automatic valves to the set position. Diaphram automatic valves are not used except with oiling systems. This is due to the pressure required for opening them, and the success of the operation of the machinery is contingent upon the successful operation of the oiling system. In other words, an oiling system of this type must always be in effective operation for continued running and therefore is not merely a convenience.

The requirements are very satisfactorily met by the piston type automatic valve with hand arrangement for feeding and regulating, when oil is fed by hand. This style allows the use of gravity oiling systems, is self closing, free from glass parts and can be used with a small reservoir at each engine as shown in Fig. 59 and allow the shutting off of the main parts of the oiling system, or it can be used independent of all piping as a separate hand fed cup. An engine oiling system of this type would have as one of its details an emergency tank placed just above the highest cup and arranged so that it could be filled by hand during those times when the oil main is out of service. Should the lines on the engine be damaged during operation the entire engine piping system could be shut off and the cups hand filled until the damaged section was capped up. Then the piping system would be opened and again be allowed to feed into the cups. If one or two of the cups were on the damaged portion of the pipe they could be filled by hand until such time as the engine could be shut down and the pipe work repaired. In regular service when the engine is to be started the stop valve A is opened, then all cups open from the oil pressure and start flowing. On shutting down the engine the valve A is closed and the lack of pressure to the engine oil supply allows all the cups to close automatically. This is quite a valuable feature on a large compound engine that has between 24 and 30 cups, and especially is it advantageous over a system of cups whose set must be disturbed to close the cups.

The supply to the feed main can be of the low pressure or gravity system for any of the different styles of feeders except the diaphram pattern self-closing cup. This latter type must be used with a fairly high pressure system if satisfactory operation is to be insured, and so gravity pressure is quite out of the question, because the head required for 80-lb. pressure in a gravity system would be 185 feet above the cups or somewhere near the top of the stack.

There are various methods of supplying the oil main but these requirements must be provided for if it is wished to have a practical and satisfactory system:

1. Any piece of machinery used to supply the oiling system must be so designed that it will permit of its being shut down for an hour or two without stopping the supply of oil to the engines.

2. All tanks, filters, and similar apparatus should be of the open pattern, which will permit complete inspection at any time.

3. Means must be provided for discharging any water returning with the oil drips.

4. All tanks, filters and similar apparatus must be so designed that they will permit of thorough cleaning while the system is in operation.

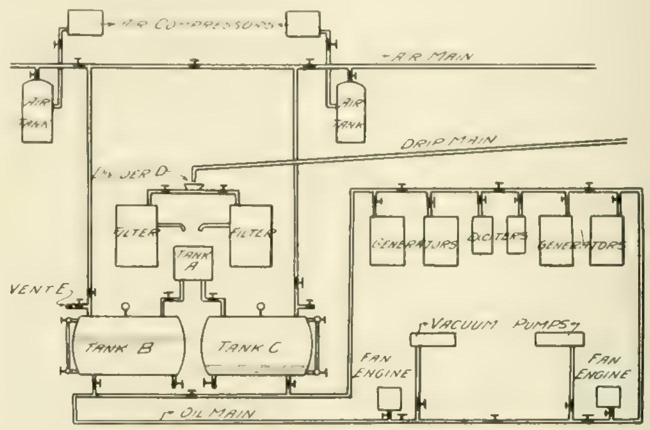


FIG. 60

5. Drip lines should be so designed that any branch or section can be cleaned out without taking the pipe work apart.

6. The system should be so arranged that it will operate continuously and not require constant watching to see that one tank will not overflow, another run empty, etc.

Some of the systems for supplying oil do not satisfy these requirements; for instance, engine oil supplied to the main by a pump and governor as in Fig. 57 requires the continued operation of the pump. The system shown in Fig. 56 requires the air compressor to be in operation continuously unless the storage air tank is of sufficient capacity to allow air to expand, say, from 20 lb. down to 10 lb. in discharging oil for two hours, which discharge may be four barrels. A tank of about 16 barrels capacity or 100 cu. ft. would be required to run such a system for two hours, but ordinarily the air tanks would not have over two or three barrels capacity, which would be sufficient for only 20 minutes' run. Another objection to the air system is the inability to properly clean the tanks, since they are closed in from view so that their condition cannot be noted.

Probably as satisfactory an air system as can be laid out is shown in Fig. 60. It will be noted that the tanks and air compressors are in duplicate. The filters are also in duplicate and arranged so that both can be worked in parallel, not in series, because the work done in a filter depends upon the velocity of the flow of the filtrate. The small open tank A is a receiver, designed to take the discharge from the filters during the time of changing over from tank B to tank C. When tank B is taking drips from the filter, tank C is under pressure. When the oil becomes low in tank C, the drip from tank A is closed and air pressure is put on tank B; when tank B is under pressure the valve to the oil line is opened and a tank put onto the system. Then the oil valve at the bottom of tank C is closed, air vent is opened and the valve between tanks A and C is opened, thus allowing the filtered oil to replenish the supply in tank C. If these tanks have a capacity of 8 or 10 barrels, then this arrangement of valves need not be disturbed for four or five hours. The tanks B and C accumulate much impurity.

Unless tank A has sufficient capacity to store the drips while tanks B or C are being cleaned, it may be found necessary to ... after shutting down the machinery at night. The device D must be a dividing arrangement which will allow one half the drips to flow each way. And this is rather a difficult detail to provide if it is wished that the division be even fairly accurate. Although not shown in the figure, all tanks would require sewer connections or outlets for water, refuse, etc.

This system, Fig. 60, fails to provide the necessary previously stated requirements, 2, 4 and 6, and unless the air tanks are large it will fail to provide for requirement 1.

Instead of using air as a pressure supply for the oil, the same system as that shown in Fig. 60 can have its pressure supply by water. In this case the oil would be taken from the top of the tank instead of the bottom and the water would be admitted at the bottom. The use of water in oiling systems should be eliminated as much as possible, not only in tanks B and C, but in the filters, because enough trouble is caused by water incorporating with the oil, even though every precaution is taken to avoid it. In one particular case the system shown in Fig. 60 was originally equipped for water pressure and was operated thus until the condition of the oil required the change to air pressure, about 30 per cent of that which was supposed to be oil was water permanently carried in suspension.

This difficulty does not appear in cylinder oil feeding systems which use a water condensation column to carry oil into a steam pipe, because cylinder oil is much heavier, and even though it would take up water the fact would never demonstrate itself, since the oil does not return to afford the chance to again take up more water and thus by repeated contact combine into a soapy mass of froth and foam that will neither flow in drain pipes nor pass by the needle valves of oil cups.

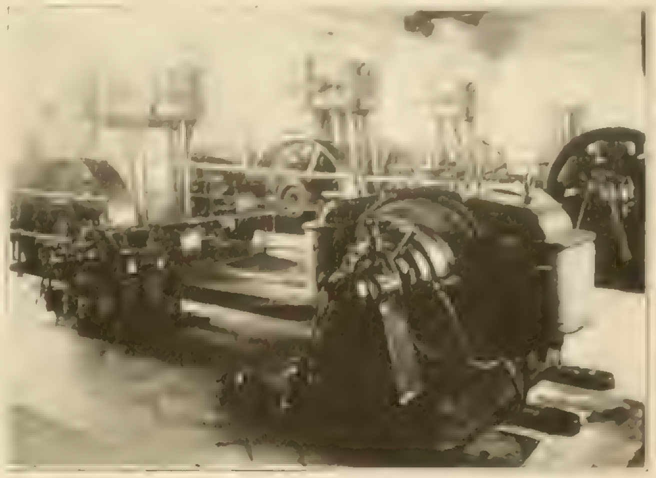
(To be Continued.)

The Tabor-Bechyne (Austria) Interurban Line.

The Tabor-Bechyne Interurban Ry., which has been electrically equipped by the firm of F. R. Krizik, of Prague, is not a very extensive one, but is interesting because of the use of direct current, supplied from a single station, and secondly, because the distribution is made on the three-wire system, permitting a potential of 1,400 volts direct current to be used satisfactorily. The road is 24.24 km. (15.2 miles) in length and is double track throughout. The maximum grades are 3½ per cent and the sharpest curves of 125 meters radius.

The power house is situated at one extremity of the line and there are no sub-stations. The difference of potentials between the two trolley wires is 1,400 volts; the track rails serve as the third or neutral [illegible] trolley and the rails. The power plant is about three-quarters of a mile from [illegible] initial pressure of 160 lb. per sq. in.

[illegible] with a storage battery, which is located some 800 meters from the power plant.



[illegible]

The city service is on a three-wire system with a maximum difference of potential of 440 volts. The connections between the storage battery station and the power plant permit the generators to be regulated from the battery house. For regulating the charging and discharging batteries there are motor driven boosters.

The railway generators are bi-polar machines of 80 kw. each, running at 500 r. p. m. and each giving 700-volt current; there is a storage battery in the station which consists of 700 Tudor cells with a capacity of 123 to 171 ampere-hours, according to the time of discharge one to three hours.

POWER HOUSE, TABOR-BECHYNE INTERURBAN LINE.

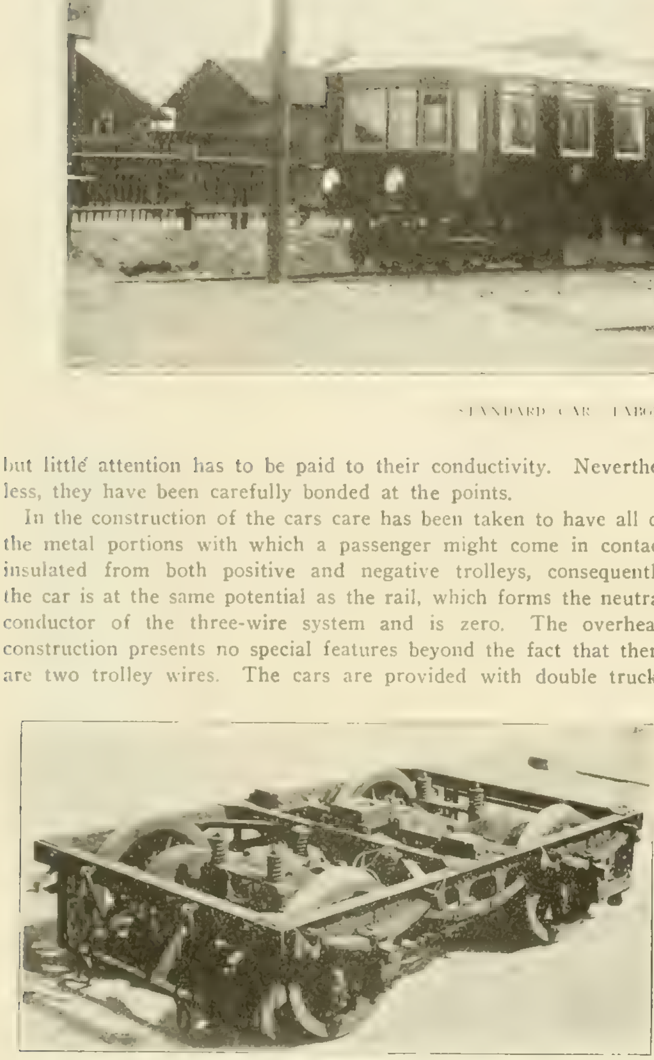
The section of the line near the power station is fed direct from the generators, while the other portion receives current through two feeders, each of which connects to a booster to compensate for the transmission [illegible]

with the two armatures mounted upon one shaft and the fields upon a single bed plate. At maximum load the potential of the current is raised about 116 volts in each machine, the regulation of the boosters being effected by the introduction of resistance in parallel with the fields. The boosters are belt driven from the steam engine.

The track is laid with steel rails of 21.75 kg. per meter. The rails are not called upon to carry much current and consequently but little attention has to be paid to their conductivity. Nevertheless, they have been carefully bonded at the points.

STANDARD CAR, TABOR-BECHYNE INTERURBAN LINE.

In the construction of the cars care has been taken to have all of the metal portions with which a passenger might come in contact insulated from both positive and negative trolleys, consequently the car is at the same potential as the rail, which forms the neutral conductor of the three-wire system and is zero. The overhead construction presents no special features beyond the fact that there are two trolley wires. The cars are provided with double trucks



DOUBLE TRUCK WITH 30-H. P. MOTORS.

and have a 30-h. p. motor mounted on each axle. They are series wound to give 550 r. p. m. with a current of 40 amperes at 650 volts. for running and six for operating the brakes. For starting, the Controllers are placed on each platform, each having eight points and two in parallel. For braking, groups of two motors are confour motors are connected in series, and in running are placed two nected in parallel. The car bodies are divided into three compartments, one for express matter and two for passengers, seating 10 and 30 persons respectively.

To protect its workmen the Metropolitan West Side Elevated Railway Co., of Chicago, uses signs reading, "Lookout for Men Working on Tracks." These are hung on the end railings of the nearest platform each way from the workmen.

New Orleans Railway & Light Co.

After considerable litigation the New Orleans Railways Co. has been reorganized and the control of its stock has passed from the hands of New York, Louisville and Amsterdam holders to those of New Orleans capitalists. The final steps in the reorganization were taken Saturday, July 8th, and a charter was granted to the New Orleans Railway & Light Co., July 12th. The reorganization was the result of a suit brought against the old company by the attorney-general of Louisiana to compel the New Orleans Railways Co. to reduce its capitalization from $80,000,000 to a figure that would more accurately represent the true earning capacity and value of the property. A receivership followed this suit, the properties of the company were sold at public auction to satisfy a floating indebtedness of $3,500,000 held against it by the trustee of the bond holders, the New York Security & Trust Co.; the reorganization committee bid in the property for the face of the debt and the suit was withdrawn by the attorney-general, with the understanding that the proposed new capitalization be reduced to $60,000,000. This has been done and the new capitalization is issued as follows: Bonds, $30,000,000; preferred stock, $10,000,000; common stock, $20,000,000.

The directors of the reorganized company are: A. B. Wheeler, Elwyn C. Foster, William Alder, J. J. Gannon, Hugh McCloskey, A. Brittin, W. R. Stauffer, S. P. Walmsley, T. H. McCarthy, W. E. Stauffer, A. M. Young, George A. Hero, Harry Baldwin, jr., and Joseph H. DeGrange. The members of the board who retired were: Jules A. Gauche, E. Perrin, B. T. Eshleman, Victor Leovy and Joseph McCloskey. At a meeting of the reorganized board of directors held July 27th, Mr. Elwyn C. Foster was elected president and Mr. Joseph H. DeGrange, vice-president and secretary.

In connection with the reorganization of this company a statement of the gross receipts for the first six months of 1905 as compared with those of the previous year should be of interest; it is as follows:

	1905.	1904.	Increase.
January	$448,172.88	$395,512.87	$52,660.01
February	429,041.31	412,153.38	16,887.93
March	478,119.29	384,826.98	93,292.31
April	428,636.17	375,018.48	53,617.69
May	427,700.89	385,747.16	41,953.73
*June	409,300.95	367,300.95	42,000.00
Total	$2,620,971.49	$2,320,559.82	$300,411.67

*Estimated.

The Accountants' Question Box.

Under date of July 15th, Mr. Elmer M. White, secretary of the Street Railway Accountants' Association, sent to members the list of queries submitted for the 1905 Question Box, which is as follows:

1. What is the best method of establishing a "Sinking Fund Account"?

2. What is the best method of filing canceled coupons?

3. In cases where a company operates both railway and lighting plants, what is an equitable division of expenses not directly chargeable to either plant?

4. What is the best method of computing car mileage and car hours, in detail?

5. What is the best method of handling employes' transportation by operating as well as accounting department?

6. Is it better practice to keep car, armature and wheel records at the shop or at the office?

7. What system do you think best in keeping track of scrap material?

8. What is the best method of destroying used tickets after an accounting has been made?

9. What are the methods used by interurban roads in the accounting of cash fares paid on the car? If registers are used, how many classes of fares have you, and do you register tickets according to their value?

10. On roads where single and round trip tickets are sold, is it the practice to carry indefinitely the value of the return coupon (not good after thirty days) in the ticket sale account, or are the values transferred to profit and loss at set periods?

11. Where a company is obliged to sell round trip and other tickets through conductors on the cars, what system is employed to keep account of tickets supplied to conductors? How often is their stock of tickets checked up? And is a deposit required from conductors to protect company against loss?

12. On an interurban line with collections made on zone plan, what is the method to obtain traffic statistics? For instance, a road of 21 miles has six separate 5-cent fare collections; how is the actual number of passengers carried through from one terminal to the other, or between certain stations, ascertained?

13. When a weekly pay roll does not end with the calendar month, what is the best way to separate it for a charge?

14. Is an individual receipt for each person on the pay roll considered better than the plan of signing on a book?

15. What is the best process of apportioning damages into operating accounts 33 and 34.

16. What is the best [illegible] expense incident to [illegible] damage?

17. What is the [illegible] Betterments" account for a particular fiscal year?

18. What are the [illegible] method of separate [illegible]?

19. What is the [illegible] that could be called [illegible]?

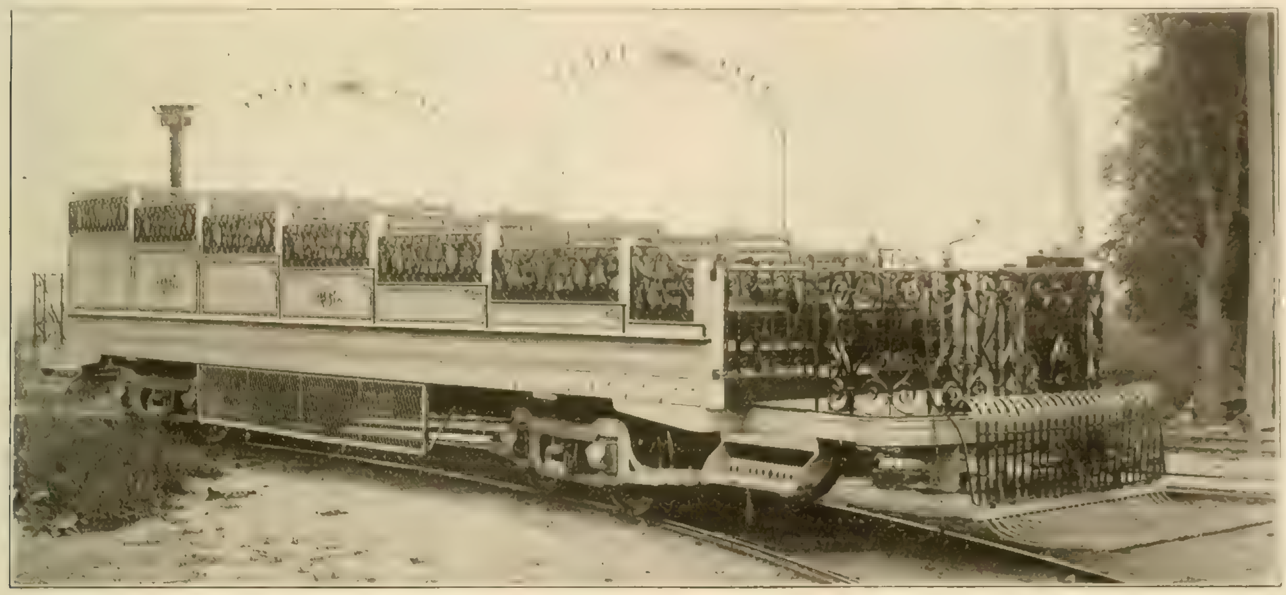
20. What operating expense accounts should be taken to get the cost of power per kilowatt hour? Should anything be added for interest or depreciation?

21. On a small road [illegible] checkers and ticket counters from the cash counters?

22. Should register totals be carried forward from day to day; that is, a record made so that the closing number can be compared with the opening number the next day?

New Observation Car for Montreal.

The Montreal Street Railway Co. has introduced something new in the line of observation cars. As may be seen in the accompanying illustration, the car is without the usual top, and the seats, in place of being all on one plane, are elevated one above the other, after the manner of seats in a theatre. There are in all six rows of these seats, with a broad aisle between them. Around the front platform is a handsome railing and gates which may be closed at will. Over the top, from side to side, are two heavy brass railings, from which are suspended 15 lights, each of 16 c. p. The car, which was designed by officials of the Montreal Street Railway Co., was built in the company's shops, and a patent on the car has been applied for.



OBSERVATION CAR, MONTREAL STREET RAILWAY CO.

The dimensions of the car are as follows: Length over car lines, 46 ft. 6½ in.; length over corner posts, 34 ft. 5 in.; length of front platform and rear platform, 5 ft. each.; width over all, 8 ft. 2 in. There are 25 cross-bench seats 36 in. long, and the seating capacity of the car is for 50 persons, with a standing capacity for 20 persons. The trucks were manufactured by the Montreal Steel Works, Ltd., and are known as the manufacturer's Class 50, weighing 11,000 lb per pair. The distance between truck centers is 23 ft., with wheel base of 4 ft. 4 in.; the diameter of the wheels is 33 in., of axles 4 in., and the size of journals 3½ x 8 in. The system of springs includes two independent sets of elliptic and spiral springs. The car is equipped with four Westinghouse No. 68 motors, with a speed rating of from 30 to 40 miles per hour. Westinghouse 402 controllers and Westinghouse air brakes.

THE STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE

KENFIELD PUBLISHING CO.,

45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address, "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:

New York—39 Cortlandt Street. Cleveland—302 Electric Building. London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV AUGUST 15, 1905 No. 8

CONTENTS OF THIS NUMBER.

LOTTERIES IN AID OF ACCOUNTING.

Many of our readers doubtless recall the very interesting paper on "Registration of Transfers" presented before the American Street Railway Association at the Detroit meeting in 1902 by Mr. C. D. Meneely, secretary and treasurer of the Brooklyn Heights R. R., in which the author outlined a plan to secure a more complete accounting from conductors, and at the same time eliminate abuse of the transfer privilege by passengers. This plan was to provide conductors with numbered transfers and numbered receipts and for each transfer and each receipt issued require the conductor to account for a cash fare. The numbered receipts issued to passengers not needing transfers would be made tickets in a lottery having say monthly drawings. The effect would be, first passengers would take transfers only when they were needed to complete the ride; second, passengers would save the receipts, and thus prevent possible reissue or other misuse. The scheme was not adopted because in the opinion of counsel, while it would not violate the letter of anti-lottery laws, the decisions under the federal law prohibiting the circulation of notices of drawings through the mails rendered it inadvisable to attempt the plan.

The Compania Limitada de Tranvias Electricos de Mexico, of the City of Mexico, has adopted a plan similar to that described by Mr. Meneely, excepting that as the Mexico company has graded fares and no free transfers, the cash fare receipts are the only papers issued by conductors. The company has 17 rates of fare, and each month the cash-fare receipts issued participate in a lottery in which there are 209 prizes. The value of any prize depends upon the cost of the ticket winning it; the capital prize drawn on a 6-cent ticket is $200, if it were drawn on a 30-cent ticket it would be $1,000. The minimum value of the 209 prizes is $2,000 and the maximum $10,000 per month.

This is, so far as we know, the first practical application of the lottery principle in street railway management, though in Europe lotteries in aid of all sorts of enterprises are widely used. In the United States the policy of the government, at least as evidenced by federal and state statutes, is strongly opposed to gambling in whatever guise presented, and because of the recognized demoralizing effect of lotteries they would probably not be permitted here. In all seriousness, however, it is to be doubted whether the device described would or could lower the standard of morals that obtains when the public deals with a transportation corporation.

VALUE OF VERIFIED PUBLICITY.

In the address of President C. Loomis Allen, before the Street Railway Association of the State of New York, as reported in the "Review" for July he stated in apt words that the greatest need of American public service corporations in their defense against municipal ownership is "to know, in minutest detail, the facts, figures conditions and results of municipally operated street railways." Mr. Allen states he has been forced to the conclusion that all the articles on the subject which he has been able to secure are prejudiced either in favor of or against municipal ownership.

What is required is information which the public will accept as accurate; therefore, it must be authentic, and presented in a manner that will admit of that authenticity being readily verified. All American street railway men know that accurate information leads to but one conclusion regarding rates of fare, which is that a basing rate of less than 5 cents including free transfers is not practicable in American cities.

But a serious difficulty in convincing the general public of this fact, and for that matter in all discussions between municipalities and urban transportation companies, is that the accuracy of the figures on cost of construction and operation submitted by the latter is nearly always impugned, and reasonable agrument thereupon becomes impossible. It is a boon indeed to have a witness called by the other side, as was Mr. Dalrymple on the Chicago situation, testify to the reasonableness of the existing rate.

The accounting officers of corporations usually demand that their books be audited by disinterested persons, quite as much for their own protection as for that of the company's stockholders; if it is alleged errors have been made the head of the accounting department wishes to know that fact at once while the matter is comparatively fresh and more easily explained or corrected. Similarly it strengthens the position of a company if the public is given all the information which it rightfully should have when asked to

make franchise grants to the company. The management of the Detroit United Ry. has recently invited the mayor of Detroit, by a committee of the city council with the mayor as chairman ex officio, or by a commission chosen by the mayor and council to make an investigation of the affairs of that company. Mr. Hutchins expressed his object in these words: "It was my thought that after all the facts bearing upon the subject should become known to the people in some such way, the matter of an adjustment of the relations between the company and the city could be effected accordingly." This is an attempt to secure the proper and helpful kind of publicity.

The books of a company cannot be thrown open to the public indiscriminately. Were that done incompetent busybodies would be the most anxious to serve as the examiners, and much harm, but no good, would result. Here is the field for the public accountant, whose profession it is to furnish that valuable commodity which may be called verified publicity.

THE OFFICE OF THE SECRETARY.

In the plan for the reorganization of the American Street Railway Association it is stated that the secretary of the principal or parent association would devote his entire time to the work of the associaion, and duties of the office are defined in the proposed by-laws as follows:

"Art. VI. The duties of the secretary shall be to take minutes of all proceedings of the Association and of the Executive Committee and enter them in books proper for the purpose. He shall conduct the correspondence of the Association, read minutes and notices at all meetings, and also papers and communications, if the authors wish it.

"The secretary shall maintain an office in the city of New York at which shall be on file for the benefit of the members a collection of information in regard to all matters affecting the operation of electric railways.

"The secretary shall attend to the publication of the proceedings of this Association as well as those of the branch or affiliated organizations. He shall perform whatever duties may be required in the constitution and by-laws appertaining to his department and such other duties as shall be assigned him by the Executive Committee. He shall be paid a salary to be fixed by the Executive Committee."

This is in accordance with the sentiment, expressed at the St. Louis Convention last year, that the present importance and the rapid growth of the electric railway industry warrant making the scope of the national association representing it such as will require all the time and energy of a competent man serving as active executive officer. There are many directions in which a thoroughly representative national association could afford the greatest assistance to its members by careful and continuous work. To cite a single subject now strongly before the public we may take municipal ownership. The many ramifications of this subject and the wide variation in special conditions which companies threatened by "municipalism" have to meet renders it difficult for companies to take full advantage of the work done by one another in this direction. The collection of pertinent data on this subject is pre-eminently proper work for the A. S. R. A.

We believe there is no difference in opinion as to the desirability of making the duties of the secretary such as to require all of his time to properly perform them. Regarding the proposed location of the secretary's office, however, as expressed in the second paragraph of the extract quoted from the by-laws, there is not the same unanimity.

The recommendation that the secretary maintain an office in New York City, where shall be kept on file data for the benefit of members, seems to proceed upon the assumption that New York, as the largest city and the financial center of the country, is the most appropriate place for the headquarters of a national association. And we fear that sentiment rather than consideration for the convenience of members actuated the choice of the city named. New York is out greatest city, but it is not our capital, nor is it all dominating as is Paris to France, or London to Great Britain, and sentiment should not be the deciding element in choosing headquarters.

While it is true that the bulk of the business between the members and the secretary would be transacted by correspondence, there would be a great many [illegible] in person, were the location of his office convenient to the majority of members.

There are [illegible] taste. Perhaps most of the business houses dividing territory between the East and the West [illegible] western limits of the East. For our dividing line we have come a trifle farther west and chosen the meridian of Cleveland. Of the 195 members of the A. S. R. A., 75 are in cities and towns east of Cleveland, and 120 are in Cleveland and cities and towns west of that point. The 75 eastern companies represent an aggregate of 8,875 miles of track, and the 120 western companies represent an aggregate of 9,057 miles of track.

If the convenience of members who it is assumed wish to visit the secretary's office be consulted, Cleveland certainly is a far better point for headquarters of the association. Chicago, the present headquarters, is more conveniently located than New York to serve the entire membership, and Chicago is also the greatest steam railroad center of the entire country. Chicago is the chief city in the central West, the territory which is now and for years to come will be the scene of greatest activity in electric railway building.

The executive office of the association should be near the "center of the load," and we recommend to members consideration of the relative advantages of a point in the Central West as compared with a city on the Atlantic seaboard.

MOTOR BUSES AND ELECTRIC CARS.

On another page are illustrated several types of motor buses used in Great Britain in competition with or as substitutes for electric tram cars. The conditions in England are much more favorable to the operation of such vehicles than would be the case in this country—two particular instances may be cited; in London street cars are excluded from certain large areas which in the past have been served only by horse drawn buses or cabs, and there are a vast number of villages and hamlets without connection with railroads. In America the larger centers of population as they exist today are the result of the development of electric railways—we mean that suburbs have developed along the extensions of urban street railways, instead of the railways being built to serve existing needs—and the same thing is true of the smaller villages, they being located on the steam railway lines. In an older country the modern transportation systems had to be laid down to suit the existing distribution of population, and in a densely populated country like England, the most extended of railways could not serve all points.

British tramway officials have given considerable attention to the motor car question from the standpoint of the trackless mechanically propelled vehicle being in competition with the tram car, but see no reason for alarm.

Sir Clifton Robinson in his article on "Motor Buses vs. Electric Tramways," which was published in the "Review" for March, 1905, (page 143) made several points against the motor bus: 1. Greater power per unit of weight needed for a trackless vehicle. 2. Relatively smaller carrying capacity. 3. Greater cost of operation per mile run. 4. Excessive cost of maintenance of rubber tires.

Mr. Alfred Baker in his address as president of the Municipal Tramways Association quotes the following figures on the cost of operating motor buses: General repairs and tires, 7 cents; wages, drivers and barn men, 5 cents; petrol, oil, grease, etc., 4 cents; all other expenses, including depreciation at 20 per cent, 7 cents; total 23 cents per car-mile. Mr. Baker finds that for six of the largest tramways in the United Kingdom, the cost per car-mile is but 12.24 cents, which figure includes power, traffic and general expenses and maintenance and renewals. With the interest and repayments of loans on permanent way and overhead lines included in the tramway operating cost, there still remains a difference 8.71 cents in favor of the tram car.

Even if the cost of tire renewals estimated at 4 to 5 cents per mile for motor buses, and no additional charge be made for cost of a railroad over which the motor buses could operate, the difference in cost in favor of the electric tram car remains about 4 cents per mile.

[illegible] The tram car's arrests were usually much briefer than those of the bus, twice being only 3 seconds. Although the tram car took 26 minutes 17 seconds for the 3½ miles, as compared with the bus's 20 minutes 10 seconds, the maximum speed attained was higher, probably 15 miles an hour. But the tram car was constantly delayed by traffic on the lines. This is the reason why motor-buses will inevitably prove faster than tram cars. The buses, indeed, would travel more quickly over the journey if they were not frequently obstructed by stationary tram cars in the middle of the road."

It will be noted that the tram car's principal handicap is because of obstructions that should not exist.

In America railway men are attracted to the motor car because of the possibility of its adaptation for operation over rails, and are much interested in the experiments now being made by several railroads with gasoline motor cars. Few data on these have been published as yet. In one case the cost for fuel alone of a gasoline-electric motor car recently built for service on an American interurban railway is given as about 10 cents per mile. It may be assumed that the motor car drew passenger cars equivalent in carrying capacity to an electric interurban car. There are data available for electrically operated lines from which comparisons as to the relative cost of power per mile might be deduced, but such comparisons would be of little value since in every individual case the number of car-miles necessary for the traffic at present, and in the reasonably near future, would affect the permissible increase in cost of operating self-contained motors.

AMALGAMATION OF BRITISH ASSOCIATIONS.

The British electric railway men are also considering the consolidation of the national associations representing the industry, but their problem is rather different from that confronting the members of the A. S. R. A. In Great Britain there are now three organizations, the Municipal Tramways Association, the Tramways and Light Railways Association, and the Association of Tramway and Light Railway Officials, and all parties interested are believed to favor the amalgamation of these three bodies under a plan that will be "fair to all." It seems to be felt that while there are manifest advantages in having one larger and more influential society in place of three small ones, the interests of municipalities or of private companies might suffer were the representative of both to be a single association.

While in a single body there would be wide differences between members on the question of municipal versus private ownership, it would appear that the public would derive great benefit from discussion of these points of difference by men who have so much in common. The public, both as patrons of electric railways and as taxpayers, have the greatest interest in learning which is the better economic policy, and the truth is what all should be seeking. In everything that pertains to operation both municipal and company managers stand on common ground.

In the matter of accounting two of the British associations adopted differing standards, whereas we can conceive no good reason why the best accounting system for a privately owned railway is not likewise the best for a municipally owned road. This is one instance where a consolidation of the organizations could better serve the members of all.

ARTIFICIAL PROFILES IN CHICAGO.

About two weeks ago the Chicago Tribune published the statement that the South Side Elevated Railroad Co. had decided to adopt artificial profiles, making summits at the stations, and thus save a large amount in cost of power, and this story is now on its round. The Western Electrician accepted this report as its text and in its issue for August 5th comments upon the advantages of such a plan, quoting Mr. H. H. Armstrong, who in 1898 showed that under certain conditions a saving of 40 to 50 per cent might be effected in energy consumption by suitably chosen profiles. A few minutes with pencil and paper will show that a profile equivalent to a scenic railway in abruptness would be required in order to secure an appreciable power saving on the Chicago elevateds.

It is true that the stations on the South Side line have been elevated with the effect of forming summits on the profile, but these summits are merely incidental to the station construction, the elevation being from 3 ft. to 4 ft. only. This slight change in grade was necessary in order to permit the use of the right of way under the structure as a roadway and give the necessary clearance between roadway and the lower platform of the station.

The question of how much energy might be saved by placing the stations on summits was taken up in the building of the Northwestern Elevated Railroad, Chicago. Assuming that stations be placed 4 ft. higher than the natural profile would call for, it was computed that the saving in power cost on the entire system would be about $3.00 per day, and even this might be overcome were variations in the assumed schedule made.

One might pardon the Tribune young man, but better things are expected of the technical press.

Annual Report Kansas City Railway & Light Co.

The annual report of the Kansas City Railway & Light Co. for the fiscal year ended May 31, 1905, has been published and shows an increase in gross earnings of 14.70 per cent, in operating expenses of 7 per cent, and in net earnings an increase of 24 per cent over the preceding year. The increase in the surplus of last year is about 35 per cent. The report of progress for the year submitted by the general manager shows that all of the requirements of the franchises granted the company in the fall of 1902 have been complied with, the line to Swope Park, a distance of 3½ miles, was opened to the public in May, the new central power station at Second St. and Grand Ave. has been operating in a most satisfactory manner and plans have been perfected for the installation of 5,000-kw. steam turbine, and plans for a car barn and car storage yard, to be located at Troost Ave. and 48th St. has been completed.

The report of construction work completed during the past fiscal year states that the foundations for the new 5,000-kw. turbine unit at the Missouri River power house have been completed and all contracts for auxiliary apparatus have been awarded and part has been received. The sub-station located at the southeast corner of 15th and Walnut Sts. has been completed and now has its full equipment of machinery, consisting of four 1,000-kw. railway rotaries, two 750-kw. lighting rotaries, and four 150-light motor-driven arc machines. During the year the company has installed approximately 64,404 duct feet of conduit, into which there has been drawn approximately 51,270 ft. of lead-covered three-conductor cable for transmitting the alternating current from the Missouri River power house to the various sub-stations. At the foot of James St. a most substantial combined railway and traffic bridge has been constructed. Forty cars used on the Intramural Railroad in St. Louis were purchased and added to the company's equipment. During the year the company laid 148,854 ft. of single track, divided as follows: New girder rail work, 36,367 ft.; new T-rail work, 54,081 ft.; cable track replaced by new girder rail, 43,135 ft.; old T-rail replaced by new T-rail, 15,271 ft. The Twelfth St. line is now the only remaining cable line which the company is operating and proceedings have been commenced whereby an agreement is expected to be made with the city for the construction of a tunnel and viaduct from Broadway to the West Bottoms, which, when completed, will enable the substitution of electricity for the present cable power, thus eliminating the last cable road in the city.

The statement of operation of the street railway properties for the year ended May 31, 1905, is as follows:

Gross earnings	$3,906,757.16
Operating expenses	2,020,378.19
Net earnings from operation	1,886,378.97
Income from other sources	16,588.72
Gross income	1,902,967.69
Taxes and interest	1,409,211.25
Net income	493,756.44
Income applied in redemption of 50 bonds	55,000.00
Surplus for the year	438,756.44

Condensers for Turbines.

When a few years ago the use of steam turbines commercially began in the American market, there were no definite standards as to the sizes or character of condensers to go with them. The steam turbine is a heat engine and therefore its theoretical efficiency is greatest when the difference between the initial temperature and the final temeperature of the steam, which constitutes its working fluid, is greatest. The principle of the turbine permits a design that is free from several important limitations, which are inherent in the reciprocating engine; the initial temperature in a reciprocating engine must not be too high to secure good lubrication of the cylinder, while in a turbine no lubricant is used in the interior; in a piston engine the ratio of expansion of the steam is limited because at low pressures the steam has too great a volume to be handled in cylinders of reasonable size and cost, because the low temperature unduly cools the cylinder walls and increases cylinder condensation losses, and also because of the leakage of air into the engine at low pressures.

The design of the turbine permits both higher and lower limits of working and therefore to secure the best efficiency high-pressure steam, superheated when practicable, is used and expanded down to as low a pressure (or as high a vacuum) as the apparatus available permits. Within reason the higher the vacuum the better.

When the manufacturers of turbines called upon the manufacturers of condensers for apparatus to secure these high vacuums, the latter were not very well prepared to supply the demand. They had had no previous experience, it being generally recognized that a vacuum of between 25 in. and 26 in. was not only all that was necessary for reciprocating engines, but all that was advisable. The manufacturers of condensing apparatus attempted to meet the demand by using the same class of condensers, and of air and circulating pumps that they had been supplying for engine practice, making them just a little larger so as to be liberal, but did not at all realize either the size or the character of the machinery that is really necessary to produce the results desired. There were some manufacturers of high grade air pumps who had been making them of the crank and fly wheel type and using them to obtain vacuums of 27 in. to 28 in. in sugar house work, but there is not recalled a single instance in the early condenser practice for turbines where such pumps were used. Pumps of this type are expensive and having never been used on engine work, they were not thought of for turbines. The result was that the first condensing apparatus supplied for turbines did not give the vacuum guaranteed, and that led to its being rejected or changes proposed.

Three types of condensers are usually recognized: First, the jet condenser attached directly to a stock air pump of either the vertical or horizontal pattern; second, the barometric condenser, with or without dry air pumps; third, the surface type of condenser with air and circulating pumps. Steam turbines have been and probably will be attached to all forms of condensers, but in the vast majority of cases—it is believed fully 99 per cent—the condensers installed with turbines are and will be of the surface type. The reasons are: The condensed steam from a turbine is pure water without any admixture of oil whatever, so that it can be used without fear in the boilers. Another important reason is that air is contained in the injection water; if a jet condenser of any type is used, the air must be removed [illegible] vacuum, while in the case of the surface condenser there is no injection water, so that only the air that was contained in the condensed steam [illegible]. Again, in the surface condenser the circulating water may be of any character, foul or otherwise, so long as it is wet and reasonably cool. For these and other reasons the surface condensing plant is to be taken as the most desirable and best form for use with turbines.

It has become customary for the manufacturers and purchasers of turbines to demand [illegible] based on a 30-in. barometer, and the problem which presents itself to the maker of [illegible] in., or a pressure of 1 lb. per sq. in. absolute, has a temperature in round numbers of 100 [illegible]. The latent heat per pound [illegible] a small drop in the temperature of the air pump discharge below that of the steam itself, it may be rightly assumed that 1,050 B. t. u. are taken out of every pound of steam.

The general practice is to assume that the circulating water has an initial temperature of 70° F. If for good results it be further assumed that the circulating water will leave the condenser at 85° F., or 15° below the 100° theoretical temperature of the steam, then there is a rise in the temperature of the circulating water of 15°. Since there are 1,050 B. t. u. in a pound of steam to be condensed the ratio of circulating water to condensed steam is as 1,050 to 15 or as 70 to 1. The capacity usually provided is for an amount little in excess of this ratio. There are cases in southern waters of the United States where a ratio as high as 160 to 1 has been used, but the conditions were such that no lifting of the circulating water was necessary.

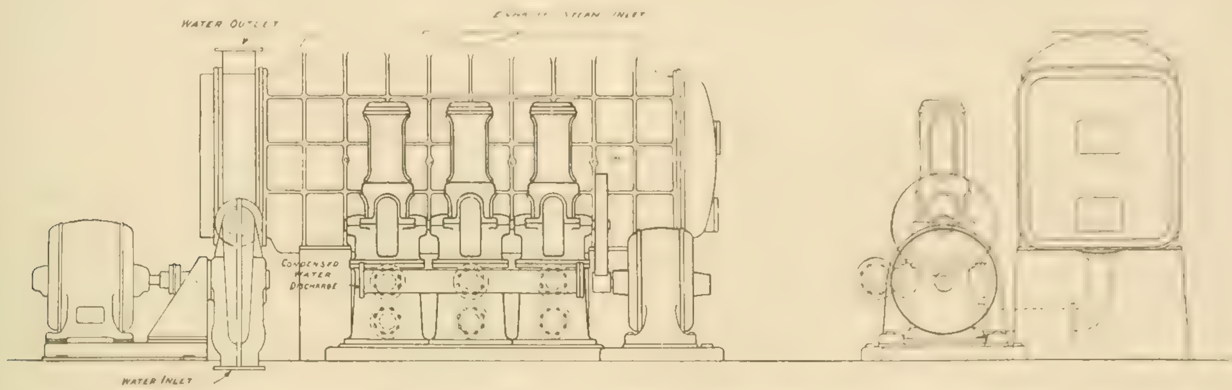


FIG. 1. WHEELER ADMIRALTY SURFACE CONDENSER, WITH EDWARDS AIR PUMP FOR 1,000 KW. WESTINGHOUSE-PARSONS TURBINE.

The size of the air pump is not so easily calculated, because provision must be made for the leakage of air into the system, which is much greater than any air liberated from the steam. For this reason the size of the air pump becomes a matter of judgment or experience or conforming to good practice on the part of the engineer or manufacturer. One thing is certain, the volume of the air under 28 in. vacuum, or 1 lb. per sq. in. absolute, is twice that of the air under 26 in. vacuum, or 2 lb. per sq. in. absolute, so that the air pump for 28 in. vacuum should be twice as large as that for 26 in. vacuum. But this is not the only change necessary. The clearance in a pump for maintaining a high vacuum must be very small, and a first-class single or double acting air pump of any well-known make or design in which the length of stroke may vary and in which the pump frequently makes short strokes will not do. A crank and fly-wheel air pump, in which the stroke is positive and the clearance a minimum, must be adopted; with pump of this type good practice is to provide a capacity 40 times the volume of the condensed steam.

One method of securing this high vacuum is to use separate wet and dry air pumps. The accompany illustrations, however, show two condenser installations which are presented by the Wheeler Condenser & Engineering Co. as being simpler in that only one air pump is used. This pump is of the Edwards type and in Fig. 1 is shown triplex motor driven. In Fig. 2 a steam-driven twin Edwards air pump is illustrated. Both illustrations show a centrifugal circulating pump, which may be either motor or steam

driven. The centrifugal pump circulates the enormous volume of water required at moderate cost and very good efficiency.

In the surface condenser the temperature of the exhaust steam is very nearly that of the circulating water while its volume is enormous. For these reasons a large amount of brass tube cooling surface must be used. It has been to a great extent a matter of experiment among the manufacturers of condensers as to how great the cooling surface should be. Moreover, what would be ample surface with clean water will not be enough when the condenser becomes foul. Some engineers have settled on about 4 sq. ft. of cooling surface for each kilowatt of capacity of the plant, that is, 4,000 sq. ft. for a 1,000-kw. turbine. This not only allows for a certain degree of foulness, such as would result from the mud in the western streams, but takes care of a moderate overload capacity. Brass or copper tubes are invariably used for the cooling surface; the tubes are of various diameters, depending on the condition of the circulating water.

The manufacturers of turbines ordinarily recognize the enormous volume of exhaust steam leaving the turbine, and provide openings

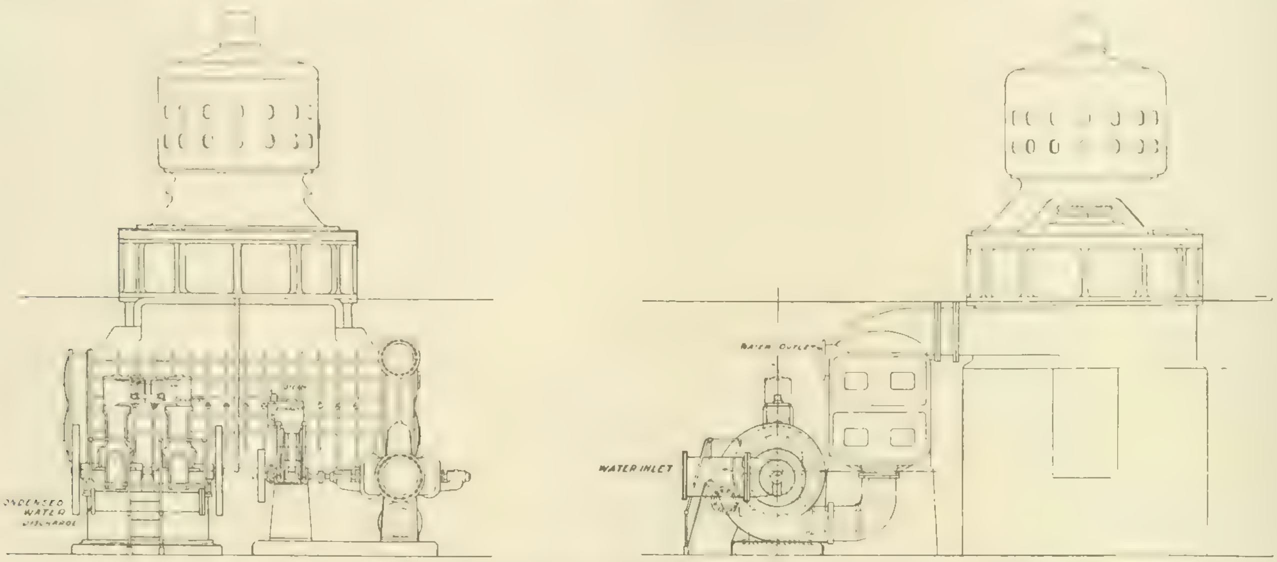


FIG. 2—3,000-KW. CURTIS TURBINE, WHEELER SURFACE CONDENSER, EDWARDS AIR PUMP.

of either rectangular or round shape, accordingly. These openings seem very great in comparison with engine practice. In the case of engines, however, very little attention has been paid to the proper size of the exhaust, especially when the engines are to run condensing. Many engine builders make no difference whether the engine is to exhaust to the atmosphere or into a vacuum, although even with 25 in. or 26 in. of vacuum the volume of the steam is about six times greater than when under atmospheric pressure.

To obtain and maintain a high vacuum on a turbine means not only to have the best of apparatus but also that there must be constant vigilance and care on the part of the operating force. With the best of apparatus, made and installed by manufacturers of the largest experience, it is impossible to get a high vacuum if there are air leaks. For this reason the condensers are set as close to the turbines as is possible, the joints are few in number and are very carefully made. The free exhaust valve, or any opening into the apparatus, in the nature of a stuffing box, should be water sealed. The joints should be most carefully pointed with asphaltum or something of the kind, and in many cases the entire apparatus, the condenser and its connections, has been given several coats of shellac varnish with beneficial results. The same remarks apply to the base of the turbine and any joints therein.

Engineers who have been called upon to design and operate high vacuum installations know the difficulties encountered, and how apparently trivial faults in construction and fitting prove to be serious in practice. The satisfactory results now obtained in turbine condenser practice have earned for both manufacturers and engineers the respect of the profession.

The first car of the Kokomo, Marion & Western Traction Co. was run into Marion July 23rd and regular service between Marion and Kokomo was established Wednesday, July 26th.

Blank for Time Keeping and Pay Roll.

The accounting department of the Ft. Wayne & Wabash Valley Traction Co. having experienced considerable difficulty in making a satisfactory distribution of time with the blanks formerly in use, Mr. H. E. Vordemark, auditor of the company, designed the form illustrated herewith, which has been in use since May 1, 1905. The blank is 17 x 19½ in. in size, with the upper section ruled to show the distribution of the time of each man, and the lower section ruled to show the distribution for each kind of work.

On the back of the blank are printed instructions for its use and general instructions to foreman as follows:

"This blank will be used to report the time of all trainmen, shopmen, section men, station men and linemen. It will be made as instructed below, certified as to correctness by the heads of each department and forwarded to the auditor.

"'Extraordinary' repair work is that made necessary to restore roadway, track of structures to former condition when damaged by floods, etc., cars damaged by wrecks, etc.

GENERAL INSTRUCTIONS TO ALL FOREMEN.

"1. For handy use in keeping time of trackmen use a supplementary time book, which will be furnished, from which time must be drawn off at the close of each day and distributed on this form.

"2. Shopmen, station men and linemen will report their time on time slips, showing distribution, from which time must be drawn off at the close of each day and distributed on this form.

"3. Beginning the first of each half of each month the names of all members of the gang will be entered in the column headed 'Names,' and the names of all foremen or assistant foremen will be the first to be entered.

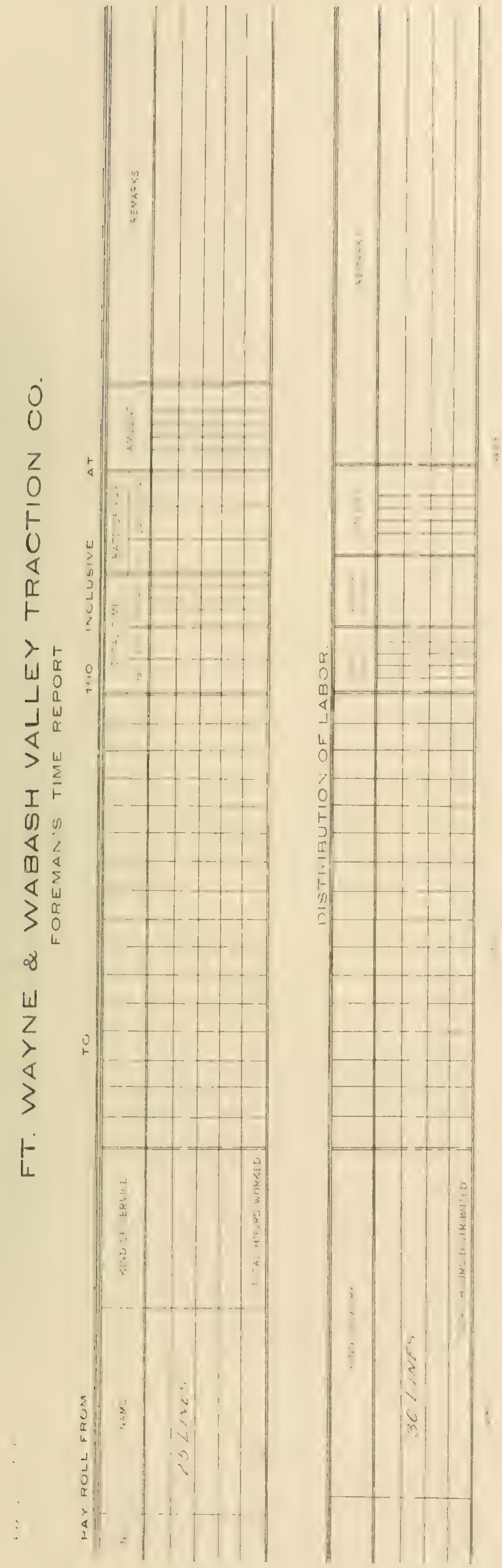
"4. When a gang consists of more than 25 men, use a second sheet of this report for the purpose of entering the names and time of each man, but distribute the time of the entire gang in the lower portion of one blank only. When the 'Distribution of Labor' requires more lines than there are places on the blank, use a second sheet for this purpose, marking as second sheet in each case.

"5. Opposite the name in the column headed 'Kind of services' will be entered the occupation, such as trackman, carpenter, engineer, lineman, etc., etc.

"6. Opposite each man's name in the columns, one being provided for each day, which should be dated at the beginning of the pay roll, insert the number of hours of services performed by each man each day as designated in the heading.

"7. In the lower portion of the blank will be made the daily distribution of the entire time of the gang.

"8. In the column headed 'Distribution of Labor' will be inserted the various classes of work performed, and in the columns provided for each day, which should show the date the same as above, will be inserted the number of hours the entire gang was engaged in each class of work. The total hours so distributed should corre-



[illegible] pond with the total [illegible] the entire gang, as shown in the upper portion [illegible]. A gang consisting of [illegible] 10 hours each. In the upper portion, opposite each name, will be shown in the column [illegible] line total hours worked will be shown 120. In the lower portion of the blank, under the heading 'Distribution of Labor,' will be shown the number of hours which the entire gang worked, as: Repairing armatures, city cars, 50 hours. Changing wheels, interurban cars, 20 hours. Repairing city cars, 20 hours. Repairing registers, interurban cars, 10 hours. Cleaning city cars, 20 hours. At the bottom of the lower portion of the blank opposite the line 'Total Hours Distributed' will be shown 120.

"9. On the succeeding day, if the same gang worked the same time, and in addition to the work performed on the first day another class of work was performed, the hours worked in repairing motors, etc., would be entered in the column headed No. 2, and under the heading 'Distribution of Labor' would be entered the new class of work performed, and in the column headed No. 2 would be entered the time so engaged.

"10. When repairing buildings, state what building the repair work is done on. When engaged in work which is special, say just what the work is and where located, as an extra siding at such a place, putting roof on car barn, repairing washout at a certain place, etc., etc.

"11. Be particular in all cases to state kind of work done.

"12. At the close of the pay roll, cross-foot the upper portion of the blank, entering under the heading 'Total Time' the number of hours worked by each man, and under the head 'Rate of Pay' enter the rate per hour or per month to which each employe is entitled, making extensions in column headed 'Amount' by multiplying the number of hours worked by the rate of pay. Foot the columns headed 'Total Time' and 'Amount,' entering the totals in the line opposite total hours worked.

"13. In the lower portion of the blank make a cross-footing for each class of work, and under the heading 'Total Hours' enter the number of hours engaged on each different class of work. This column should also be footed, and opposite the line 'Total Hours Distributed' should be entered the total number of hours engaged in all classes of work. This total should in all cases agree with the entry in the same column on the upper portion of the blank 'Total Hours Worked.' No entry will be made in the lower portion of the blank in the columns headed average rate or amount, as these columns are reserved for use of the general offices.

"14. No time will be allowed an employe whose work is being done (temporarily) by a substitute, but the name of the substitute will be entered and time allowed to him the same as if he was a regular man.

"15. In entering time for work that is 'extraordinary,' enter the number of hours worked by each man, and place an (X) in front of the number of hours worked by each man.

"16. Any additional explanation or remarks should be entered in the column headed 'Remarks.'

"17. When a time order is given for an employe who has left the service or has been discharged, notation to that effect should be made opposite the employe's name in the upper portion of the blank in 'Remarks.'

"18. When extra time has been allowed a man any one day, it should be explained why this extra time was allowed. Illustration: 'John Smith, for work at night repairing car damaged in wreck,' or whatever the case might have been.

"19. Distributing the time of foreman or assistant foremen, the number of hours on which each was engaged on different classes of work should be distributed as correctly as possible.

"20. When a gang is about to enter upon work covered by construction or improvement or new work, the foreman should be particular to so report the number of men engaged thereon, in order that work classed as construction, additions and improvements may be kept separate from expenditures chargeable to the regular operation."

The first electric train on the Long Island railroad was run Tuesday, July 18th, from Woodhaven Junction to Flatbush and back. Two round trips were made for the purpose of testing the clearance of the contact shoes on the third rail.

Motor Omnibuses in Great Britain.

In view of the interest which is being taken throughout England in the question of motor omnibuses and their future, particulars of some of the leading systems now running in various parts of the United Kingdom will prove of interest to our readers. Although we do not share the opinion expressed in certain sections of the popular press that the motor omnibus will render existing tramway systems obsolete, and will make it impossible for any proposed systems of tramways to be constructed and to run successfully in face of the competition which the newer form of passenger traction will introduce, we believe that the motor bus has a very large field of usefulness, and that its use will extend very greatly as the defects, which are so apparent, are removed, and improvements effected, and reductions made in running costs and maintenance charges. In districts such as the City and West End portions of London, where tramways are not permitted, the motor bus will be a welcome successor to the present obsolete horse-drawn vehicles, and will afford plenty of scope to the builders of these vehicles without entering into competition with the successful tramway systems now operating throughout the suburban districts of London. Motor omnibuses may also be used extensively as feeders to existing systems of tramways, and as feeders to steam and electric railways in districts where it could not pay to establish a tramway. For joining isolated hamlets and small villages, and for providing a regular passenger and parcels service from village to village and from village to tramway terminus or railway station, the motor bus will prove of the greatest benefit, but it can never hope to compete with a well-equipped system of electric tramways in urban districts or within the limits of cities.

The accompanying illustrations show a number of the better-known motor vehicles.

FIG. 1. MILNES-DAIMLER 18 H. P. 4-CYLINDER MOTOR OMNIBUS.

Fig. 1 is a single-deck omnibus to seat 18 passengers, which has been supplied by Milnes-Daimler, Ltd., of 221 Tottenham Court Road, London, to the Great Western Railway Co., which uses it as a feeder to its system in Cornwall. The route followed is between Helston and the Lizard, Helston being a terminus of the railway some 10 miles from the Lizard. The car is equipped with a 4-cylinder vertical petrol engine rated at 18 h. p., and running at a normal speed of 800 r. p. m. This is capable of driving the car on the level at speeds up to 15 miles per hour. It has four forward speeds and one reverse, the whole of the transmission gear being provided with ball bearings, a special type of plain bearing being used for the road, wheels and engine shaft.

The petrol tanks attached to the chassis have a capacity of about 16 gallons; the fuel consumption is about one gallon per hour, there being comparatively little difference in the amount of fuel used whether the engine is running light or fully loaded. The main frame of the chassis is built up of steel channel girders strengthened by several cross members. It is supported over the axles by semi-elliptic side springs in front and at the back, the rear ends of the latter being connected by an inverted transverse spring. Both the axles are steel forgings, and all the brackets that are fixed on the frame are forged out of nickel steel, the frame itself being riveted together.

The engine and gear box are carried by an under frame consisting of two angle steel members bent upwards and riveted at each end to the main frame. Two wooden beams, fixed to the back axle and hinged at the front to special brackets which project downwards from the center of the frame, form radius rods. They are stiffened on both sides with steel plates. These relieve the springs of strains due to the driving mechanism, and give sufficient flexibility to absorb sudden shocks which inequalities in the road surface may cause. These wooden radius rods are a distinctive feature of the Milnes-Daimler vehicles.

The drive from the engine is through a longitudinal shaft which transmits its motion to the rear wheels, through bevel gear and differential to a countershaft, the outward ends of which are furnished with pinions which are engaged with internal gear rings bolted to the road wheels. The casing containing the countershaft, bevel wheels, and differential gear, is fixed to the wooden radius rods. The shafts inside this casing run on ball bearings, the entire gear being filled up with solid lubricant.

An unusual feature of the transmission gear is that the differential is carried on the rear end of the longitudinal driving shaft instead of upon the countershaft itself, and that each differential member of that gear has a pair of bevel wheels introduced between it and one-half of the countershaft. By this arrangement the differential gear runs at a higher speed than it otherwise would, and need not, therefore, be so large. The engine and change-speed gear, with the friction clutch between, are fixed in front of the chassis in the position which has now become usual with petrol vehicles. The engine is incased in a metal bonnet, its under side being protected by a sheet metal casing, while the gear box is also protected from mud and dirt by a canvas apron.

The radiator is of the Mercedes honeycomb pattern, forming the front of the bonnet, the fly wheel of the engine being constructed with fan blades instead of the usual spokes, so that they draw air through the radiator and increase its cooling capacity.

The clutch is of the ordinary cone pattern with leather face, a coupling being introduced between the clutch and the first motion shaft of the change-speed gear.

The gear box is made in three pieces, the central portion having four feet which are bolted to the under frame. The horizontal joints between the three portions pass through the main bearings, and both shafts rotate on ball bearings. The first motion shaft carries the sliding gear wheels, the second motion shaft lying immediately beneath it. The four sliding wheels are grouped in pairs, each of which is controlled by a guide fork, and is operated by a separate hand lever. The reverse gear is provided by a large intermediate pinion, mounted on ball bearings on a pin which can be caused to slide longitudinally by a third hand lever; when the wheels on the first motion shaft are in their neutral position, this intermediate wheel can be made to gear into the first speed wheels on both shafts.

The three gear-levers are fitted in quadrants alongside one another in the center of the chassis, the quadrants being rigid with a substantial bridge-piece is fixed to the main frame, and forms the front support for the driver's seat.

The driving shaft connecting the second-motion-shaft with the differential gear is provided with universal joints at each end, so constructed that they can take up the necessary telescopic movement. On the front end of the second-motion-shaft a powerful brake of the drum type is introduced, and is operated by the same pedal that controls the clutch. When this pedal is partly depressed, it disengages the clutch but does not begin to apply the brake, so that the engine is free to run without driving the first motion shaft. There are two other brakes of similar pattern on the ends of the countershaft inside the gear wheels which drive the road wheels. These are simultaneously operated by a second foot pedal. In addition to these brakes, there is a pair of shoe-brakes which act upon the tires of the driving wheels, and these are applied by a hand lever.

The steering gear is of the well-known worm and segment type.

Fig. 2 shows the pattern of motor omnibus which the same company has supplied to Messrs. Thomas Tilling for regular passenger service between Peckham and Oxford St.; these cars have been in regular use for several months.

The car is equipped with a 20 h. p. 4-cylinder engine, and carries 36 passengers. The engines and chassis are exactly similar in design to those employed on the 18 h. p. car shown in Fig. 1.

Messrs. Milnes-Daimler have also supplied motor omnibuses of similar pattern to the Atlas Omnibus Association for service between Charing Cross and St. Thomas' Hospital; to the London

General Omnibus Co., and to the Hastings & St. Leonards Omnibus Co., Ltd., and other passenger cars of the same make are running at Birmingham, Eastbourne, and between Torquay and Paignton.

Fig. 3 illustrates the type of double deck petrol motor omnibus which John I. Thornycroft & Co., Cheswick, London, are constructing for the London Motor Omnibus Co. The engine is of the 4-cylinder Otto cycle type with cylinders 4¼ in. in diameter and 5-in. stroke, capable of developing 24 b. h. p. at 900 r. p. m. The average working speed on the level is about 12 miles per hour and the car is capable of climbing a gradient of 1 in 8.

FIG. 2. MILNES-DAIMLER 20 H. P. 4-CYLINDER MOTOR OMNIBUS.

The engine and cam gear are enclosed in an oil-tight and dust-proof case, forced lubrication being provided to all moving parts. The cylinders are cooled by the usual water circulation operated by a rotary gear pump. The ignition is effected on the low tension magneto system, but the makers are prepared to fit the more usual high tension ignition with coil and accumulators if required.

There are four forward speeds giving 3, 5½, 8¼ and 12 miles per hour, and a reverse speed giving 3 miles. If the speed of the engine is increased the car can easily run at 14 miles an hour for short periods without over-heating. All gear rings are of hardened mild steel, enclosed in a dust-proof and oil-retaining case, so arranged as to be easily accessible from the footboard.

The petrol tanks hold a sufficient supply for a run of about 75 miles under full load. Very powerful double acting brakes are provided on the countershaft, sufficiently powerful to hold the vehicle on the steepest hills, while a screw-down brake, acting on a drum on the back axle, is also furnished. The wheels have solid rubber tires, the driving wheels having twin tires.

The clutch is of the multiple disk friction Hele-Shaw type completely enclosed and immersed in oil, and the makers state that it

FIG. 3. THORNYCROFT & CO. 24 H. P. MOTOR OMNIBUS.

increased the working life of the transmission gear very materially. The transmission is by toothed gearing with the exception of the final drive to the rear axle, which is by a Hans Renold silent chain. The Thornycroft patent spring drive is embodied in this design, which relieves the transmission gear from much shock.

Fig. 4 shows the type of double deck petrol-driven omnibus which Straker & Squire, 9 Bush Lane, London, have recently introduced. The particular car shown is one of a number which has been built for the London Road Car Co., while others of similar design have been supplied to Messrs. Thomas Tilling and the London General Omnibus Co. [illegible] London. [illegible]

The bus is equipped with a 4-cylinder vertical engine developing 24 h. p. at normal speed. The principal feature of the engine consists in the placing of the cam shaft which actuates the inlet and exhaust valves, as well as the ignition tappets, on the top of the cylinders. By this means the inlet and exhaust valves are arranged at opposite sides of the cylinders, and are actuated by a common shaft which is driven off the crankshaft by means of skew bevel gears and a vertical shaft. The cam shaft and cams are of nickel steel, motion being transmitted to the valves by means of rocking levers at each side. This arrangement gives certainty of action with little wear, the moving parts being placed where dust and dirt can least affect them. The cam and the rollers at the end of the rocking levers run in an oil bath. The valves are mechanically actuated, and are interchangeable.

The cylinders are cast in pairs; the explosion chambers of the cylinders, and also the valve chambers, are completely water jacketed. The cylinders and pistons are of hard cast iron. The crank chamber is formed of two aluminum castings, from the lower portion of which are projecting feet by which the engine is bolted to the side members of the frame.

The connecting rods are nickel-steel drop forgings, hollowed out to reduce the weight of the reciprocating parts. The crankshaft is a nickel-steel forging.

The carburetter is of the jet pattern, and takes its air supply

FIG. 4. STRAKER & SQUIRE 24 H. P. 4-CYLINDER OMNIBUS.

from a jacket round the exhaust. Sufficient petrol can be carried to give a run of 160 miles, the consumption of fuel under full load being given as approximately 8 miles to the gallon.

A governor is fixed to the vertical shaft which acts directly on the throttle of the engine, and this can also be controlled from the driver's seat, enabling a variation from 200 to 900 r. p. m. to be obtained. Low tension magneto ignition is employed. The cooling water is circulated by means of a centrifugal pump driven by a spur wheel on the crankshaft. The radiator is built up of long thin flat tubes, giving a large cooling surface, and the passage of air through the radiator is increased by means of a fan mounted direct on the crankshaft.

The two gear boxes contain respectively the change speed gear and the countershaft and differential gear. In the first box provision is made for three changes of speed and one reverse, while in the gear box containing the counter-shaft and differential gear there is a gear ratio change on the third-motion shaft, which in its turn drives on to the back axle through chains. By actuating the gear change in the rear box the three speeds contained in the front box can be doubled or halved. By thus making use of the two ratios six speeds are available, which permits speeds from 1½ to 14 miles per hour.

The gear wheels are made of Siemens-Martin steel machine cut, and run in oil-proof casings. The steering gear is of the Ackermann type, working with worm and segment and is irreversible. The wheels are of the artillery pattern, constructed with oak spokes

and ash felloes, and are arranged for carrying single or double tires.

The frame is built up of steel channels, T's, gussets and angles, well braced, and is carried upon long resilient springs. The rear axle is fitted with a spring radius rod attachment, which eliminates the shock which is sustained when starting under heavy load, and relieves the jerk which usually occurs when changing speeds.

Two brakes are provided, one close to the first gear box actuated by a foot pedal and working on the differential, and the other a compensated brake actuated by a hand lever, and working on steel drums fixed to the driving wheels.

FIG. 5 MAUDSLAY CO. 14 H. P. OMNIBUS, CAPACITY 14 PASSENGERS

Fig. 5 is a 14-h. p. single deck passenger bus, which is one of a number the Maudslay Motor Co., Ltd., of Parkside, Coventry, has built for the Great Western Railway Co. for use as feeders in thinly populated districts. This car is constructed to carry from 12 to 14 passengers at speeds up to 12 miles an hour. It is equipped with a two-cylinder vertical engine developing 14 b. h. p. when running at its normal speed of 900 r. p. m. The change speed gear allows for four forward speeds and one reverse, the control being through a single lever.

Large single rubber tires are fitted to the front wheels, and twin rubber tires to the back wheels. The brakes are two in number; the first is actuated by a foot pedal and works on the counter-shaft, and is double acting and water cooled, while the second is a double acting brake applied by a hand lever, and working on drums bolted to the rear wheels.

The car has a 9-ft. wheel base with a track of 4 ft. 5½ in., the total length of the frame being 11 ft. 6 in. This car is particularly suited for light passenger and parcel service in rural districts, and the maker has secured a number of orders from railway companies for similar vehicles.

Fig. 6 illustrates a new type of single deck passenger omnibus which the Walseley Tool & Motor Car Co., Ltd., of Adderley Park, Birmingham, has constructed to meet the requirements of railway and other companies running passenger services in country districts. It has double seats in front to accommodate passengers who object to riding inside, or who wish to smoke. A large quantity of luggage can be carried on the roof, to which access is given by an iron ladder at the side of the driver's seat. The car has seats for 22 passengers, of which 16 could be accommodated inside, the other 6 being in front. The roof projects well over the driver's seat, and this gives protection from the weather to those occupying outside seats.

The frame is of pressed steel and is of taper channel section. There is a 12-ft. wheel base with a track of 6 ft. 2 in., the overall width coming inside the 7 ft. 2 in. limit.

The car is equipped with a double cylinder horizontal engine developing 20 b. h. p. at 600 r. p. m. The cylinders are of 6 in. bore by 7 in. stroke, and the engine is fitted with half compression cams to make the starting easier. No governor is used, the engine being controlled by a hand throttle on the steering column, and a foot throttle in connection with the brake pedal.

The carburetter is of the Wolseley compensated type, and high tension electric ignition with accumulators and induction coil is employed. The drive to the gear box is through a Renold silent chain. The gear box is suspended from three points, and contains all gearing in one grease-tight box.

The gears are of the sliding type, and give normally four forward speeds of 2½, 5, 8, and 13 miles per hour respectively, and one reverse speed of 5 miles per hour. All the changes are made with one lever. The final drive is from the ends of the differential shafts in the gear box, by rubber chains, one to each rear road wheel.

The vehicle is provided with three independent sets of brakes. They are all of the metal type, and act equally well in both directions. The pedal brake acts on a water cooled drum on the gear box high speed countershaft. The side brake is equalized and acts on two drums attached to the sprockets on the differential shaft. An emergency brake is operated by a lever in front of the driver, and acts on the insides of drums on the rear road wheels; this brake is also equalized. Both hand brakes are provided with toothed quadrants and grip levers. The rear axle is formed of a weldless steel tube. The front axle is forged in one piece. The steering is irreversible, being operated through a worm and sector, the worm being on the lower end of the inclined pillar.

The radiator is of the gilled tube pattern, and is fan cooled; it is placed under the driver's seat.

The petrol tank has a capacity of 12 gallons, the fuel consumption averaging about 1¼ gallons per hour under ordinary working conditions, and this is sufficient for a run of about 60 miles. The company recommends the use of 4½-in. "Giant" solid rubber tires on the front wheels, and twin 4-in. solid rubber tires on the the back wheels.

The engine being horizontal is placed below the level of the frame, and enables the whole of the upper portion of the chassis to be utilized for carrying passengers, and a large carrying capacity is thus secured without an abnormally long wheel base.

The wheels are of the artillery pattern, the front wheels being 34 in. and the back 42 in. in diameter.

Fig. 7 shows a type of single deck steam omnibus which the Clarkson Steam Car Works, Chelmsford, has constructed for use by the London General Omnibus Co. on the Hammersmith, Kensington, and Piccadilly Circus route in London.

This car differs from the others illustrated in being driven by a steam instead of a petrol engine, the advantages accruing from this, being absence of smell and noise, and less risk of fire as heavy oil is used to generate the steam. The burner under the boiler is capable of consuming almost any grade of mineral oil from crude petroleum upwards. The oil is forced from the supply tank under a pressure of 35 to 40 lb. per sq. in., a feed pump keeping the pressure constant. The burner is enclosed in a sheet-steel box lined with nickel and asbestos.

The boiler is of the water-tube type, and the tubes which form an endless pipe are arranged in a square gridiron pattern measuring about 30 in. by 12 in. They are of weldless steel, half an inch in diameter, and are expanded in top and bottom plates. Each boiler is tested by hydraulic pressure to 750 lb. per sq. in., and by steam

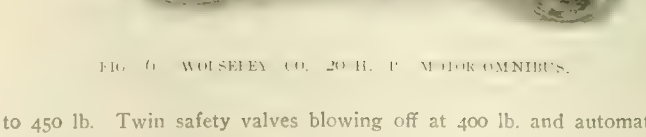


FIG. 6 WOLSELEY CO. 20 H. P. MOTOR OMNIBUS.

to 450 lb. Twin safety valves blowing off at 400 lb. and automatic regulator and water gage are fitted to the boiler. The circulation of water in the tubes is so rapid that no trouble is experienced with lime or other deposits.

The engine is double acting, and has two horizontal cylinders 4 in. by 4 in. The valves are actuated by the Joy gear. The engine is enclosed in a cast aluminum case with removable panels.

The engine shaft drives on to a bronze gear ring encircling the differential gear box. The six gear wheels are of phosphor bronze and are machine cut. Power is transmitted from the differential shaft to the driving wheels through strong roller chains.

The wheels are of the artillery pattern with steel hubs, oak spokes,

and ash felloes, and are 34 in. in diameter. The car is provided with two independent band brakes, operated respectively by a foot and hand lever.

Cars similar to the one illustrated are in use by the [illegible] Motor Omnibus Co. and have been running with [illegible].

[illegible] he can take it for granted that ordinary bank gravel containing [illegible]

Fig. 7. Clarkson 16-Passenger Steam Motor Omnibus.

addition to single-deck omnibuses, Messrs. Clarkson have built double-deck buses, to carry 32 passengers, for the London Road Car Co., equipped with 32-h. p. engines, and has supplied a 32-h. p. car to the London & Southwestern Railway Co. for use as a feeder, to carry 18 passengers with 1,050 lb. of luggage.

Cement and Concrete Mixing.

In the interest of its product, the revolving cube concrete mixer, the Municipal Engineering & Contracting Co., 607 Railway Exchange, Chicago, has recently issued a pamphlet of some 30 pages containing instructions to agents, a description of its mixer and other data regarding cement and concrete. The instructions to agents do not, as one might infer from the title, tell a man how to approach and secure a customer, but comprise useful and valuable information regarding cement and concrete.

With the object in view of equipping its agents with a knowledge of the properties and uses of concrete and of the mixer, cement and other chemicals are first considered, including methods for testing portland and puzzolan cement. Under the subject of concrete follows a discussion of the relative merits of the two methods largely followed in hand mixing, giving detailed descriptions of both processes. The relative advantages of "wet" and "dry" mixing are then considered as well as those of "fat" and "lean" concrete, these latter being the terms employed to designate concrete that is rich in cement and that that is poor in cement. Following this are a few words on the question of proportions including a table giving an idea of how quantities vary with the sizes of broken stone. This brings the reader to the subject of proper mixing, which is treated in the publication as follows:

"When a man is starting into the work of making concrete and he has no proportion given, but wishes to be as economical as possible in the use of cement, it would be well for him to ascertain the amount of space the neat cement-mortar is to occupy. Fill a box level with stone; shake it slightly so that the voids in the stones will be fairly well reduced; pour into this box, water, carefully measured, until the box is full. This amount of water represents the sand required to fill the voids in the stone. Empty the box and dry it. Lay the stone on a platform when it is dry, or nearly dry, and put over it the amount of sand found necessary to fill the voids; mix the sand and stone together as thoroughly as possible with shovels, and refill the box with this mixture. If the stone was dry when the sand was added and the mixing is well done, this sand and stone together should just fill the box. It may take considerable shaking and pouring to get it all in. When the box is full, measure into it as much water as it will hold. This last amount of water determines the amount of cement it will take to fill the voids remaining after the sand has been added. It is usual, however, to figure on 20 per cent, and if by actual trial it is found not to be enough, then more cement can be added.

"To find the amount of cement required for a cubic yard of bank gravel mixed—say 1 to 8: Add 20 per cent of the yard to it; this makes a bulk of 32.4 cu. ft.; 1-9 of this represents cement, or 3.6 cu. ft. A barrel of cement contains about 3.8 cu. ft. of cement, so it will be seen that one cubic yard of ordinary bank gravel will require practically one barrel of cement when mixed 1 to 8.

"If this mixture had been one part of cement, three parts of sand and five parts of stone, the procedure would be as follows:

"Counting the stone as having 50 per cent voids, 13.5 cu. ft. of sand will fill the voids, but the mixture is 3 to 5, instead of 2½ to 5. Therefore, mixing this concrete on a basis of 27 cu. ft. of stone, 3-5 of that represents the amount of sand, or say 16.2 cu. ft. The difference between 16.2 cu. ft. and 13.5 cu. ft. equals 2.7 cu. ft., which we have in excess of one yard. This excess must be divided proportionately between the sand and stone. Figuring that there are 8 parts in this excess—5 parts stone and 3 parts sand—divide it in the proportion of ⅝ to ⅜, or say 1.7 cu. ft. of stone must be subtracted from the 27 cu. ft. of stone, which will leave say then 25.3 cu. ft. of stone. One cubic foot of sand will be subtracted from the 16.2 cu. ft., leaving 15.2 cu. ft. of sand.

"Now we must obtain the amount of cement required. The measured cement is to the sand as 1 is to 3, therefore, we take ⅓ of 15.2 cu. ft. of sand, or practically 5 cu. ft. of cement. As this does not quite fill the voids left in the mass composed of sand, having 50 per cent of voids, we will consider then that a cubic yard of a 1-3-5 mixture will contain practically 1.2 barrels of cement, 15.5 cu. ft. of sand and 25.3 cu. ft. of stone.

"Another way of figuring this is to take the cubic yard of sand and cement as above ascertained and take one-half the bulk of sand, which will amount to 7.6 cu. ft. as being the amount of voids in the mass. Add this 7.6 to the 27 cu. ft. in a yard; divide by 9 (as the cement is 1-9 of the mass), which gives practically 3.8 cu. ft. of cement, or about one barrel. This means a difference of 20 per cent in the amount of cement used.

"This is not right (although often used) for the voids in the yard really amount to 50 per cent, whereas, here we have taken only the voids in the sand. By counting the voids in the yard at 50 per cent, one-ninth equals 4.5 cu. ft. of cement.

"The first method is the more correct one for the reason that sand and stone are measured in boxes and the cement is either measured in the bag or barrel, or may be, on some work, measured in boxes.

"On a large piece of work it is well to figure in this way so that when the quantities are measured, an excess of cement will be better than if it is found necessary to buy more cement to fill out the mortar. The methods above given will apply to any proportion.

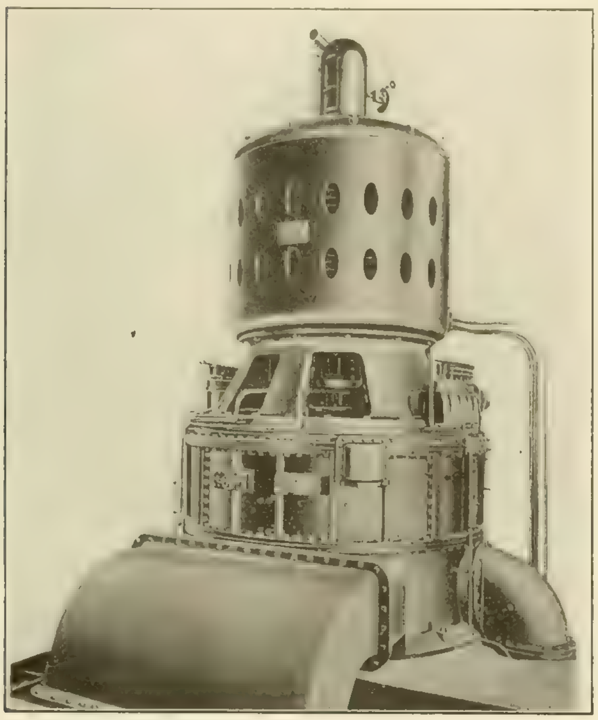
but the user must bear in mind at all times that these proportions are based upon an assumption as to the voids in the materials, and it is much better for him to take the material he is going to use and ascertain the voids for himself before making his measuring boxes.

"The principal advantage possessed by a fat concrete is that it is more dense than a lean concrete, because of the more perfect filling of the voids with cement-mortar. It is also stronger in tensile strength, although that is not of great importance as a tensile stress is hardly ever put upon concrete; but even a fat concrete may be porous if it is not well mixed, and a lean concrete if thoroughly mixed may be more dense and impervious than a fat concrete. The denseness of concrete governs its compressive strength.

"Therefore, it should be borne in mind that no matter what mixture is used the best results cannot be obtained without perfect mixing."

Test of 2,000-Kw. Turbine.

There have just been made public the results of a test of a 2,000-kw. steam turbine generator unit of the Curtis type, made at Schenectady, N. Y., by Mr. Frederick Sargent, of Sargent & Lundy, and Mr. Louis A. Furgeson, second vice-president of the Commonwealth Electric Co., Chicago. The turbine tested is a four-stage



GENERAL ELECTRIC CO. 2,000 KW. TURBINE UNIT.

machine designed in 1903, with some changes in a few particulars as a result of experiments made during the last year.

In their report Messrs. Sargent and Ferguson state that all the apparatus used was carefully standardized and that every precaution was taken to make the test reliable and accurate.

The results are given as follows:

FULL LOAD TEST.

Duration of test, hours	1.25
Steam pressure (gage), lb.	166.3
Back pressure (absolute), in mercury	1.49
Superheat, degrees F.	207.
Load in kilowatts	2,023.7
Steam consumption per kw. hour, lb.	15.[illegible]

HALF LOAD TEST.

Duration of test, hours	0.916
Steam pressure (gage), lb.	170.2
Back pressure (absolute), in mercury	1.40
Superheat, degrees F.	120.
Load in kilowatts	1,000.7
Steam consumption per kw. hour, lb.	16.31

QUARTER LOAD TEST.

Duration of test, hours	1.
Steam pressure (gage), lb.	155.5
Back pressure (absolute), in mercury	1.45
Superheat, degrees F.	204.
Load in kilowatts	555
Steam consumption per kw. hour, lb.	18.09

ZERO LOAD.

Duration of test, hours	1.33
Steam pressure (gage), lb.	154.5
Back pressure (absolute), in mercury	1.85
Superheat, degrees F.	156.
Steam consumption per hour, lb.	1,510.5

The Maintenance of Way Master Painters' Convention.

The officers and executive board of the Association of Maintenance of Way Master Painters of the United States and Canada are now preparing for the convention which is to be held in Cincinnati, November 13th and 14th.

In commenting on this the Painters' Magazine for July says: One of the most important things to be done in order to make the convention a success from the educational standpoint, which is the real purpose of the organization, is the selection of suitable subjects for the programme, and every one interested in the roadway, bridge or building painting of railroads, whether he be a foreman painter, an engineer of maintenance of way, a manufacturer, or even though he have no actual connection with railroad work, is requested to send as early as possible to the secretary, Mr. H. J. Schnell, 100 William St., New York City, suggestions for suitable practical subjects for discussion. As is the case with all railroad societies, the primary objects are to secure better work, reduced cost and increased efficiency of the maintenance of way painting department, rather than the individual profit or benefit of the members. This association, then, should appeal to all engineers of maintenance of way, road masters or general superintendents, whatever the officer may be who has charge of bridge, building and roadway painting for his company—and they should see to it that their foreman painters attend the coming convention, in order that they may interchange experience with fellow workers in the same line and thereby increase their efficiency to the employing companies. No railroad should object to the small expense incurred in sending the foreman maintenance of way painters to the convention, especially when the experience gained there will undoubtedly increase the efficiency of the painting department and save money to the companies.

Brill Cars for Memphis.

The J. G. Brill Co. has just booked an order for 35 of its patented type of semi-convertible cars for the Memphis Street Railway Co. The cars were ordered through the engineering firm of Ford, Bacon & Davis, of New York City. The semi-convertible system includes the late improvement eliminating the sash trunnions and runways formerly used and simplifies the method of conecting each pair of sashes. The arrangement is known as the grooveless post semi-convertible, and has been specified in recent orders from Philadelphia, Boston, Baltimore and elsewhere. The general plan of the lower sash carrying the upper into pockets in the side roofs is preserved. The cars are to be mounted on Brill No. 27-G short-base double-trucks, with solid forged side frames, for fast and heavy city and suburban service. The cars will measure 30 ft. 6 in. over the end panels and 42 ft. over all. The decks are to be standard monitor type and the seating plan consists of transverse seats with reversible backs and longitudinal corner seats accommodating four passengers each.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" [illegible] Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I [illegible] Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 1903. Vol. V is now in press. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram four volumes, $6.[illegible]]

LIABILITY FOR LOSS OF PROPERTY IN FIRE FROM CUTTING OF HOSE.

Little Rock Traction & Electric Co. vs. McCaskill (Ark.), 86 S. W. Rep. 997. Apr. 22, 1905.

Where a street car negligently runs over a hose lying across the tracks and cuts it in two, from which there results a loss of property by the fire to throw water on which the hose was being used, the supreme court of Arkansas holds that the street railway company will be liable therefor in damages.

CONTRIBUTORY NEGLIGENCE IN CHILD.

Murphy vs. Boston Elevated Railway Co. (Mass.), 73 N. E. Rep 1018. Apr. 4, 1905.

If a child of sufficient age and capacity to be allowed properly to travel unattended in a public way used in part by electric cars is injured by a collision in the street, it is contributory negligence on his part, the supreme judicial court of Massachusetts holds, if he unreasonably, intelligently and intentionally ran into the danger, even if children of his age often are reckless.

RIGHT AND DUTY OF MOTORMAN WHERE THERE IS A PEDESTRIAN ON THE TRACK.

McLean vs. Omaha & Council Bluffs Railway & Bridge Co. (Neb.), 103 N. W. Rep. 285. Apr. 10, 1905.

The supreme court commissioners of Nebraska say that they do not understand that it is the duty of the operators of a street railway car to stop the car as soon as they see a foot passenger occupying the track in front. They think that ordinarily the motorman may proceed toward such foot passenger on the presumption that such passenger will step off the track before the car reaches him, until it becomes apparent that for some reason such passenger, either on account of deficient hearing or other inability to apprehend his danger, cannot and probably will not be able to get off the track, and that then it becomes his duty to use all reasonable means at his command to stop the car.

TRAVELERS ON STREET NOT ALWAYS REQUIRED TO STOP BEFORE CROSSING TRACKS.

Los Angeles Traction Co. vs. Conneally (U. S. C. C. A., Cal.), 136 Fed. Rep. 104. Feb. 6, 1905.

The United States circuit court of appeals, ninth circuit, says that it knows of no decision, and was cited to none, in which it has been held that it is always the duty of a person to stop before crossing a street railroad track in an incorporated city. Certainly, in the populous portion of a city or town such a rule would be unreasonable and highly inconvenient; but it may be that in the more sparsely settled portions a like rule to that applicable to steam roads should apply to street railroads.

CONSTRUCTION OF SWITCH NOT AN INTERFERENCE WITH RIGHTS OF ABUTTING PROPERTY OWNER.

Rosenbaum vs. Meridian Light & Railway Co. (Miss.), 38 So. Rep. May 1, 1905.

It appeared in this case that the company maintained a single track down the center of a certain street, and that after a diamond switch was built there would be between the curb line and the edge of a passing car 10.5 feet on one side and 9.7 feet on the other, which would be the narrowest space left outside of the double track at any point along the switch. The testimony developed that the railway would be constructed according to the grade of the street, and would be level with the surface of the highway. The chancellor decided that the construction of the proposed switch would not materially [illegible] street, nor operate as a serious interference with the plaintiff's enjoyment of his property. The supreme court of Mississippi thinks the conclusion manifestly correct.

COURT MAY TAKE JUDICIAL NOTICE OF CONSTRUCTION OF HORSE CAR

Kleffman vs. Dry Dock, East Broadway & Battery Railroad Co. (N. Y. Sup.), 93 N. Y. Supp. 741. May 5, 1905.

The first appellate division of the supreme court of New York says in this case that it may take judicial notice of the construction of an ordinary horse street car.

OPERATION OF BUT ONE CAR A DAY NOT EVIDENCE OF ABANDONMENT OF ROUTE.

Forty-Second street, Manhattanville & St. Nicholas Avenue Railroad Co. vs. Cantor (N. Y. Sup.), 93 N. Y. Supp. 943. May 12, 1905.

It appeared in evidence that in 1901 35 cars a day were run by the plaintiff on its tracks on Amsterdam avenue, but that for a portion of 1902 there was only one car operated a day, and in case of snow storms there were days when no car was operated, and that condition continued until the time of the trial, which was in April, 1903. The first appellate division of the supreme court of New York does not think those facts evidence of a practical abandonment of the use of the tracks on said avenue, but that the running of one car a day indicated that it was not the company's intention to abandon the use of the tracks, and that very much stronger evidence should be required before it should be denied relief by injunction against the removal of its tracks, which would have the effect of depriving it of its franchise, there being no evidence that public convenience was in any way affected by its action.

PRESUMPTION FROM CONTROLLER BOX BEING DANGEROUSLY CHARGED WITH ELECTRICITY—DUTY TO HAVE CARS SAFE.

South Covington & Cincinnati Street Railway Co. vs. Smith (Ky.), 86 S. W. Rep. 970. May 2, 1905. "Not to be officially reported."

If the controller box was charged with electricity to such an extent as to endanger the safety of the passengers who might accidentally touch it by any cause, the court of appeals of Kentucky says, the jury would be warranted in inferring from this fact negligence on the part of the defendant. It is the duty of the carrier to have his vehicles safe, and if they are unsafe, negligence may be presumed. A vehicle is unsafe when the passenger may receive a deadly charge of electricity by coming in contact with a part of the vehicle which he is liable to touch while being carried. If the jury believed from the evidence that the plaintiff received a shock of electricity from touching the controller box, inflicting on him the injury complained of, they might properly find for the plaintiff.

CONSOLIDATION LAW CONSTITUTIONAL.

Cincinnati Street Railway Co. vs. Horstman (Ohio), 73 N. E. Rep. 1075. Feb. 28, 1905.

The supreme court of Ohio holds that the act of the General Assembly entitled "An act to amend and supplement sections 2505a and 2505b of the Revised Statutes of Ohio, as enacted May 1, 1891, and amended April 18, 1892," passed April 22, 1896 (92 Ohio Laws, p. 277), which gives power to lease or purchase, to let or sell, to enter into beneficial arrangements to purchase stock, etc., and of consolidation, is constitutional; it being a law of a general nature, which operates uniformly throughout the state, and upon

every individual corporation of the classes therein defined. It holds that a temporary act may be either general or special, and an act of a general nature which operates uniformly throughout the state, and upon every individual corporation of the classes therein defined, but which is by its terms limited in operation to a specified period of time, is a temporary general statute.

EFFECT ON COMPANY'S LIABILITY TO OCCUPANT OF VEHICLE OF NEGLIGENCE OF DRIVER.

Chicago Union Traction Co. vs. Leach (Ill.), 74 N. E. Rep. 119. Apr. 17, 1905.

The defendant, the supreme court of Illinois says, would not be relieved from liability to the plaintiff, if it was guilty of negligence, merely on the ground that the driver of the carriage in which she was riding was also negligent in turning across the track. But if the accident was solely attributable to the negligence of the driver in turning across the track when the car was too near to enable the motorman to stop it, there would be no negligence of the defendant and no liability.

ORDINANCE LIMITING SPEED OF VEHICLES NOT APPLICABLE TO ELECTRIC CARS.

Robinson vs. Metropolitan Street Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 1010. Apr. 7, 1905.

An ordinance of the city of New York providing that "it shall not be lawful for any cart, wagon or other vehicle, used for the purpose of carrying passengers, to be driven through any streets or avenues of the city of New York at a greater speed than at the rate of eight miles an hour," the first appellate division of the supreme court of New York holds, did not apply to street surface cars, and was not admissible in evidence in an action against a street railway company, there being nothing connecting it with street surface cars—nothing to show that it had any relation to cars operated by electricity—while in its terms it spoke of a vehicle to be driven, which certainly would not be applicable to cars where the motor power was electricity.

ATTEMPTING TO BOARD MOVING CAR CLOSE TO BARRIER IS NEGLIGENCE.

Berry vs. Utica Belt Line Street Railway Co. (N. Y.), 73 N. E. Rep 970. Apr. 11, 1905.

The plaintiff, standing within from two to four feet of a barrier in the street, which he had on a previous occasion observed, and where there was an electric light, attempted to board a moving car and was swept from the step by contact with the barrier—a plank extending to within two to four inches of the side of the car. His theory was that while he was attempting to enter the car the signal was given by the conductor to go ahead, and that the sudden starting of the car threw him out against the barrier, thus causing his injuries. But the court of appeals of New York thinks it quite inconceivable that in the brief interval, "two seconds or so," the speed of the car could have been so appreciably accelerated as to be regarded the proximate cause of the accident. It says that it was a highly negligent act on the part of the plaintiff, standing so near the barrier, to attempt entering the car, even assuming that no bell was given the motorman to go ahead, and that it seemed absolutely clear that the accident was due to this error of judgment on the part of the plaintiff.

DUTY OF MOTORMAN TO KEEP WATCH OF TRACK AHEAD TO AVOID COLLISION—LIABILITY FOR NEGLIGENT INJURY TO A HORSE WRONGFULLY IN HIGHWAY.

Laronde vs. Boston & Maine Railroad (N. H.), 60 Atl. Rep. 684. Apr. 4, 1905.

It was the duty of the motorman, the supreme court of New Hampshire says in this case, to keep watch of the track ahead of his car to avoid collisions with objects that might be upon the track, whether rightfully or wrongfully. The law imposed the duty upon him for the safety of persons both upon the highway and upon the car. Indeed, his own safety depended upon its faithful performance. If the light was dim, and the weather was foggy, greater watchfulness and care would be needed to bring his conduct up to the standard of ordinary care than if it was light and clear. If the jury found that the weather was densely foggy, they might reasonably find, also, that so large an object as a horse hitched to a grocery wagon could be seen when at a distance from the car sufficient to enable the motorman to stop the car before colliding with the team; or, if not, that it was negligence to run a car in a village highway in such weather at a speed of 15 miles an hour.

If, as the defendants said, the horse injured was wrongfully in the highway, the fact would not relieve them from responsibility for the injury in case is was caused by their negligence. In that event their wrong would consist of negligently injuring the plaintiff's horse while carelessly exposed to danger and the plaintiff was not present. The law would not justify the defendants injuring the horse under such circumstances, by their negligent acts, any more than it would if their acts were intentional. The only question would be whether they could have prevented the injury by an exercise of ordinary care. If they could, their negligence would be, in law, the sole cause of the injury.

LIABILITY FOR INJURY TO EMPLOYE FROM FALL OF BRIDGE.

City of Indianapolis vs. Cauley (Ind.), 73 N. E. Rep. 691. Mar. 7, 1905.

This was an action against the City of Indianapolis and the Indianapolis Street Railway Company, brought to recover damages for personal injuries received by an employe of the company, who, as a member of its track-repairing force, was being carried to his work on its construction car when a street bridge over which the latter was crossing fell. The supreme court of Indiana says that it made no difference that the plaintiff was an employe, and not a passenger. He was in the car rightfully, and by command of the company. He had no knowledge, nor means of knowledge, of the defective and dangerous condition of the bridge, and, in the absence of opportunity or means of information, it could not be said that he assumed an extraordinary risk that was wholly unknown to him. A special finding that both the city and the company knew at the time of the accident that the bridge was dangerous to travel, and unsafe for the use to which it was at the time being put by the street car company, of itself imported negligence in both. Moreover, if it be true, as submitted, that a corporation is under no legal duty to go in advance of its employe traveling on a highway over which it has no control, and inspect and make the road and bridges safe, yet the court knows of no law that gives a corporation the right to knowingly and recklessly carry its uninformed employes into a place of eminent danger.

An instruction given advised the jury that a street car company, when using a city bridge for its tracks, thereby adopts such bridge as one of its appliances, and if such company knows, or by the exercise of reasonable care could know, that such bridge is in a defective and unsafe condition, and liable to give way and fall by reason of such condition, and knowingly causes or permits its cars to be run over such bridge, and the bridge gives way and falls because of said defective condition, while cars of such company are in the act of crossing, and its employes in charge of the cars, or upon them, in the line of their employment, are, without negligence on their part, injured in the fall of such cars, such employes would be entitled to recover for injuries so received; but if such employe knew, or could have known by the exercise of ordinary care and diligence, that such bridge was out of repair and unsafe, and liable to fall because of such condition, and with such knowledge, or means of knowledge, operated and ran, or rode upon, cars onto the bridge, and, while attempting so to cross, the bridge broke and fell by reason of its said defective condition, such employes must be held to have assumed the risk, and cannot recover for injuries received by the fall. In another instruction the trial court applied the general principles announced in the first-mentioned instruction to the facts of this case, upon the hypothesis that the evidence established guilty knowledge in the company and the absence of fault in the plaintiff, and in still another instruction applied the same upon the hypothesis that the evidence established knowledge and assumption of risk in the plaintiff. The supreme court says that it perceived nothing erroneous in either of these three instructions.

ORDINANCE GIVING VEHICLES PROCEEDING IN A CERTAIN DIRECTION THE RIGHT OF WAY NOT ABSOLUTE—NO DEFENSE THAT THIRD PARTY CONTRIBUTED TO INJURY

Demarest vs. Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Co. (N. Y. Sup.), 93 N. Y. Supp. 663. May 5, 1905.

Where a city ordinance gave vehicles proceeding in a northerly or southerly direction the right of way over vehicles proceeding in an easterly or westerly direction, the first appellate division of the supreme court of New York holds that it was nevertheless error to instruct the jury that "such right of way required the driver of the truck or wagon to stop his horses and let the car pass, if that was necessary to prevent the obstruction of the car upon its passage." It says that the car did not have an absolute right to the exclusive use of the street. The truckman had a right to cross; so did the plaintiff, who was injured in a collision between the car and the truck; and the defendant was bound to operate its cars having regard to that right, and if it failed to do so, it was obligated to make good to the plaintiff any damage he sustained by reason thereof.

The court also says that the rule has long been settled in that state that a third person who is injured by the negligence of two or more persons, he himself being free from negligence, may maintain an action against them jointly or severally to recover the damages sustained, and when such action is brought a defendant cannot successfully defend the same on the ground that negligence of another contributed to the injury.

CARE REQUIRED OF PERSON WORKING WHERE CARS CANNOT PASS WITHOUT STRIKING HIM.

Hennessey vs. Forty-Second Street, Manhattanville & St. Nicholas Avenue Railway Co. (N. Y. Sup.), 92 N. Y. Supp. 1058. Apr. 7, 1905.

A carpenter in the employ of a firm of contractors engaged in constructing a subway was building a fence about 30 inches from a street railway track. He knew that the cars were passing every two or three minutes, and knew it was a dangerous place to work, and, with this knowledge, worked on, without paying any attention to the passing cars; relying, as he said, upon his hearing the bell when one approached. The first appellate division of the supreme court of New York holds that he was guilty of contributory negligence. It says that the situation was perfectly apparent. In working in such a dangerous place, he was bound to exercise the care and caution that were necessary to protect him from the cars running upon the track. It was certainly not the care of a prudent man to keep on working in such a situation, without either looking or listening for approaching cars. If he had paid any attention to the cars when one came in front of him, he would have seen it, and then, by standing up close to the fence, could have avoided injury. A person attempting to cross a track is bound to look so as to see whether a car is approaching, and, when he is at work in such a position that a car cannot pass without striking him, he is bound to watch for the cars; and if, by a lack of attention, he unnecessarily expose himself to danger, he is guilty of contributory negligence.

RIGHTS AND DUTIES AT AND BETWEEN CROSSINGS—LOOKING AND LISTENING—SPEED AS EVIDENCE OF NEGLIGENCE.

Marden vs. Portsmouth, Kittery & York Street Railway (Me.), 60 Atl. Rep. 530. Mar. 2, 1905.

In an action on the case for negligence on account of a collision between a team and an electric car, the supreme judicial court of Maine holds that between street crossings the car, from the fact that it must pursue one course and cannot turn out, necessarily has a paramount right, to be exercised in a reasonable and prudent manner. That, when approaching a public street junction, the rule is that the motorman shall be held to anticipate that any person approaching such junction from either side may turn his team into it, and shall then exercise all due care to have his car under such control as to be able to stop it at the crossing, if necessary, to avoid an accident. At such crossings the car has no right superior to that of other [illegible]. The care [illegible] required in approaching the crossing of a [illegible] does not [illegible] apply to the crossing of an [illegible]. In approaching [illegible] it is not incumbent upon the traveler upon foot or with a team, as a matter of law, to [illegible] and listen. [illegible] of reasonable care. Whether [illegible] of reasonable care is a question of fact for the jury, depending upon the circumstances of each particular case. [illegible] In crossing a car track at the junction of a street the traveler is not required to look the [illegible] to see if a car is coming, but along the track far enough to warrant an ordinarily prudent man, having in mind his own safety, under like circumstances, to conclude that no car was in such proximity as to endanger his safety in crossing.

PRESUMPTION OF NEGLIGENCE FROM COLLISION—BURDEN OF PROOF RESTING ON COMPANY

Fagan vs. Rhode Island Co. (R. I.), 60 Atl. Rep. 672. Mar. 15, 1905.

A passenger upon an electric car was injured by a coilision with a team. The supreme court of Rhode Island says that, undoubtedly, if the collision had been between two cars operated by the defendant, the implication of negligence would have been irresistible. If the collision had been with a team in a frequented city street, where care is always necessary to avoid collisions, and where proper care will generally avoid them, the implication would arise that proper care had not been used, and the burden would have been upon the company to show that it had not been negligent. So, if the collision had been between a street car and a steam car at a crossing, or if the admitted circumstances of the case were such that they probably involved negligence on the part of the company—then the burden would have been thrown upon the company to explain such circumstances, and to show to the satisfaction of the jury that their employes had observed due care.

But here the collision was between a car and two horses, one wandering about the road, unattached, and the other harnessed to a wagon the driver of which was asleep, and the court does not think there was any presumption of negligence. Is it a reasonable implication from these circumstances, the court asks, that the motorman carelessly ran into the horses at the peril of his own life and to the damage of his limbs, after seeing the team on the track a considerable distance away, in time to have stopped his car before meeting it? The court thinks it much more reasonable to suppose that the horses, seeing the bright light of the approaching car, were dazzled and confused, and in their unguided stupidity rushed into the danger which a reasonable being would have avoided. The mind requires proof to establish the less probable of two contradictory propositions. And the evidence here was all the other way.

DUTY TO PASSENGER INVITED BY MOTORMAN TO ENTER CAR BY FRONT PLATFORM—PRESUMPTION FROM SLIPPING OF BRAKE.

Thompson vs. St. Louis & Suburban Railway Co. (Mo. App.), 85 S. W. Rep. 465. Mar. 21, 1905.

The defendant, the St. Louis court of appeals says, is a carrier of passengers for hire, and the law is that it is bound to exercise the greatest care, consistent with the practical operation of its cars, towards its passengers, not only while they are on the cars, but while they are in the act of boarding them or alighting from them. When its cars are stopped for the purpose of taking on passengers its duty is to see that they are safely aboard. As the motorman invited the plaintiff to enter the car by the front platform (the rear one being in a crowded condition), it was his duty to exercise that high degree of care the law requires to prevent injury to the plaintiff while she was mounting the steps to the platform for the purpose of taking passage on the car. The narrowness of the platform, the fact that there were three men beside the motorman on it, and the presence of the gates swinging inward and toward the body of the car, tended to show that one boarding the car would, in all probability come within the radius of the brake handle. The sudden turning of the brake, which, striking the plaintiff while boarding the car, caused the injury complained of, was not accounted for. It was under the control of the motorman, who testified that

it could not set itself free, and that it was impossible for the brake to turn without the cogwheel was first released from the dog, and that the dog could not be moved except by human agency. From this evidence it was shown that in the ordinary course of things the accident would not have happened if the motorman had used proper care to set the brake, and the reasonable inference was that he did not properly set it. And as there was no evidence tending to show that the plaintiff was negligent in any respect whatever, the court concludes that the case was one for the jury, and that there was no error in refusing a compulsory nonsuit.

PERSON TRANSFERRING FROM ONE CAR TO ANOTHER A PASSENGER—DUTY OF CONDUCTOR WHEN CAR STOPS TO RECEIVE PASSENGERS, AND TO PERSONS AFFECTED WITH A DISABILITY.

Clark vs. Durham Traction Co. (N. C.) 50 S. E. Rep. 518. Apr. 11, 1905.

A person who has obtained a transfer ticket, in transferring from one car to another, the supreme court of North Carolina holds, is still a passenger, the transfer being but a part of the trip, for the whole of which the company agrees to convey in safety.

When the car stopped for the purpose of receiving passengers either from the street or those transferred from other cars, it was plainly the duty of the conductor, the court says, to be at his station on the platform where passengers are in the habit of boarding the car. It was his duty to give them such assistance as was necessary in getting on and off the car, and to see to it that the motorman was not signaled and the car not started until reasonable time had been given the passengers there assembled, who manifested an intention to get on the car. The authorities show that if a street car has stopped for the reception of passengers, or if an intending passenger has signaled it to stop, and has put his foot upon the step of the car in the act of getting on, and is injured by a sudden starting, he will have the right to damages for his injury, whether the servants who started the car knew that he was in the act of getting on or not. Such person is entitled to the care due a passenger, and it is the conductor's duty to know before he starts his car whether any person is in the act of getting on or not. If the conductor is busy, it is not enough for him to wait a reasonable time for passengers to board the car, but it is his plain duty to look and see that intending passengers are safely on board before signaling the motorman to start.

The authorities, the court further says, are all to the effect that a degree of attention beyond that due to ordinary passengers should be bestowed on those affected with a disability by which the hazards of travel are increased. The sick, the lame, children, and aged persons are entitled to more care and attention from those in charge of a car than those in full possession of their strength and faculties. They should be allowed more time in which to get on and off the car and to secure a safe position therein.

ABUTTER NOT DAMAGED BY SLIGHT OVERHANGING OF PAVEMENT BY CAR IN PASSING CORNER—STREET RAILWAY NOT ADDITIONAL BURDEN.

Hester vs. Durham Traction Co. (N. C.), 50 S. E. Rep. 711. May 2, 1905.

The owner of a lot occupying the apex of an acute angle lying at the junction of two streets, the supreme court of North Carolina holds, was not injured in the use of his property by a slight overhanging of the pavement or sidewalk by cars for an instant of time as they passed around on a curve connecting the tracks on those streets, the edge of the car for a few inches of distance being slightly over the edge of the sidewalk.

The court says that the authorities, with singular uniformity, concur that it is "now well settled that the use of the streets in cities or villages for a street railway is one of the ordinary purposes for which such streets and highways may be used, and does not impose an additional burden or servitude, so as to entitle the abutting property owners, as a matter of right, to compensation before such use can be made. * * * This rule is generally recognized, irrespective of the question whether, in the original laying out of the street, a mere easement was taken, leaving the fee simple in the abutting property." The rights, powers, and liability of the municipality extend equally to the sidewalk as to the roadway, for both are parts of the street. The abutting proprietor has no more right in the sidewalk than in the roadway. His rights are simply that the street, including roading and sidewalk, shall not be closed or obstructed so as to impair ingress or egress to his lot by himself and those whom he invites there for trade or other purposes.

The authorities might have narrowed the sidewalk at the toe of the plaintiff's lot by drawing in its outer edge, or they might have made the outer edge curving to correspond with the curve of the car track, and thus prevented the car overhanging the edge of the sidewalk. If so, they might, so far as the plaintiff was concerned, let the car overhang the corner instead of cutting off that corner from the sidewalk. If the sidewalk were so far narrowed as to impede the circulation of passers-by on foot, so as to hinder the ingress and egress to the plaintiff's building, he would have cause of complaint, but such was not the case here. If the overhanging of the car were to injure any one walking on the sidewalk, such person might possibly have a cause of action against the city or the defendant, for the establishment and maintenance of the sidewalk were an invitation to pedestrians to walk anywhere thereon, but the plaintiff would not be injured thereby in his property rights to the lot.

CARE REQUIRED IN BOARDING CAR—BEING ON PREPARED PLATFORM NOTICE OF DESIRE TO TAKE CAR—ACCEPTANCE OF OFFER TO BECOME A PASSENGER—SECRET INTENTION OF MOTORMAN OF NO AVAIL.

Spencer vs. St. Louis Transit Co. (Mo. App.), 86 S. W. Rep. 593. Apr. 18, 1905.

One, in boarding a car for the purpose of becoming a passenger thereon, the St. Louis court of appeals says, is bound to exercise ordinary care.

The evidence in this case showed that the platform on which the plaintiff and others were lined up was constructed by the defendant for the convenience of its passengers in getting on and off its cars, and that the plaintiff and others were on the platform early in the morning, in the attitude of waiting for a car to take them down town to their several places of business and employment. These circumstances, the court says, were notice to the motorman of the desire to board the car, and his evidence that he waived his hand and hallooed to them to take the next car showed conclusively that he knew they were on the platform for the purpose of taking a down-town car. Therefore, if the motorman, as the plaintiff's evidence tended to show, turned off the power, and applied the brake, and checked the speed of the car for the apparent purpose of taking on passengers, and the plaintiff was induced thereby to believe he was going to stop the car for that purpose, then the plaintiff had a right to assume that he and the crowd were invited to board the car; and if, when he attempted to board it, its speed was not so great as to make the effort obviously perilous, he was entitled to have his case submitted to the jury.

Where a signal is given by one wishing to board a street car, or where his attitude is such as to indicate such wish, and either is seen and recognized by the motorman, and in apparent response he turns off the power and sets the brake, in view of the passenger, indicating to him that the car is going to be stopped, that he may get aboard, and he, without negligence, attempts to do so, the contract of carrier and passenger is complete, for the passenger understands from the movements of the motorman that his offer to become a passenger is accepted, and he may act on it with as much reliance as if the offer and acceptance had been reduced to writing; and the offer cannot be repudiated or avoided by a showing on the part of the company that the motorman turned off the power or set the brake for some purpose other than taking on passengers, if such other purpose was not in some way communicated to the passenger. A secret intention or mental reservation on the part of the motorman in respect to the handling of his car is no more available to disprove a contract of carriage than is a secret intention or mental reservation of a party to a written contract available to show that he did not intend to be bound by the contract as written.

Power House Management.*

Mr. G. M. Campbell: Power house "management" is getting the best results in the way of power output at the lowest cost. To accomplish this it is necessary that a systematic record be kept of all expenses and of the output of power, for it is mainly by careful comparison of such figures that costs can be reduced and output increased for the same outlay. In scanning the record of expenses, it would not be sufficient to consider prices in the abstract, material must also be taken account of; for example, a high grade cylinder oil at 65 cents a gallon would undoubtedly be cheaper for many purposes than a poor grade at 35 cents. Again, it is often poor economy to be too careful about the amount of supplies used; the wear and tear on the machinery by use of insufficient supplies may far exceed the saving in supplies.

For the best results the plant should be designed with the object of economy and efficiency in view; boilers, engines, pumps, etc., should be chosen with particular reference to the conditions under which they will work, and everything should be so installed that it is capable of being easily repaired; that is, there should be working space around all apparatus, and pipe lines, valves, etc., should be easy of access. All large power houses are equipped with cranes; the smaller plants are not always so equipped, but they should be, and if a crane is not part of the original installation it should be added.

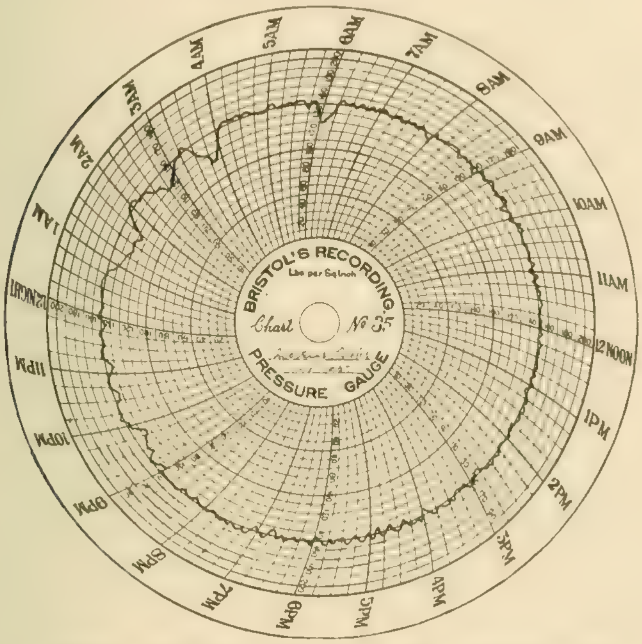


FIG. 1—"Fireman went to sleep. He was discharged."

It is generally assumed that a low water rate condensing plant is more economical than a non-condensing one where the rate is higher, but such is not always the case. If all the heat in the exhaust steam can be made use of, then relatively inefficient but low cost engines would, when interest and depreciation as well as the coal pile are considered, be the cheapest to install and maintain. If steam from the boilers is eventually discarded as water and at the same time the feed water enters the boiler at or near 212°, what more could be desired or obtained? I have in mind a non-condensing plant of 2,000 brake h. p., which in winter uses every ounce of exhaust steam and in summer a very large percentage of it. That plant is working very economically, though the engines and pumps installed have a high water rate.

In general, do not worry and scheme to simply repair troubles, but remove the cause. If you are burning out tubes in your boilers and keeping gangs of men putting in tubes or cleaning the scale out of old ones, do not scour the market to find the best flue scraper or where a man can be [illegible] are paying $3.25, but remove the trouble and install a plant that will soften the water. It is an easy matter usually to prove the saving; if the management refuses to spend the initial sum, hammer away with facts about costs until the management will spend it. One firm in this vicinity put in 200 tubes in two months at an average cost in place of $7.50 per tube, a total of $1,500 for two months. A water softening plant of the proper size would cost about $8,000 and would pay for itself in two to three years.

The question of stokers should be carefully gone into, and it will usually be found that there will be an undoubted saving in maintenance and improvement in service, especially in large plants. On quite small plants it is not necessarily advisable to install stokers.

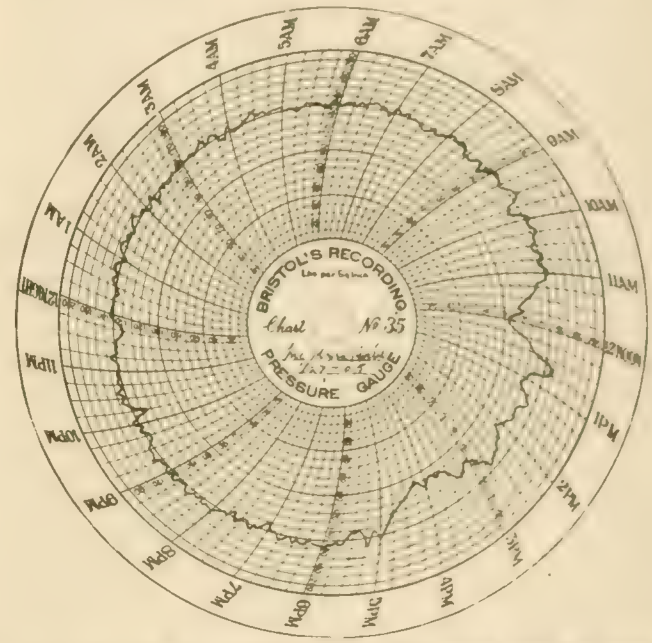


FIG. 2—"Drop on pressure gauge was caused by poor draft. Found combustion chamber back of boilers filled up with the ashes. Took air blower and blowed ashes out. Combustion chambers are cleaned out when boilers are off. I find they need cleaning oftener. Have ordered night fireman to blow combustion chambers under boilers every night. I think this will keep combustion chambers free from filling up."

Another and important item is the personnel of the force; the men, as well as the machinery, should work at high efficiency, and good and intelligent men should be obtained, even if the price is somewhat higher than that demanded by inferior men. It would be easy to obtain common labor at $1.50 for an eight hour day as fireman, but if by paying $1.90 or $2 for the same service a superior workman can be obtained, the difference will be more than made up by the decreased use of coal and better service. In general, the organization consists of the head of the department controlling the various power houses, if there are more than one, or the power house and the general power distribution. Under him is a superintendent for each power house and others for outside work. If the plants are large, there may be a night as well as a day superintendent. Under the superintendent there would be, in large plants, a head to the engine room, another to the boiler room, etc. There should be distinct seniority of rank so that when the superintendent is absent there is no doubt about who is in control. If men work at high efficiency, their hours should not be too long. Power houses have of necessity to run 24 hours a day, and therefore either two or three tricks must be used. If a man works 12 hours a day, takes three-quarters of an hour going to and returning from his home, another half hour for breakfast and supper and eight hours for sleep, he will not die of ennui in endeavoring to fill in the rest

*From a topical discussion before the Engineers' Society of Western Pennsylvania, May 2, 1905.

of the day. I am strongly in favor of three tricks of 8 hours, instead of two tricks of 12 hours. It is extremely difficult to get men of proper force of character to work on 12-hour tricks, but relatively easy to get men for 8-hour tricks, even though the wages be less. In one of our power houses we were at first running 12-hour tricks and paying the enginemen $3.25, and were unable to keep them for any length of time. We later changed to 8-hour tricks, paying the enginemen $2.80, and one of the old men came back. When good men are obtained, treat them well, so that they would rather work for you than for anybody else. If a man is sick on the three-trick force, have his work taken care of by the other two men, with no deduction of pay, or only partial deduction. This is an excellent practice where reliable men are hired, but is apt to be taken advantage of by the shiftless.

One of the best devices for the control of a power plant is the automatic recording instrument recording steam pressure, voltage, current, wattage, temperature on heating systems, pump speeds, etc. The most important in an ordinary power house are the steam pressure chart and voltage chart; the former records conditions in the boiler room, the latter, conditions in the engine room. The pressure line cannot be good unless the water level and fires are attended to, nor can the voltage line be correct if the switchboard is neglected. It is excellent practice to require that a written explanation of any irregularity in these charts be pinned to the chart, and an engineer or fireman with a too frequent repetition of bad charts should be discharged.

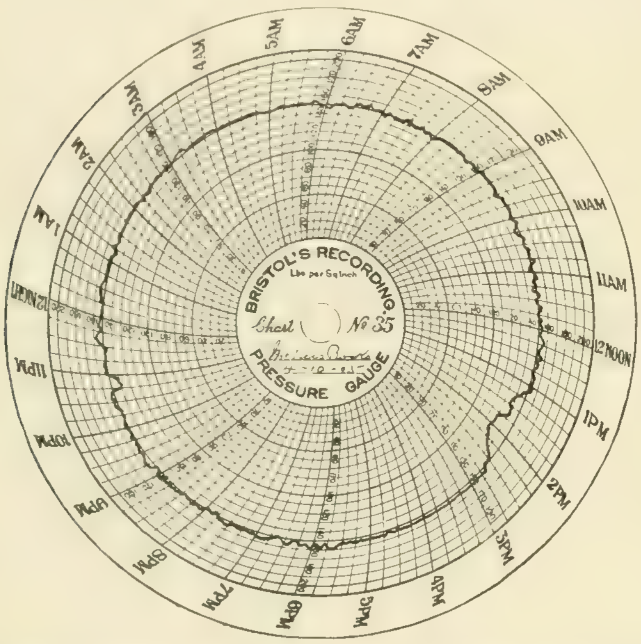


FIG. 3.—"Cause of bad line on pressure chart was from an unexpected load, 1,850 amperes. A very heavy storm was passing over McKees Rocks at the time, and the fires were not very clean."

Another important point in connection with power house management is the avoidance of shutdowns. There is nothing more annoying to the public than a shutdown of the power plant of an electric railroad, and there is nothing more costly to a producing firm than the shutdown of the plant. Cost of making repairs is a secondary consideration, the first is continuity of service. Pipe lines should be so put in that any section in the power house could be cut out for repairs without shutting down the plant. A fairly large supply of duplicate parts should be kept on hand. All machines should be inspected at frequent intervals. If an engine has run for a year or more without repairing, the superintendent should rather have a nervous than a satisfied feeling concerning it.

A few points in connection with the compact and efficient power plant for the McKees Rocks shops of the Pittsburg & Lake Erie Railroad Co. may be of some interest. This plant is thoroughly up to date in almost every respect. It embodies a great many of the best features in power plant design. The building is 77 x 100 ft. by 50 ft. high from the basement floor. Most of the pumps are in the basement. The main floor is divided by a brick partition wall into engine room and boiler room. The boilers are six Babcock & Wilcox, 264 h. p. each, nominal rating. They are, however, worked much above this rating. A load of 1,800 b. h. p. has been carried for several hours on four boilers. It was calculated that five boilers would at any time be sufficient to take care of the load, leaving one for spare. In connection with these boilers, I may say that we had a great amount of trouble at first from burning out tubes, 56 tubes requiring to be replaced in three months. When the water softening plant was installed and in good working order the trouble ceased and now the tubes remain almost as clean as the day they were installed. The coal and ashes are handled by machinery, the coal is dumped from hopper cars through a grating to a hopper beneath, whence it is hoisted by endless chain or conveyor to top of building, it is there dumped on a horizontal conveyor which deposits it at points desired in the storage bins, whence it flows by gravity to stoker hopper. The ashes are handled from the basement by the same machinery and are dumped into a storage bin directly over the track, thence into hopper cars beneath. Coal capacity is 200 tons, ash capacity 2,000 cu. ft.

The engines installed are four 14 and 24 by 14-in. Westinghouse compound engines, 280 r. p. m., about 250 h. p.

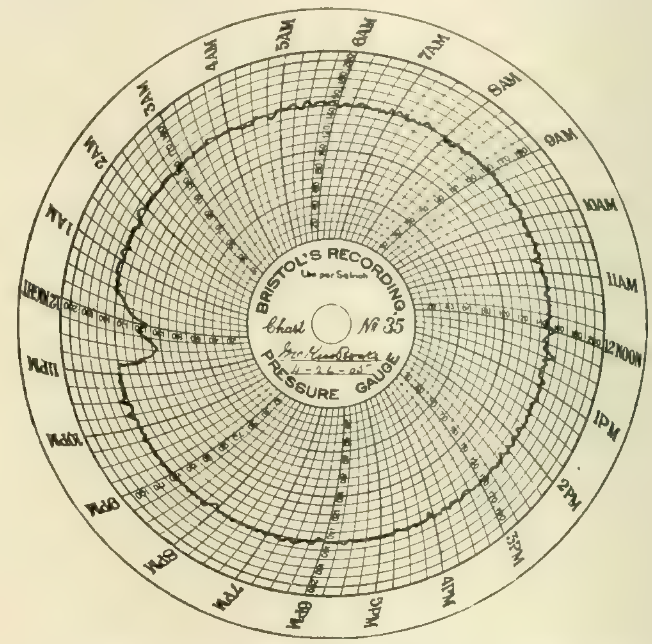


FIG. 4. "Bad line on pressure chart 11.10 p. m. was caused by bursted tube in boiler No. 4, 7th row and 6th tube."

Generators are of the direct connected Westinghouse, 150 kw. capacity, 240 volts.

The switchboard is an 18-panel board consisting of four generator panels, one load panel, five incandescent light and constant speed motor panels, three arc light panels and five variable speed motor panels.

There are 15 pumps which cover every purpose and are of various capacities, from a 50-gallon test pressure pump to a 1,000-gallon cold water supply pump. Five of the pumps are motor-driven centrifugal or turbine pumps.

The two air compressors are each capable of compressing 1,000 cu. ft. of free air per minute to 100 lb. pressure.

There are also what are termed balancers or motor generators to split the 240-volt circuit into two 120-volt circuits for the arc lighting and six voltages from 40 to 240 for the variable speed motors.

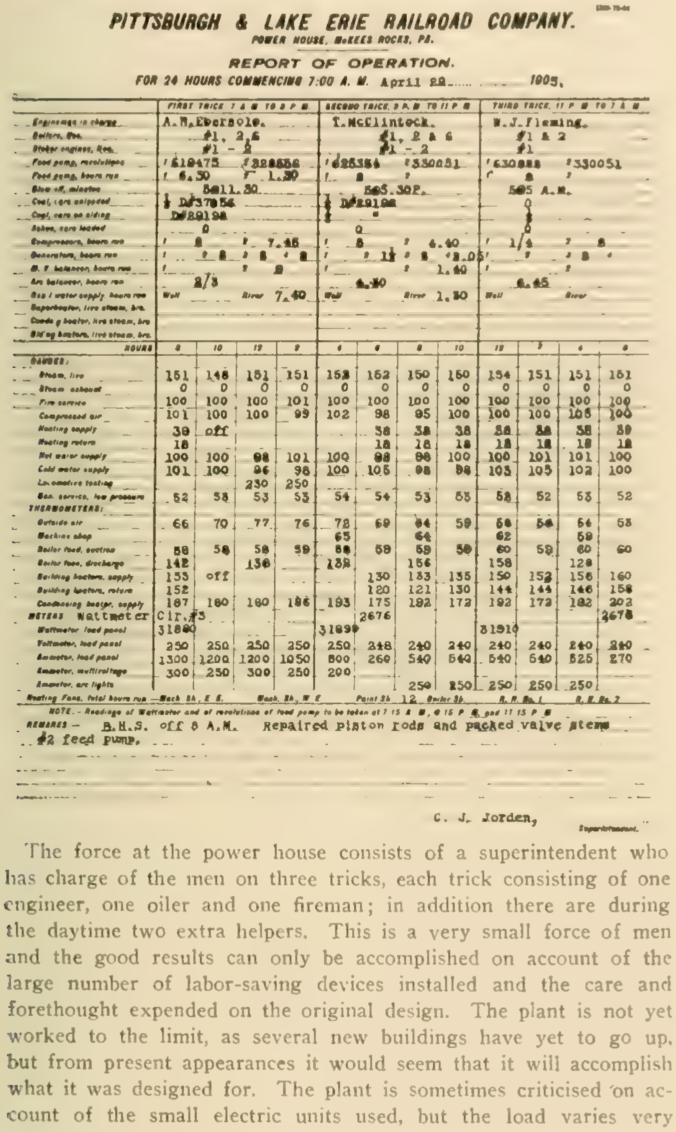
This power plant takes care of the heating of the whole system of buildings, some of the buildings being half a mile from the power house. The heating is performed by circulating hot water through large heating coils in the various buildings, from which the heat is extracted by the air forced over them by fans. The temperature in all the buildings is controlled in the power house by raising or lowering the temperature of the water, which can be done at will. The water is heated in the power house in large heaters by means of exhaust steam supplemented by live steam, and is circulated through the system by two centrifugal pumps. It is expected that the heating load in 10-degree weather will, when

all the buildings are up, be about 10,000,000 B. t. u. per hour, 40 per cent of this being taken care of by the exhaust steam.

The steam pressure carried is 150 lb., voltage 250 volts direct current, water pressure, general service, 80 lb., fire service, 100 lb., hot water supply, 125 lb., test pressure, anything up to 400 lb. About 4,000,000 gallons a week are used, and as 95 per cent of this is double pumped, the pumps handle about 8,000,000 gallons a week.

Several of the automatic recording instruments referred to in the fore part of this discussion are in use in this plant. A few of the charts, and the explanations that accompanied them, are here reproduced showing the errors they detect. It will be noticed that in general the curves are very true so that the imperfections are very noticeable.

A sample of the daily report sheet is here shown. The cut is made from the typewritten office copy, not from the original



PITTSBURGH & LAKE ERIE RAILROAD COMPANY.
POWER HOUSE, McKEES ROCKS, PA.

REPORT OF OPERATION.
FOR 24 HOURS COMMENCING 7:00 A. M. April 22 1905.

	FIRST TRICK 7 A. M. TO 3 P. M.	SECOND TRICK 3 P. M. TO 11 P. M.	THIRD TRICK 11 P. M. TO 7 A. M.
Engineman in charge	A. N. Ebersole.	T. McClintock.	W. J. Fleming.
Boilers, Nos.	#1, 2, 6	#1, 2 & 6	#1 & 2
Stoker engines, Nos.	#1 - 2	#1 - 2	#1
Feed pump, revolutions	1 618475 2 328558	1 625354 2 330051	1 630888 2 330051
Feed pump, hours run	1 6.30 2 1.30	1 8 2	1 8 2
Blow off, minutes	5@11.30	5@5.30 P.	5@5 A. M.
Coal, cars unloaded	1 D#37054	1 D#29198	0
Coal, cars on siding	D#29198	"	
Ashes, cars loaded	0	0	0
Compressors, hours run	1 8 2 7.15	1 8 2 6.40	1 1/4 2 8
Generators, hours run	1 2 8 3 8 4 8	1 2 11 3 8 4 2.05	1 2 3 8 4
D. V. balancer, hours run	1 2 8	1 2 1.40	1 2
Arc balancer, hours run	2/3	6.30	6.45
Gen'l water supply, hours run	Well River 7.40	Well River 1.30	Well River
Superheater, live steam, hrs.			
Cond'g heater, live steam, hrs.			
Bld'ng heaters, live steam, hrs.			

HOURS	8	10	12	2	4	6	8	10	12	2	4	6
GAUGES:												
Steam, live	151	148	151	151	152	152	150	150	154	151	151	151
Steam, exhaust	0	0	0	0	0	0	0	0	0	0	0	0
Fire service	100	100	100	101	100	100	100	100	100	100	100	100
Compressed air	101	100	100	99	102	98	95	100	100	100	105	100
Heating supply	38	off				38	38	38	38	38	38	38
Heating return	18					18	18	18	18	18	18	18
Hot water supply	100	100	98	101	100	98	98	100	100	101	101	100
Cold water supply	101	100	96	98	100	105	98	98	105	105	102	100
Locomotive testing			230	250								
Gen. service, low pressure	52	58	53	53	54	54	53	55	52	52	53	52
THERMOMETERS:												
Outside air	66	70	77	76	72	69	64	59	56	56	54	53
Machine shop					65		64		62		59	
Boiler feed, suction	58	58	58	59	58	58	59	58	60	59	60	60
Boiler feed, discharge	142		136		132		156		158		128	
Building heaters, supply	155	off				130	133	135	150	152	156	160
Building heaters, return	152					120	121	130	144	144	146	158
Condensing heater, supply	187	180	180	186	193	175	182	172	192	172	182	202
METERS Wattmeter	Cir. #3					2676						2678
Wattmeter, load panel	31880				31890				31910			
Voltmeter, load panel	250	250	250	250	250	248	240	240	240	240	240	240
Ammeter, load panel	1300	1200	1200	1050	800	260	540	540	540	540	525	270
Ammeter, multivoltage	300	250	300	250	200							
Ammeter, arc lights							250	250	250	250	250	

Heating Fans, total hours run — Mach. Sh., E. E. Mach. Sh., W. E. Paint Sh. 12 Boiler Sh. R. H. No. 1 R. H. No. 2

NOTE.—Readings of Wattmeter and of revolutions of feed pump to be taken at 7.15 A. M., 3.15 P. M. and 11.15 P. M.

REMARKS— B.H.S. off 8 A.M. Repaired piston rods and packed valve stems #2 feed pump.

C. J. Jorden,
Superintendent.

The force at the power house consists of a superintendent who has charge of the men on three tricks, each trick consisting of one engineer, one oiler and one fireman; in addition there are during the daytime two extra helpers. This is a very small force of men and the good results can only be accomplished on account of the large number of labor-saving devices installed and the care and forethought expended on the original design. The plant is not yet worked to the limit, as several new buildings have yet to go up, but from present appearances it would seem that it will accomplish what it was designed for. The plant is sometimes criticised on account of the small electric units used, but the load varies very greatly. On summer nights one generator is sufficient to carry the load, while on dark days in winter all four generators are in service.

In proportioning the cost everything is based pro rata on the actual steam consumption, the steam consumption in most cases being based on result of tests.

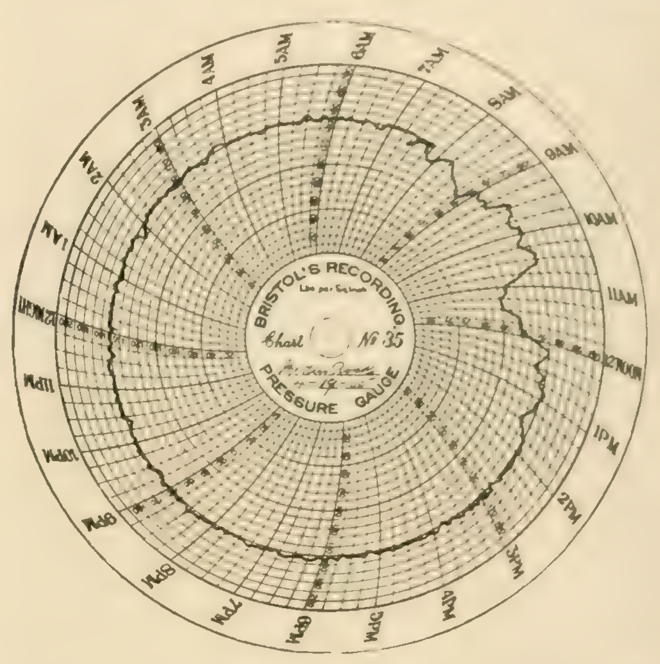
An extract from the 1904 yearly report is as follows:

Pittsburg & Lake Erie Railroad Co., McKees Rocks Power Plant.

	Total.	Monthly Average
Steam pressure, lb.		148.3
Coal consumption:		
Cars, total	265	22.08
Pounds, total	22,724,400	1,893,700
Pounds per hour		2,592.1
Ashes, cars loaded	42	3.5*
Water evaropated:		
Gallons, total	[illegible]	[illegible]
Pounds per hour		[illegible]
Pounds per hour per lb. of coal:		
Actual		7.47
From and at 212°		[illegible]
Boiler h. p. developed		[illegible]

*Ashes were 13 per cent weight of the coal.

	Expenses.		Per Cent.
Wages	$10,273.[illegible]	[illegible]	50.27
Supplies	[illegible]	[illegible]	9.11
Machine Repairs	[illegible]	[illegible]	7.26
Coal	[illegible]	[illegible]	33.36
Total	$20,437.54	$1,703.13	100.00



FIGS. 5 AND 6. "The bad line on pressure chart was caused by letting too much coal in furnace."

General Distribution.

Heating	$3,208.01	$267.34	17.00
Compressed air	5,464.00	455.30	26.31
Lighting	2,255.20	187.93	11.10
Pumping	4,779.[illegible]	398.31	22.78
Machine tools, etc.	3,602.66	300.22	17.32
Locomotive filling	1,127.32	93.94	5.49
Total	$20,437.54	$1,703.13	100.00

Rates.

Cost in cents, per	Maintenance.	*Total.
B. h. p. hour, developed	0.367	0.752
Kw.-hour	0.628	1.286
H. p.-hour, electric	0.469	0.962
1,000 cu. ft. free air, compressed	1.695	3.474

Mr. Charles Fitzgerald.—If our memory serves us aright we have a test where we used slack coal on a Murphy stoker and the ash came down even below Mr. Campbell's figure. Our coal cost us 70 cents a ton delivered, and our average horse power was about 650 for 20 hours. We used Murphy stokers and return tubular boilers. When we started we had trouble, but after considerable experimenting we got our firemen so they knew how to handle the slack coal and our ash was gotten down to the minimum. It seemed that we got as good work out of the ordinary slack coal as we could out of run-of-mine, crushed, or any high grade coal.

*Based on cost of [illegible] per cent depreciation.

There are some things that I used to make a hobby of. One is cleanliness in the power house. The first thing I try to do with an engineer is to have him clean himself. Polishing the bright work is never satisfactory to us, we also want the corners of the engine and boiler rooms clean. If you instill that into your engineers they will soon commence to take pride in their work. Unless a man is clean and tidy about the place we don't think you will ever get good records from him.

We are firm believers in recording charts, steam, vacuum, coal, and so forth. We had quite an experience in the last two years in the operation of a hydraulic dredge. We used charts for the suction, and could go around the dredge once a day and look over the charts and know whether the men had been simply pumping water or pumping sand. We kept records for many years at the 34th St. and 47th St. power stations. We had water meters and they were comparatively accurate. Then we had a space arranged in front of the boilers where every wheelbarrow load of coal was weighed and checked. The ashes were weighed once in a while simply as a check. I was able to report to our directors at the end of the year exactly how much of each kind of oil we had used, how much waste, packing, etc., and show them the cost per horse power for each one of these articles. I presented it to them the first year —and it was asked for after that.

Mr. J. N. Chester.—What I say will be from the standpoint of a superintendent of power stations consisting almost entirely of water works from 25 to 600 h. p. And, unfortunately, not of stations that we have been able to build as we would have them.

The question of records has always been to our minds a very grave one, as to what extent it can be carried and not be a detriment to the plant. With large plants there is no doubt that the system we have heard described is a profitable one. But apply this to smaller plants it will ride your horse to death. It was well expressed by a large contractor who accounted for his high bid as against another contractor who did not do work on so magnificent a scale, by saying, "He carries his office in his pocket. He hasn't any fixed charges and can make money at a price where we would lose."

It is the same with a small plant. If you add a system of records you will have to add another clerk in the local office and two or three in the general office to tabulate them, and the clerk hire will more than eat up any saving you will make. We are a firm believer in records and apply them more or less according to the size and general make up of the plant in question.

Our experience has been that the grade and cost of oil can be varied considerably. In an old high pressure or compound non-condensing pump with 3½ expansions we would not expect to use the same quality of oil that we would in a cross-compound or triple expansion pumping engine with 21 expansions. We feel that to pay over 22 cents or 23 cents a gallon for cylinder oil for compound non-condensing and high pressure pumping engines is over-stepping the limit of economy; while for triple expansion engines with 21 expansions we would hardly feel that we could get good enough oil. Another thing is the quality of the steam that enters the cylinders. We cannot find a great saving in mixing high class oil with low class steam. We must consider the temperature of steam above the point of saturation in the selection of oils. Superheating of steam is going to cut quite a figure in the quality of oil used. If we had an elaborate plant we would wish to fit it up with every convenience, but if an old water works built prior to the days of cranes, condensing apparatus and the many conveniences of today, and many times where the capacity is less than 100 h. p., these conveniences might cost more than the necessities.

Stations which we would design today with 200 to 400 h. p. or even less, would include cranes. The type of machinery to be installed under these cranes would be given consideration. Vertical machinery along rivers that rise and fall to a great degree, as in this part of the country, and horizontal machinery where we can pump water at the same head, having the same horse power as we have with a vertical engine and reducing the weight of our machinery one-half to two-thirds, are features that have something to do with investing in a crane. In numbers of stations that we operate the crane might cost more than the station. No matter how large your organization is you have to put each plant on its own basis and your directors and investors are going to look over the balance sheets at the end of the year and look for as large a percentage of profit in the smaller plants as there is in the larger ones, and if you have as many conveniences in the smaller plant as in the larger, you may show a minus quantity for profits in the smaller plant.

The personnel of the men is something that we have tried to study. In the first place we give a man leeway enough to make him feel that he is some one, that he is a factor in the company, and still to an extent keep down his movements, and govern his actions, so that he will not overstep the bounds of the authority that should be delegated to him.

The vices that we encounter might be summed up as dishonesty, laziness, procrastination and superstition. They are not all possessed by any one, and we can be thankful that there are a great many that possess none. By dishonesty we do not mean serious things but little items that tend to annoy. For instance we weigh coal and tabulate the records and put one fireman against another. That man has pride and he very soon conceives the idea that by handing in short weights he can make a better record. And in our experience they will do it. When you come to check up your coal receipts against the weights of coal consumed you will find a leak

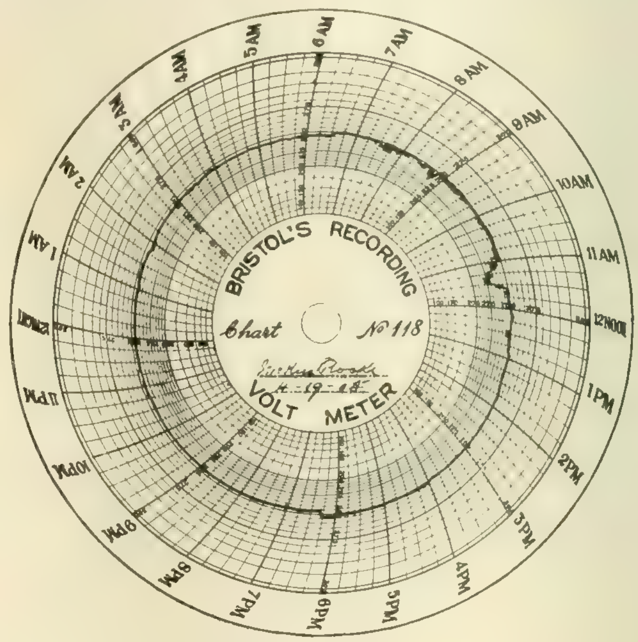


FIG. 6—(See Fig. 5.)

that is hard to locate. Then we buy our coal by mine weight and if we check coal consumed against mine weight, unless we allow for the customary losses in shipping coal, we are going to think our fireman dishonest whether he is or not.

Another form of dishonesty is that feature introduced, and fostered by the material men in the little attentions, such as presents, courtesies, dinners and theater parties, they give to our engineers, always tending to breed in the men a leaning to favoritism. The engineer does not intend this for dishonesty, but nevertheless it will sooner or later take that form. In our experience it has been found necessary to bar from the engine room the dictation of what shall be purchased in the way of supplies. But in so doing you are in a measure killing what might, if properly built up, become a valuable feature in the employe.

Laziness and procrastination generally occur in the same individual. The tendency to not do things at all or to put off until tomorrow what might be done today. Especially in the small power house where the fireman hasn't enough to do, as where you originally started with a small water works and one man to attend to the pump and fire the boilers. Then the station grows to where it is too much for one man and not enough for two—and you generally find that with the two it is not then as well taken care of as it was with the one who had too much to do.

Generally, in the smaller towns they have the old fire pressure requirements, that when a fire breaks out you must double your pressure. That sometimes means multiplying your horse power by four. The machine is purchased for its economical design in what

we still term domestic pressure. When fire pressure is needed we must not only double our horse power but cut the efficiency, or economy, in half. Then we need a larger number of men, larger boilers and a surplus of energy generally going to rust.

Superstition—this objectionable feature takes the form of a belief that certain things that should be well known physical facts cannot be done; that one engine or pump similar to another will not perform the same service, or the excusing of the bad action of a machine by the simple assumption that it's contrary. While we will allow that there is something in the "innate cussedness of material," we believe that it seldom exhibits its temper to any marked degree and always argue with our engine room employes that we have reason to expect certain results and when they are not forthcoming we should know why and not attempt to blame the machines or to excuse the shortcomings in any way other than by a thorough investigation and analysis of the difficulty.

One thing noticed in connection with the charts exhibited is that the excuse for a bad run was written on a piece of paper and pinned to the chart. We require the excuse to be written with an indelible pencil or ink on the back of the chart. We sometimes get into court and such an entry goes as evidence, which we doubt if the paper attached to it would.

Mr. J. J. Muir: One thing we wish to emphasize is cleanliness. Where there is dirt there will be disorder, and where you find disorder you find inefficiency, not only in the men but in the machinery.

We find also that a great deal of trouble, where you have many repairs, is that they have not been done in an efficient manner. They have been done hurriedly, or in a slipshod manner. It is very hard in many instances to get men in charge of machinery to appreciate that it is really a saving to themselves in the long run, besides tending to the efficiency of the plant.

We think the indicator can be used to great advantage, if used regularly and not spasmodically. A slight disorder in the working of the engine can often be detected by the indicator diagram. In power plants the indicator is just as important as the steam chart or any other chart.

In plants where firing is done by hand, firemen tend to, and often are allowed to fire irregularly, both as to intervals and quantity of coal shoveled in. It is very difficult to get men to understand that such irregular working of the fires results in inefficiency, and causes shortage of steam where there is no surplus boiler power. I believe such inefficiency in hand firing is largely accountable for the adoption of mechanical stokers.

We are firmly of the opinion that in many instances it pays to give a little higher price to get a proper quality of oil, particularly in the cylinders. In many power houses the system of pressure feeding of bearings and all working parts obtains, and this tends to economy. We think that a cheaper grade of oil can be used and the oil can be used over and over again, though there is of course a certain amount of loss to be made up.

Very often the surface condenser can be installed to advantage, and will eliminate the trouble from incrustation of the boilers. In many instances the quality of the water makes it impossible to use the water from a jet condenser for boiler feeding. In such cases it would be necessary to adopt some means of purifying the water; the surface condenser avoids the necessity of this.

Mr. Ralph Crooker, jr.: I think no one who has used a water purifier would ever think of using a surface condenser as a substitute for it. I know of no better practice than purifying water before you put it in the boiler, especially where you have to contend with sulphate of lime, you can save money in the installation of your plant by putting in a purifier.

Mr. Charles Fitzgerald: The speaker took charge of the 34th St. power house in 1889 and ran it until 1897, and in that time there had not been a boiler failure, nor a crack, nor a tube taken out, nor was there in any part of those boilers an 1/8 in. of scale. We attribute the success of those boilers, as far as repairs were concerned, to the [illegible] boilers to pieces more than any [illegible] with a hot fire and allowing a cold blast to strike the sheet. With a stoker you keep a regular temperature. When we cooled those boilers down we would simply let the fire go out and keep everything closed from [illegible] we would take, if possible, 24 hours to bring the boiler up to pressure.

Semi-Convertible Cars for Washington.

Semi-convertible cars of the types illustrated built by the J. G. Brill Co. have recently been placed on the lines of the Gray's Harbor Electric Co., Aberdeen, Wash. The company operates between the two towns of Aberdeen and Hoquiam, which are located on Gray's Harbor in the central western part of Washington. The Brill semi-convertible type of car is largely used under conditions similar to those of this road and has always given the highest satisfaction. The windows [illegible] raised entirely into the roof pockets. The combination passenger and baggage car illustrated is 38 ft. 7 in. over the end panels and is mounted on the Brill No. 27-E-2 high-speed trucks. The baggage compartment is 10 ft. 9 in long. The partition dividing the compartments has a single sliding door and on either side of the baggage compartment there is a 4-ft sliding door next to the partition. Transverse spring cane seats 37 in. long, with longitudinal corner seats occupying the space of two windows, are in the passenger compartment and slat seats arranged to fold when not in use are in the baggage compartment. The aisle is 24 in. wide. The type of passenger and smoking car is 34 ft. 4 in. over the end panels and is mounted on the Brill No. 27-G trucks for fast and heavy city and suburban service, having 55-h. p. motors. The smoking compartment is 11 ft. 10 in. long. A partition with single sliding doors separates the compartments. The seating plan of this type is practically the same as in the type described above. Both cars are finished in cherry, natural, with ceiling of birch, neatly decorated. The passenger and baggage car including trucks and electrical equipment weighs 54,520 lb., and the passenger and smoking car, including the trucks and equipment weighs 37,000 lb. Among the Brill patented specialties included in the furnishings are angle iron bumpers, "Dedenda" gongs, "Retriever" signal bells, ratchet brake handles, and "Dumpit" sand boxes.

COMBINATION BAGGAGE AND PASSENGER CAR.

SEMI-CONVERTIBLE [illegible] ABERDEEN, WASH.

The general dimensions of the passenger and baggage type are: Length of body, 38 ft. 7 in.; of body over vestibules, 48 ft.; from panel over crown piece, 4 ft. 8½ in.; width over sills and sheathing is 8 ft. 6 in.; between centers of posts, 2 ft. 8 in.; side sills, 4¾ x 8¾ in.; end sills, 5¼ x 6⅞ in.; sill plates, 15 x ⅜ in.; thickness of corner posts, 3⅝ in. and of side posts, 3¼ in. The trucks have a wheel base of 6 ft. and 33 in. wheels. The passenger and smoking type is 34 ft. 4 in. over the body and 43 ft. 9 in. over the vestibules. The side sills are 4 x 7¾ in., and the end sills 5¼ x 6⅞ in. The sill plates are 12 x ⅜ in. The Brill No. 27-G trucks have a 4-ft. wheel base and 33-in. wheels.

Test of 400-Kw. Westinghouse-Parsons Turbine.

The Westinghouse Machine Co. has published recently, in facsimile form, the results of efficiency tests of a 400-kw. Westinghouse-Parsons turbine unit built for Joseph Benn & Sons, of Providence, R. I. Both turbine and generator are of the builders' standard construction for machines of this size.

SATURATED STEAM.

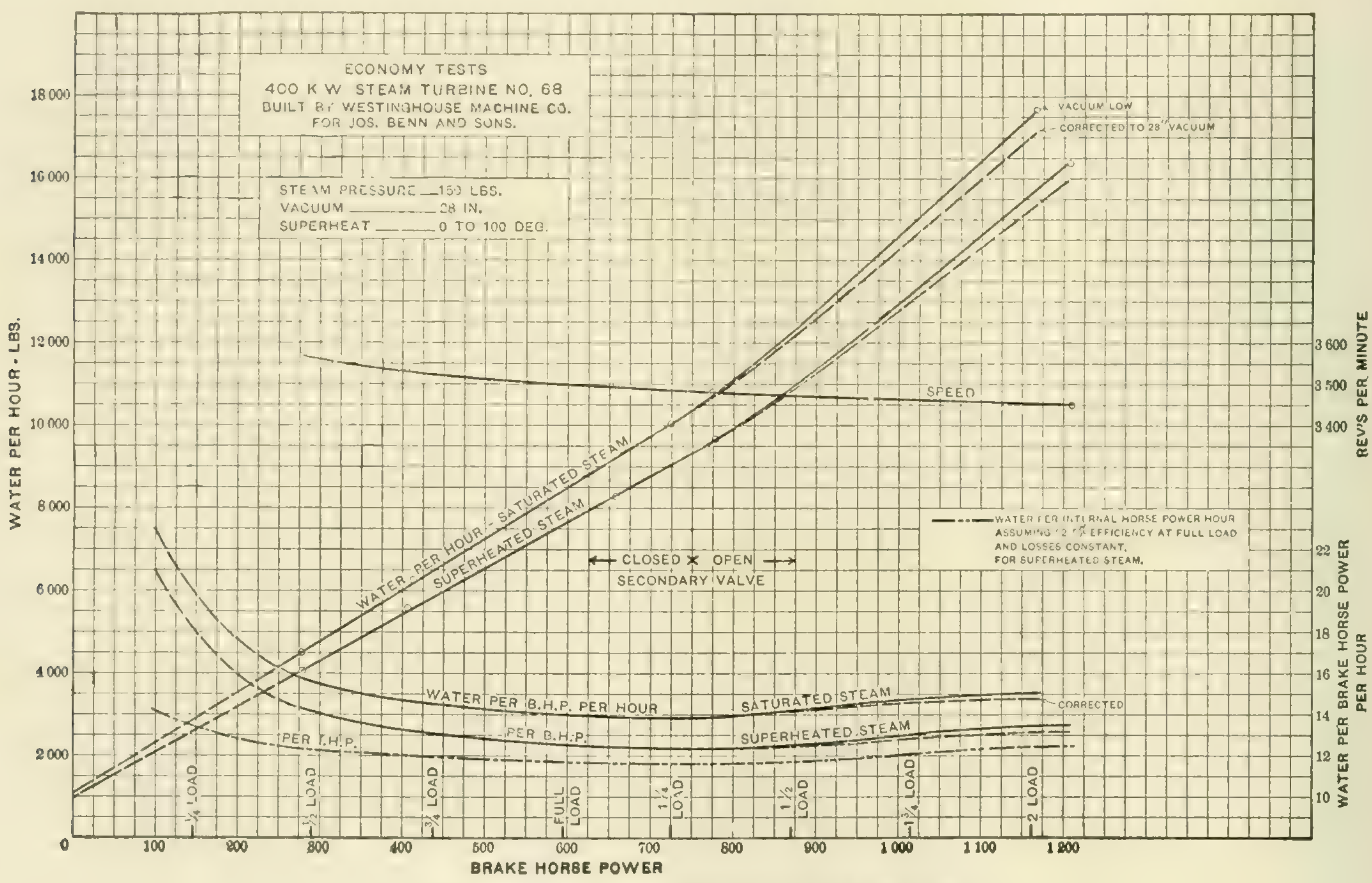
Steam pressure, 150 lb.; dry and saturated; vacuum, 28 in.

	Steam per hour, lb. Full load.	¾ load.	½ load.
Guarantee, per electrical h. p.	16.4	17.2	18.7
Equivalent water per brake h. p.	15.5	16.8	17.0
Actual consumption by test, brake h. p.	13.89	15.05	15.86
Exceeded guarantee, per cent	10.3	10.4	7.0

The Curve Sheet —1 shows the results graphically. As shown in the curves the overload capacity was tested up to over twice full load, 108 per cent, with an excellent economy. The good result is obtained because of the automatic secondary governor, which becomes effective at 15 per cent overload.

Tests of the governor showed variations as follows:

Load.	R. p. m.	Variation, R. p. m.	Variation, Per cent.
Zero	3,620	+124	+3.55
½	3,541	+45	+1.29
Full	3,496	0	0
1½	3,460	—36	—1.03



CURVE SHEET ECONOMY TEST 400-KW. STEAM TURBINE.

The tests were made by F. P. Sheldon & Co., engineers, of Providence, the turbine and the generator being tested separately. Brake tests were made on the turbine. The exhaust steam was condensed in a surface condenser and the water of condensation weighed.

The following table shows the water rates at different loadings and with superheated and saturated steam:

SUPERHEATED STEAM.

Steam pressure, 150 lb.; superheat, 100° F.; vacuum, 28 in.

	Steam per hour, lb. Full load.	¾ load.	½ load.
Guarantee, per electrical h. p.	14.8	15.5	16.9
Guarantee, generator efficiency, per cent	94.5	93.5	91.0
Equivalent water per brake h. p.	13.98	14.49	15.38
Actual consumption by test, brake h. p.	12.48	13.45	14.34
Exceeded guarantee, per cent	10.9	7.2	6.7

The regulation obtained in the efficiency test, shown by the speed curve, is closer than given by the preliminary governor test.

The conclusions of Messrs. Sheldon & Co. are expressed in the report as follows:

"The tests show a high efficiency in the use of steam, generous overload capacity, and close speed regulation.

"The builders' guarantee of economy was made under 165 lb. gage pressure at throttle. The tests were made under 150 lb. pressure, and as the results are over 10 per cent better than the guarantee, it is reasonable to suppose that if the required steam pressure had been available, the guaranteed economy would have been exceeded still more.

"Under test the turbine showed the remarkable overload capacity of 108 per cent at a very slight diminution of the full load economy, viz., about 6 per cent. The speed regulation of the turbine was all that could be desired."

Tariff Sheets of the Detroit United Railway and Rapid Railway System.

On the lines of the Detroit United Ry. and Rapid Railway System there are 205 stations and stops to and from which express and freight are handled. The company has issued a local express tariff bulletin for the use of its agents and customers, the arrangement of which is interesting. This bulletin consists of eight pages 8 x 10¾ in. in size. The front page is used for the title and also includes the following storage caution: "All express unloaded into stations of above companies must be removed within 48 hours after arrival, and if not so removed, will at the option of the carrier either be sent to public storage at owner's cost and risk there to be held subject to lien for freight and charges or will be retained in company's stations or warehouses under the same conditions and subject to same charges [illegible] public warehouse except as may be otherwise provided."

On the second page is printed an [illegible] of the names of the stations and their corresponding identification numbers. The names of those stations at which there are regular agencies are printed in heavy type, which distinguishes them from the names of other stops at which there are no agents and to which all freight charges must be prepaid.

On the third page is a list of the same stations arranged geographically and classified as to each of the five divisions of the system.

MAP OF DETROIT UNITED RAILWAY AND CONNECTIONS

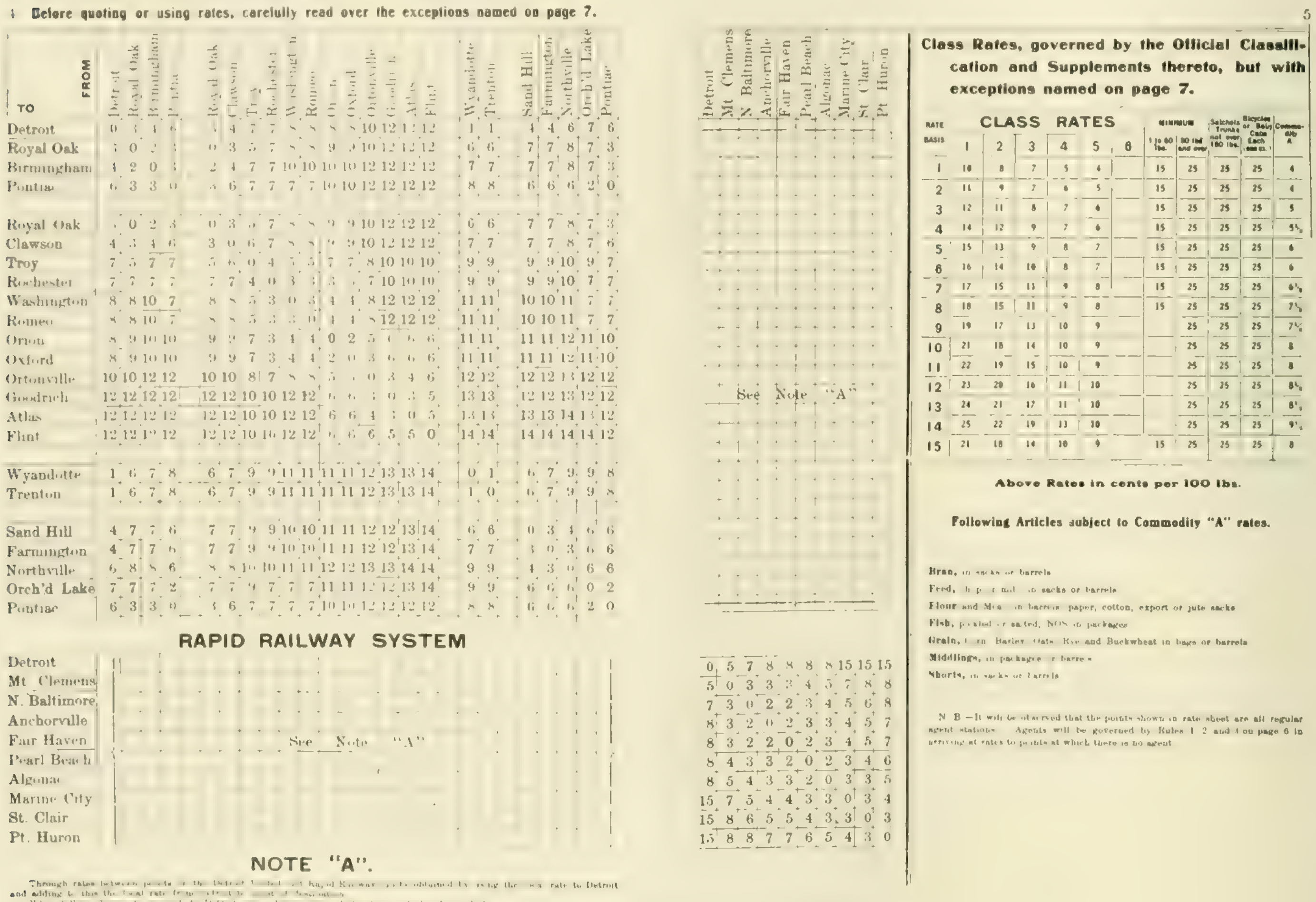
On the fourth page is a key to the tariff rates between any stations on the line. This indexing is accomplished by laying off the page into squares with the names of the stations reading from the upper left hand corner to the bottom of the page and from the upper left hand corner to the upper right hand corner of the page.

The lines on which these station names are printed cross-section the page into small squares in which are the index numbers to the rate basis, which is printed opposite on page 5.

All regular freight shipments are divided into five classes upon which the rates are based. There are 15 different classifications as to distance, for fixing the charges of all classes of freight and express. The distance and rate classifications are arranged in a tabular form. When it is desired to find the cost in cents per 100 lb., shipping from one agency to another, it is first necessary to look on the index page for the index number, which occurs in the small square at the intersection of the two columns in which the names of the agencies occur. Having found this index or number of the so called rate basis, the shipping rate is found in the table of class rates in the column under the proper class number and on a line with the rate basis index figure. Other than the regular five official freight classifications, there are special minimum charges and special rates for baggage, bicycles and the following commodities: bran in sacks or barrels, feed chop or mill in sacks or barrels, flour and meal in packages or special sacks, fish, pickled or salted, and shorts and middlings in sacks, packages or barrels.

The sixth and seventh pages of the bulletin bear the instructions for express agents and messengers. Attention is called to the fact no prepaid points are shown in the tariff proper and in way-billing shipments for points at which there is no agent set instructions must be followed. The rule for making special shipments from non-agent stations to regular stations is this: "On shipments from non-agent points destined to a regular agent station, conductor will make a pick-up way-bill, showing where picked up, name of shipper, if possible, also full name and address of consignee, together with particulars of shipment, weight, etc., and whether charges were paid or not, turning this way-bill in to agent at destination. Agent receiving same will take into account by making regular way-bill, billing from his station to his station, using the rates applying from the next regular station beyond where shipment was picked up, for example: The conductor on the Flint division picks up a shipment at Starr's, a prepaid point on the Flint division, consigned to Flint, the conductor makes up his pick-up way-bill as instructed above, and on arrival at Flint turns the way-bill and freight, also charges, if any, to the agent at that point, who immediately takes the pick-up way-bill into account by making revenue billing reading from Flint to Flint, applying rates from Royal Oak to Flint, after which he files away the conductor's pick-up way-bill for future reference."

On page 7 are given the exceptions to the regular rate for particular articles, some of which may be of interest. For automobiles the regular rate applies with a minimum charge of $5 each. Brick are accepted when boxed, crated or barrelled. Corpses must be shipped under the regular rules and regulations of the Board of Health and the minimum rate for their transportation is $2. Commodities of an injurious odor will not be accepted for shipment on express cars. The rear cover of the bulletin is a full page map showing the entire system operating out of Detroit and the electric railway connections from Toledo south as far as Findlay, east as far as Cleveland and west as far as Pioneer.



4 Before quoting or using rates, carefully read over the exceptions named on page 7.

TO \ FROM	Detroit	Royal Oak	Birmingham	Pontiac	Royal Oak	Clawson	Troy	Rochester	Washington	Romeo	Orion	Oxford	Ortonville	Goodrich	Atlas	Flint	Wyandotte	Trenton	Sand Hill	Farmington	Northville	Orch'd Lake	Pontiac
Detroit	0	3	4	6	3	4	7	7	8	8	8	8	10	12	12	12	1	1	4	4	6	7	6
Royal Oak	3	0	2	3	0	3	5	7	8	8	9	9	10	12	12	12	6	6	7	7	8	7	3
Birmingham	4	2	0	3	2	4	7	7	10	10	10	10	12	12	12	12	7	7	7	7	8	7	3
Pontiac	6	3	3	0	3	6	7	7	7	7	10	10	12	12	12	12	8	8	6	6	6	2	0
Royal Oak	3	0	2	3	0	3	5	7	8	8	9	9	10	12	12	12	6	6	7	7	8	7	3
Clawson	4	3	4	6	3	0	6	7	8	8	9	9	10	12	12	12	7	7	7	7	8	7	6
Troy	7	5	7	7	5	6	0	4	5	5	7	7	8	10	10	10	9	9	9	9	10	9	7
Rochester	7	7	7	7	7	7	4	0	3	3	5	[illegible]	7	10	10	10	9	9	9	9	10	7	7
Washington	8	8	10	7	8	8	5	3	0	3	4	4	8	12	12	12	11	11	10	10	11	7	7
Romeo	8	8	10	7	8	8	5	3	3	0	4	4	8	12	12	12	11	11	10	10	11	7	7
Orion	8	9	10	10	9	9	7	3	4	4	0	2	5	[illegible]	6	6	11	11	11	11	12	11	10
Oxford	8	9	10	10	9	9	7	3	4	4	2	0	3	6	6	6	11	11	11	11	12	11	10
Ortonville	10	10	12	12	10	10	8	7	8	8	5	[illegible]	0	3	4	6	12	12	12	12	13	12	12
Goodrich	12	12	12	12	12	12	10	10	12	12	6	6	3	0	3	5	13	13	12	12	13	12	12
Atlas	12	12	12	12	12	12	10	10	12	12	6	6	4	3	0	5	13	13	13	13	14	13	12
Flint	12	12	12	12	12	12	10	10	12	12	6	6	6	5	5	0	14	14	14	14	14	14	12
Wyandotte	1	6	7	8	6	7	9	9	11	11	11	11	12	13	13	14	0	1	6	7	9	9	8
Trenton	1	6	7	8	6	7	9	9	11	11	11	11	12	13	13	14	1	0	6	7	9	9	8
Sand Hill	4	7	7	6	7	7	9	9	10	10	11	11	12	12	13	14	6	6	0	3	4	6	6
Farmington	4	7	7	6	7	7	9	9	10	10	11	11	12	12	13	14	7	7	3	0	3	6	6
Northville	6	8	8	6	8	8	10	10	11	11	12	12	13	13	14	14	9	9	4	3	0	6	6
Orch'd Lake	7	7	7	2	7	7	9	7	7	7	11	11	12	12	13	14	9	9	6	6	6	0	2
Pontiac	6	3	3	0	3	6	7	7	7	7	10	10	12	12	12	12	8	8	6	6	6	2	0

RAPID RAILWAY SYSTEM

Detroit, Mt. Clemens, N. Baltimore, Anchorville, Fair Haven, Pearl Beach, Algonac, Marine City, St. Clair, Pt. Huron — See Note "A"

TO \ FROM	Detroit	Mt Clemens	N Baltimore	Anchorville	Fair Haven	Pearl Beach	Algonac	Marine City	St Clair	Pt Huron
Detroit	0	5	7	8	8	8	8	15	15	15
Mt. Clemens	5	0	3	3	3	4	5	7	8	8
N. Baltimore	7	3	0	2	2	3	4	5	6	8
Anchorville	8	3	2	0	2	3	3	4	5	7
Fair Haven	8	3	2	2	0	2	3	4	5	7
Pearl Beach	8	4	3	3	2	0	2	3	4	6
Algonac	8	5	4	3	3	2	0	3	3	5
Marine City	15	7	5	4	4	3	3	0	3	4
St. Clair	15	8	6	5	5	4	3	3	0	3
Pt. Huron	15	8	8	7	7	6	5	4	3	0

NOTE "A".

Through rates between points on the Detroit United and Rapid Railway [illegible] obtained by using the [illegible] rate to Detroit and adding to this the local rate [illegible]

When [illegible]

5

Class Rates, governed by the Official Classification and Supplements thereto, but with exceptions named on page 7.

RATE BASIS	CLASS RATES 1	2	3	4	5	6	MINIMUM 1 to 60 lbs.	MINIMUM 60 lbs and over	Satchels Trunks not over 150 lbs.	Bicycles or Baby Cabs Each	Commodity A
1	10	8	7	5	4		15	25	25	25	4
2	11	9	7	6	5		15	25	25	25	4
3	12	11	8	7	6		15	25	25	25	5
4	14	12	9	7	6		15	25	25	25	5½
5	15	13	9	8	7		15	25	25	25	6
6	16	14	10	8	7		15	25	25	25	6
7	17	15	11	9	8		15	25	25	25	6½
8	18	15	11	9	8		15	25	25	25	7½
9	19	17	13	10	9			25	25	25	7½
10	21	18	14	10	9			25	25	25	8
11	22	19	15	10	9			25	25	25	8
12	23	20	16	11	10			25	25	25	8½
13	24	21	17	11	10			25	25	25	8½
14	25	22	19	13	10			25	25	25	9½
15	21	18	14	10	9		15	25	25	25	8

Above Rates in cents per 100 lbs.

Following Articles subject to Commodity "A" rates.

Bran, in sacks or barrels
Feed, chop or mill in sacks or barrels
Flour and Meal in barrels, paper, cotton, export or jute sacks
Fish, pickled or salted, NOS in packages
Grain, Corn, Barley, Oats, Rye and Buckwheat in bags or barrels
Middlings, in packages or barrels
Shorts, in sacks or barrels

N. B.—It will be observed that the points shown in rate sheet are all regular agent stations. Agents will be governed by Rules 1, 2 and 4 on page 6 in arriving at rates to points at which there is no agent.

FOURTH AND FIFTH PAGES SHOWING KEY TO TARIFF RATES.

The company also issues a similarly arranged tariff sheet between the stations on the Detroit United Ry. and Rapid Railway System and stations on the Detroit, Monroe & Toledo Short Line Ry. via Detroit, Mich.

"Peacock" Brake Order.

In the "Review" for April, page 268, we noted an order placed by the Chicago City Ry. for 200 new cars, which included as part of the equipment 400 "Peacock" brakes from the National Brake Co., of Buffalo. August 3rd the Chicago City Ry. placed an order for 100 more "Peacock" brakes to be applied on the cars now in service.

The Indiana Union Traction Co. has adopted the interchangeable coupon books of the Ohio Interurban Railway Association.

Municipal Trading.

LORD AVEBURY'S ADDRESS BEFORE THE INDUSTRIAL FREEDOM LEAGUE.

In Great Britain there is a well organized opposition to the further extension of municipal trading, which include the municipal ownership or operation of street railways and lighting plants, the particular branch of municipal trading which is now of greatest interest in America. The work being done by the Industrial Freedom League, the name of the organization, is of importance because it brings clearly before those affected certain results of municipal trading that otherwise would be apparent only to the expert accountant or engineer.

The third annual meeting of the Industrial Freedom League was held June 30, 1905, and we give here an abstract and extracts from the address of the retiring president, Lord Avebury, which are of especial interest to American readers because of the data given concerning certain British municipal enterprises cited to Americans as examples of successful municipal ownership:

Existing conditions are: (1) Local (municipal) expenditure had increased in 1901-2 to four times what it was in the 60's, and was in 1901-2, 144 million pounds sterling, as compared with 76 million pounds in 1891-2. (2) The population in England and Wales has increased 62 per cent in the last 22 years, but the debt per capita has in the same period increased 95 per cent, and the rate of taxation per unit of assessed valuation has increased 61 per cent. (3) Outstanding loans of local (municipal) authorities in England and Wales, which were 215 million pounds in 1893, had increased in 1903 to 370 million pounds. (4) Business concerns which pay vast sums in taxes have no voice in their expenditure.

MUNICIPAL TRADING PROFITS.

"But then we are told that a great part of the debt has been incurred for remunerative purposes, and this is no doubt true in some cases. The accounts are, however, very difficult to follow. Let me give a case. The London County Council purchased a site in London Fields, Hackney, for re-housing about 486 persons who would be displaced by the Mare St. improvements. The value of the land was £1,250; but the housing committee said they could not afford to pay anything for it, and the improvements committee recommended the Council to fix the value of the land for re-housing purposes at nil.

"Now, though I say I do not impute any intention to deceive—indeed, I am satisfied there was none—still it is obvious that when accounts are thus dealt with it is difficult to draw conclusions from them."

INADEQUATE DEPRECIATION.

"Mr. Schooling, in the Windsor Magazine for January, gave the amounts set aside for depreciation per £100 of capital as follows: Waterworks, 11½d; gasworks, 8d; electricity, 3s 2½d; tramways, 10s 4d. He states in regard to the 1,029 reproductive undertakings given in Sir Henry Fowler's second 'Return of Reproductive Undertakings': 'I suggest that, looking at the nature of the undertakings and at the fact that by far the largest amounts of capital are invested in undertakings that involve great wear and tear to machinery, a yearly allowance of 5 per cent on the capital invested would be a most moderate allowance. Upon this basis I proceed to rectify the nominal profit and loss account as follows:

Capital invested	£121,170,000
5 per cent on this for yearly depreciation is	6,058,500
Yearly allowance for depreciation by corporation is	193,274
Extra for depreciation which should be set aside yearly is	5,865,226
Deduct net profit stated by corporation which now vanishes	378,281
Making the net loss yearly upon the 1,029 "reproductive undertakings"	£5,486,945

"I do not pretend to be an authority as to what percentage ought to be written off for depreciation, but even if the figure suggested by Mr. Schooling is perhaps too high, that actually taken certainly seems too low, and the difference would convert the small nominal profit into a substantial loss."

LONDON COUNTY [illegible] TRAMWAYS.

"The London Tramways have always seemed to me to constitute a [illegible] the court attributed to the Acts of Parliament, under which the tramways were constructed, a meaning which had never been foreseen, and the [illegible] the rights on the belief in which their money had been invested. Under these circumstances the London County Council became possessed of the property for a sum far below its real value.

"After considerable discussion the tramways north of the river were leased to a company, while the council determined itself to work those of the south. The capital value was approximately the same—£850,000 on the north, £806,000 on the south—but the mileage on the north was about 18 miles greater.

"The London County Council having thus secured a most valuable property far below its real value, it would, of course, have been difficult not to make a profit. It has amounted to £293,000, but, as Sir Melvill Beachcroft has pointed out, over £200,000 has been received from the northern system under the lease, while the southern system, worked by the council, has only given £80,000, and last year the profit claimed on the southern system was only £7,054 on a capital of £2,400,000. It seems clear that if the London County Council had leased the southern system instead of working it themselves, there would have been an advantage of over £120,000 to the London ratepayers!

"Moreover, the council has now resolved upon the electrification of the northern system at a cost of over £5,000,000, and on the construction of certain lines in south London at a cost of £400,000, upon which an annual deficiency of £13,000 is estimated. The latter proposal has stirred Mr. A. M. Torrance, a former progressive chairman of the council, to denounce their action as that of a 'rake's progress.' The financial position of the council was, he stated, appalling, and he doubted if it was fairly understood by members of the council themselves. Although he urged the postponement of the scheme, and the finance committee implored the council to stay its hand until the works to which it was committed were completed and were producing revenue, the scheme was sanctioned by a large majority. Whether the vast sum to be spent on the northern system will involve a loss to the ratepayers, the finance committee are not quite clear. But at all events they urge that, in view of the expenditure, the council's borrowings during the next few years should be prevented from becoming unduly large. If the London County Council had not prevented private enterprise from undertaking the operation of tramways, but had granted facilities under stringent regulations as to the proper conduct of the service, the ratepayers would have profited by the arrangement without being involved in any risk, and the load of debt now incurred would not have stood in the way of other improvements.

"Of course, I do not doubt that in some cases profits have been made. When a municipality has had a monopoly, and has been able to charge what it likes, it is easy, of course, to show a profit on paper.

"I may give, for instance, the following illustration: Mr. Robert Donald has pointed out that Manchester reduced its rates in 1900-1901 by 7d in the pound through municipal trading. This is the way it was done. The corporation wanted a subsidy of £50,000 in relief of rates from the gas undertaking, and, as there was no surplus, the price of gas was raised 3d per 1,000 ft. in order to yield it This is quoted as a profit.

MUNICIPAL EMPLOYES.

"Again, the time which ought to be devoted to the real business of municipalities will be frittered away on trading and manufacturing details. Very difficult labor questions will also be raised. Town councillors will have to regulate the wages of their electors. Just think of the tendency to set the wages against the votes. Our municipal governors will be placed in a difficult, if not an impossible, position.

"In Manchester there are over 17,000 persons in the employment of the corporation. In Plymouth the municipal employes are equal to 5 per cent of the voters. In Australia, the Melbourne Argus tells us that 'the state servants already constitute almost a clear majority of the names on the electors' rolls.'

"The report of the eleventh annual conference of the Municipal Employes' Association, held last month, contained the following statement: 'Mr. K[illegible]

naturally strongly in favor of organization among municipal employes, and was pleased to see the marvelous progress this association had made. In going through some Parliamentary papers the other day he came across one which fairly astounded him, for from it he learned that in this country there were over 2,000,000 municipal employes. As the total of wage-earners numbered 14,000,000, this was very interesting. He had also found that in 1903, when there was a reduction in wages all round, the wages of municipal employes had alone increased—he might say, had doubled.'

"This statement seems very suggestive. The enormous influence which municipal employes can and do exert at local elections fot purely personal objects is not a matter which the community can afford to regard with equanimity. The Municipal Employes' Association offers as an inducement to municipal servants to join it, the 'wonderful influence at municipal elections' which they would be able to exercise."

SUMMARY OF OBJECTIONS TO MUNICIPAL TRADING.

"The objections felt to this new departure are not founded in any way on mistrust of or opposition to municipal institutions. We fully recognize how admirably the members of municipal bodies have fulfilled the arduous and important duties which are entrusted to them, and the wish that they should have time fully to think out the various problems which come before them is one of the strong reasons which induce us to regret the course they have adopted While, however, admitting to the full the abilities of those who belong to our municipal bodies, it does not necessarily follow that they have the special knowledge which is required to conduct manufacturing and business undertakings to a successful issue.

"I am pleased to say that we have recently enlisted a new and most important recruit. Speaking on the Agricultural Rates Bill, Mr. Benn said: 'They ought not to vote for the continuance of this bill without some more definite assurance from the government as to their intention of dealing with the whole question. The position of the London ratepayers had become critical. The increasing rates of London were driving away industries by the dozen. For the borough of Devonport, which he represented, he could quote figures which, on the smaller scale, were equally striking.'

"I submit, then, that: Firstly, the legitimate functions and duties of our municipalities are already enough, if not, indeed, more than enough, to tax all their energies and fill up all their time.

"Secondly, it will involve an immense increase in municipal debt.

"Thirdly, it will involve municipalities in labor disputes.

"Fourthly, as there will not be the same stimulus to economy and attention, there will be a great probability, not to say certainty, that one of two things will happen: either there will be a loss, or the service will cost more.

"Fifthly, it will be a serious check to progress and discovery."

REMEDIES PROPOSED.

"And now I come to the remedies. In the first place, I would mention the axiom which, when I was young, was regarded as a self-evident proposition that taxation and representation should go together, that those who pay the rates should regulate the expenditure. At present we have so arranged matters that many thousands have votes who pay no rates, and that those who pay most rates have no votes. The Evening News recently stated that in 1901, out of 703,000 assessments in London, no fewer than 309,500 were in respect of houses and tenements where the tenants did not pay rates. A rough estimate showed that nearly one-half of the municipal electorate were not direct ratepayers. The London Chamber of Commerce has over and over again suggested that companies should be permitted to vote, and the Associated Chambers of Commerce have endorsed the proposal. This is well as far as it goes, but take such an undertaking as the Gas Light & Coke Company, it is surely a farce only to give it one vote. Yet even this small modicum of justice, though proposed by Sir Albert Rollit, M. P., was vehemently opposed by the socialists in the House of Commons.

"Sir Robert Giffen concludes the article to which I have already referred by expressing his conviction that in local 'expenditure we have to do with a real disease of local government; with an expenditure that is partly extravagant and unnecessary, because local authorities are frequently bad managers, even where they are not corrupt. They spend money on what is not really wanted; they spend more than they ought on what happens to be necessary; they incur liabilities and burden the future with a light heart. Expenditure is pleasant to those who have a little brief authority, and the increase of the number of urban authorities increases the number of those who may enjoy the pleasure. . . . The growth of expenditure in certain directions is disquieting in no small degree, and adds to the natural anxiety which must be felt at any encroachment that has occurred or is threatened upon the common fund of taxable resources on which both imperial and local expenditure must fall.'

"Sir R. Giffen suggests, and many will agree with him, 'the infusion into our present system of having the local bodies elected by the ratepayers, each person being counted as equal, a system of representation according to interest, the chief landlords of each district or town having a special representation. The suggested remedy is much against ruling prejudices, but perhaps the urgency of the evil may compel the consideration of drastic but effectual remedies, which are really in no way inconsistent with democratic ideas or ideals.' "

In conclusion Lord Avebury urged the great importance of having a uniform system of accounts for local authorities, in view of the ever-increasing number and magnitude of municipal undertakings.

Creo-Resinate Processed Wood Paving Blocks in Baltimore.

Some four years ago the city engineer of Baltimore caused to be laid in competition eight samples of improved pavement on Holliday St. in the one square or block between Baltimore St. and Fayette St.; one each of four different makes of clay blocks; one of the Bermudes and one of the Trinidad sheet asphalt; one of the asphalt block, and one of the creo-resinate processed wood blocks. Regardless of the fire which swept over this section of the city the present condition of the wood blocks, it is reported, is far better than the condition of the other sample pavements. The good qualities of the creo-resinate pavement are said to be especially noticeable along the car tracks as it has not depressed perceptibly along the rails; the conditions were trying, as there is a cross-over through this section.

FAYETTE ST. LOOKING WEST FROM CALVERT ST., BALTIMORE.

Under ordinance, Calvert St., between Baltimore St. and Fayette St. (one square), and Fayette St., between Charles St. and Calvert St. (two squares), also Saint Paul St. (one square) and the new Court House Plaza (not yet completed) have recently been paved with these blocks. There are street railway tracks on the Fayette St. and Calvert St. portions. On a part of the Fayette St. paving there is a grade of 5½ per cent, and here was laid a special grooved block, making transverse interstices of ¼ in., more or less, between each row of blocks, which were filled with a cement grout. This was done to assure a foothold for horses, and the expectation for the desired result has been fully realized. The tests (excepting with snow and sleet) of this pavement have been severe; the street

railway company has five lines of cars on this street, and its sprinklers are frequently run over the street; these together with the city's sprinkler and the sprinklers of private parties keep this grade very wet all the time. Under continued inspection during three days, by men from the city engineer's office, perceptible slipping of even smooth shod horses was not noted.

A number of bridges in Baltimore, including several upon which are street railway tracks, have been paved with these blocks for some short period of time, one to three years, and the condition of these at the present time is reported as extremely good.

The United Railways & Electric Co. co-operated with the contractor, Mr. A. H. Hieatzman, in carrying out this work, the railway track work being done after midnight and lighting current with clusters of lamps being provided for the contractor's use. The creo-resinate process of treating the blocks is a modification of the creosoting process and involves the admixture of melted resin with the creosote oil; the result is to make the wood waterproof and also to harden it and increase the wearing properties. Mr. Hieatzman is the Baltimore representative of the manufacturer of the blocks, which is the United States Wood Preserving Co., of 29 Broadway, New York.

The creo-resinate blocks have been used to a very considerable extent by street railway companies for paving under special conditions, notably by the New York City Railway Co.; the Brooklyn Rapid Transit Co., in its power houses; the North Jersey Street Railway Co., in its terminal in Jersey City; and the Hartford (Conn.) Street Railway Co.

Car Companies to Combine.

Announcement was made July 29th of plans for the much rumored consolidation of nineteen companies manufacturing electric railway cars, truck and appliances. The capital stock of the new company is to be $43,000,000, of which $27,500,000 is common and $15,500,000 is 6 per cent cumulative preferred stock. A 5 per cent bond issue of $13,000,000 is to be authorized, $2,000,000 being reserved for future requirements.

The companies included in the consolidation are:

J. G. Brill Co., Philadelphia.
John Stephenson Co., Elizabeth, N. J.
Laclede Car Co., St. Louis.
St. Louis Malleable Casting Co., St. Louis.
American Car Co., St. Louis.
G. C. Kuhlman Car Co., Cleveland.
Cincinnati Car Co., Cincinnati.
St. Louis Car Co., St. Louis.
Wason Manufacturing Co., Springfield, Mass.
Osgood, Bradley & Sons, Worcester, Mass.
John J. Cummings Car Co., Paris, Ill.
Jewett Car Co., Newark, O.
J. M. Jones' Sons, West Troy, N. Y.
Laconia Car Co., Laconia, N. H.
McGuire-Cummings Manufacturing Co., Chicago.
Peckham Manufacturing Co., Kingston, N. Y.
Niles Car & Manufacturing Co., Niles, O.
Journal Bearing Co., St. Louis.
Easy Access Door Co., Boston.

The annual net earnings of these companies are given as $1,263,391, and the net earnings of the consolidated company for the first year are estimated at $2,400,000. A circular issued by promoters says:

"The consolidation will, with the increased capacity which can be easily attained at the several plants by standardization of certain features of construction, and with the combined facilities for economical handling, be able to make great savings in the cost of manufacture and at the same time be in a position to meet the growing demand for cars in every city in this country, as is made evident by the fact that during the last five years (a period during which the income of most industrial enterprises has been subject to enormous ups and downs) the aggregate earnings of the street car building concerns included in the present combination have hardly varied.

"Some of the companies are equipped for the manufacture of and have successfully turned out steam railroad cars, so that the new company is in a position to take [illegible] steam railroad car building also should it be found advisable. The companies are likewise in a position to economically turn out steel cars should this be found desirable, though we are advised on competent authority that the advantages of the wooden car over the steel car for street railroad purposes are still such as to make the adoption of steel cars to street railroad uses unlikely to any considerable extent.

"The company will receive contracts from important officials, whereby in the event of their services not being required they shall refrain, either directly or indirectly, from engaging in the business of car construction for periods of from five to ten years within districts where the operations of the new company will be carried on. Such agreemennts to thus refrain from entering the excluded territory for carrying on business have been fully sustained in the highest courts."

Fire at Freeport, Ill.

The power plant of the Freeport Railway, Light & Power Co. was partially destroyed by fire, Saturday evening, July 22nd, the fire originating in an adjacent grist mill owned by Messrs. A. P. and A. J. Goddard, who are also president and general manager respectively of the power company. The fire lasted from 9 o'clock Saturday evening until 8 o'clock Sunday morning; it first spread to the frame building of the power house, in which were the turbine units and auxiliaries, which was completely destroyed. The roof of the brick portion of the building also burned and fell to the interior, damaging the three dynamos, switchboard and connections. Sunday morning a large force of workmen was employed in clearing away the wreck and rewiring the station. The larger units in the brick building were only slightly damaged by fire and the dynamo which furnished the power and light for commercial purposes was found to be only damaged by water. This was taken apart, thoroughly dried out and put in service by 2 o'clock Monday afternoon. The railway power units were found to be beyond immediate repair and arrangements were made for taking current from the Rockford & Interurban Railway Co.

New Publications.

THE ENGINEERING WORLD PUBLISHING CO. calls our attention to a mis-statement made in a notice concerning the Engineering World published in our issue for July. This company is incorporated as a separate concern, and while the Engineering World originally owed its institution to the Engineering Agency, we are advised it is not now published in the interest of the agency.

EVENING COURSES IN TRANSPORTATION, 1905-1906 Published by the department of mechanical engineering of the Polytechnic Institute of Brooklyn, N. Y., being an announcement of a series of evening courses in transportation, steam engineering, water supply, structural designs, draughting, mathematics, chemistry and electricity, with laboratory practice and testing. The course in transportation includes lectures on legal points as to franchises, organization, eminent domain and liability, promblems in the electrification of steam roads; design and development of locomotives; location, design and construction of power houses; signals; steam turbines; problems in train dispatching; maintenance of way problems, etc. The first lecture of the course is given October 10th, and the last April 24, 1906.

ARMOUR INSTITUTE OF TECHNOLOGY YEAR BOOK, 1905-1906. This is the annual publication of the Armour Institute of Technology and includes the usual calendar, the organization, history and government of the institution, the officers of instruction and general and detailed information regarding the requirements for admission and the departments and classes of instruction. Following this is general information on the buildings and location, degrees, scholarships, statistics, alumni association and registers of students and graduates. A plan of the grounds and buildings, together with a portrait of Mr. Phillip D. Armour, founder of the institute, are included in the publication.

The new suburban line of the Twin City Rapid Transit Co., building between Minneapolis and Ft. Snelling, Minn., was completed and opened for traffic, Tuesday, August 1st.

Tramway Progress in the United Kingdom.

In the controversy at Wakefield on the question of the liability of the Wakfield & District Light Railway Co. to pay rates, the corporation insists on payment of the district rate in full, while the company maintains that it is only liable to be rated at a quarter of the rate. It will be interesting to see what is the decision in this matter.

A novel feature in connection with local tramways is being introduced at Brighton. A special tourist car is being fitted up to perambulate the borough at the rate of 1s. per passenger for the 9 miles, while in addition to the ride the passengers will receive benefit by a lecture to be delivered by the conductor on Brighton local historic monuments. A good deal will turn on the personal equation of the conductor in such a matter.

The proposal to extend the tramways to Shoeburyness has not yet received the approval of the Light Railways Committee, as the council maintains that it is essential that the fore shore be assigned to it, and this at present the landowner declines to do.

The electrification of the tramway at Norwich has been carried out with most commendable speed, for in barely 4 months from the commencement of the work a trial run has been made, and made very successfully, so that the citizens will shortly be able to derive the benefit they have been long anticipating.

The Tramways Committee of Keighley recommends that application be made to the Board of Trade for a year's extension of the Keighley tramways' order. There are still about 150 yards of the line to be laid, though the original time has expired.

The new Mexbrough & Swinton tramways, for which an act was recently obtained, are about to be commenced. The line will join Rotherham and Mexbrough. The cost (about £200,000) includes the building of three heavy bridges. The work is in the hands of Messrs. Hopkins & Sons of London.

The attempt to make halfpenny fares pay has not been successful any more at Darlington than at the other places where they have been tried. The loss to the trams on these fares has lately amounted to £23 a month more than when penny fares only were in operation.

The conversion of the old and cumbrous horse tramways between Yarmouth and Gorleston into a well equipped electric service is now complete. A pleasing feature in the business is the retention of the staff of the old undertaking.

The negotiations for supply of current for the next five years to the Greenock & Port Glasgow Tramway Co. appears very satisfactory. The company guarantees a minimum annual consumption of 500,000 units, and the payment is to be at the rate of 1s 5d per unit for the first 500,000, 1s 25d for the next 200,000, 1s for the next 200,000, and for all units consumed in excess of 900,000 .85d per unit.

Reports of earnings of the various tramways are of interest, and are as follows: The accounts of the Cardiff tramways for the year ended March 24th will, it is expected, show a loss of about £1,400, due to deducting the heavy sums payable annually in repayment of loans and interest. The Whitsuntide returns of the Blackpool tramways show an increase of over £680 as compared with those of the same period last year. The city treasurer of Bradford reports a profit of £70,000 on the tramways undertaking, which after paying through the sinking fund 1-13 of the capital and ½ on remainder of capital leaves a surplus of £16,000. The Birmingham & Midland Tramways, Ltd., show a total revenue for the year 1904 of £108,000, which after deducting operating expenses leaves a balance of £35,948. The earnings of the Brighton tramways for the year ended March 31st show a deficiency of £321 as against £4,788 for the previous year. During the second quarter for 1905 the income of the Sheffield tramways was £63,182 as compared with £23,606 for the first quarter of 1900. The Glasgow tramways show a net profit of £93,257 for the year's working.

To the surprise of everyone, members of parliament, London County councillors and the general public, the London County Councillors' bill asking for powers to construct tramways over Blackfriars and Waterloo bridges and along the embankment between Blackfriars and Westminster, was rejected upon being read for the second time in the House of Lords, on Tuesday, July 18th, the majority being nearly two to one. The bill had already received the sanction of the House of Commons, and no one expected that the Lords would oppose and throw out a measure which was so strongly supported by public opinion.

Electric Railway Earnings.

Annual reports of earnings for the several electric railway prop erties controlled by Stone & Webster have been made, as well as those of some other companies, and are as shown:

The Jacksonville Electric Co. reports for the year ended May 31, 1905, as follows:

	1905.	1904.
Operating expenses	$180,167	$171,013
Net earnings	120,501	96,421
Surplus	93,333	50,057

The Savannah Electric Co. reports for the year ended May 31, 1905, as follows:

	1905.	1904.
Operating expenses	$322,923	$305,502
Net earnings	239,374	225,105
Surplus	112,451	101,075

The Tampa Electric Co. reports for the year ended May 31, 1905, as follows:

	1905.	1904.
Operating expenses	$231,226	$196,010
Net earnings	152,782	132,660
Surplus	130,032	107,921

The Terre Haute Traction & Light Co. reports for the year ended May 31, 1905, as follows:

	1905.	1904.
Operating expenses	$379,143	$346,157
Net earnings	209,413	170,966
Surplus	95,760	68,628

The Seattle Electric Co. reports for the year ended May 31, 1905, as follows:

	1905.	1904.
Operating expenses	$1,632,847	$1,548,916
Net earnings	745,192	664,981
Surplus	443,776	391,913

The El Paso Electric Co. reports for the year ended May 31, 1905, as follows:

	1905.	1904.
Operating expenses	$179,921	$163,796
Net earnings	92,120	66,084
Surplus	51,574	26,832

The earnings for the Elgin, Aurora & Southern Traction Co. for the year ended June 30, 1905, as compared to the previous year, are as follows:

	1905.	1904.
Total gross receipts	$454,307.87	$456,099.80
Operating expenses*	258,573.12	274,706.68
Net earnings	195,734.75	181,303.12
Deductions from income	11,223.80	110,676.22
Net income	84,510.95	70,626.90

*Operating expenses include an accident appropriation equal to two per cent of gross receipts.

All of the electric railways of Ohio have now reported their gross earnings for 1904 to the auditor of state, and the consolidated statement shows the wonderful increase which is taking place in the business of these companies. There are 48 lines in the state which report gross earnings over $25,000 a year. There are 10 companies which show a falling off of gross receipts over the year 1903, while 38 show increases. The total gross earnings of the 48 roads for the year were $20,449,189, an increase of $3,260,668, or about 16 per cent over the previous year.

The Cleveland Electric Railway Co. leads all roads with gross earnings for the year of $4,544,943. The Cincinnati Traction Co. comes next with $3,770,022, as against $3,697,962 in 1903. Toledo Railways & Light is third with $1,752,602 against $1,663,793, and the Columbus Railway & Light is fourth with $1,328,802 against $1,284,793 in 1904.

In the interurban lines: The Northern Ohio earned $895,731, against $882,276; the Lake Shore Electric, $659,873, against $882,276. The Columbus, Buckeye Lake & Newark earned $225,410, against $194,427; the Columbus, London & Springfield, $143,425, against $116,718; the Columbus, Delaware & Marion was not in operation in 1903, but in 1904 it earned $115,518. The Central Market earned $51,512, against $18,065.

Personal

MR. T. F. GROVER has resigned as vice-president and general manager of the Eastern Wisconsin Railway & Light Co.

MR. WILLIAM LA CROIX has been elected president, and Mr. Joseph Lozier appointed superintendent, of the new Lynn & Nahant Street Railway Co.

MR. GEORGE W. PARKER, general express and passenger agent of the Detroit United Railway, and Miss Mary Evelyn McGregor, of Detroit, Mich., were married June 22nd.

MR. ELY M. KINNEY, Cornell '99, of the construction department of the General Electric Co., and Miss Helen B. Cunningham, of Carthage, Mo., were married, July 29th, at Saratoga, N. Y.

MR. W. A. BUTTRICK, who until recently was connected with the Stone & Webster properties at Sydney, Nova Scotia, has been appointed superintendent of the Columbus Railroad Co., Columbus, Ga.

MR. WILLIAM E. LUXTON, superintendent of rolling stock and construction for the Canton-Akron Railway Co., has been promoted to the position of general superintendent, succeeding Mr. E. J. Rauch.

MR. FRANK J. RUTH has been appointed in charge of the Chicago office recently established by the Morgan Engineering Co., of Alliance, O. The office of Mr. Ruth will be at 755 Railway Exchange Building.

DR. A. B. W. KENNEDY, LL. D., F. R. S., formerly professor of civil and mechanical engineering at the University College, London, and now chief engineer to the Westminster Electric Supply Corporation, was knighted on the king's birthday.

MR. THOMAS E. MITTEN was elected to the presidency of the Chicago City Railway Co. at a meeting of the board of directors held July 24th. Mr. Lawrence A. Young succeeded Mr. Mitten as first vice-president of the company.

MR. F. L. MOWRY, division superintendent of the Columbus, Newark & Zanesville Electric Railway Co., has resigned to become general manager of the Stark Electric Railroad Co. He has been succeeded at Newark by Mr. O. H. A. Atherton.

MR. C. W. SHELTON, general superintendent of the West Chester, Kennett & Wilmington Electric Railway Co., West Chester, Pa., will succeed Mr. E. C. Folsom as superintendent of transportation of the Ft. Wayne & Wabash Valley Traction Co.

MR. W. P. BAILEY has been appointed auditor of the Indianapolis & Northwestern Traction Co., succeeding Mr. R. M. Boykin, of Philadelphia, who has returned east to fill a similar position with one of the Tucker-Anthony syndicate traction properties.

MR. E. C. FOLSOM on August 1st resigned as superintendent of transportation of the Ft. Wayne & Wabash Valley Traction Co. Mr. Folsom had immediate charge of the Ft. Wayne-Logansport interurban and the city lines in Ft. Wayne, Logansport and Peru, and was also acting as engineer of maintenance of way.

MR. E. G. CONNETTE, general manager of the Syracuse Rapid Transit Co., is the recipient of a very handsome and valuable diamond, which was presented him by the employes of the company July 13th. When it was first rumored that Mr. Connette was to leave Syracuse the employes of the Rapid Transit Co. arranged to present him with a testimonial of appreciation and the news of his retention did not alter their plans.

MR. H. U. WALLACE, chief engineer of the Illinois Central Railroad Co., has resigned to become third vice-president of J. G. White & Co. Mr. Wallace is a son of Mr. John F. Wallace, and has been associated with the engineering work of the Illinois Central since 1894. Among other important work carried out for the Illinois Central was the lake front improvement work at Chicago, which included the depression and reconstruction of some twenty miles of main lines and yard tracks.

MR. J. CLIFTON ROBINSON, managing director and engineer of the London United Tramways Co., Ltd., and of the Middlesborough, Stockton-on-Tees & Thornaby Electric Tramways; chief engineer of the Bristol Tramways & Carriage Co., Ltd., and director of the Metropolitan District Railway Co., which is now equipping its lines for electrical operation, was knighted June 30th, on the occasion of the king's birthday. Mr. Robinson commenced his tramway work under the late George Francis Train, the pioneer of tramways in Great Britain, whom he subsequently accompanied to America. He has been general manager of the Edinburgh Corporation Cable Tramways, and [illegible] the Highgate Hill tramway. [illegible] duced, he realized their [illegible] mechanical power, and [illegible] of the Dublin, Southern, [illegible]

MR. W. [illegible] HARRINGTON, [illegible] Trenton Railway Co. and the [illegible] Co., has resigned, but [illegible] the companies and remains as a director. Mr. Harrington is a member of the [illegible] Association and has been prominent in Eastern traction circles for several years. It is [illegible] Mr. Harrington was connected will soon by consolidated into the New York & Philadelphia Railway Co. and through service established between New York and Philadelphia.

THE MICHIGAN CENTRAL RAILROAD CO. announces that the construction of the Detroit tunnel line from Windsor, Ont., to West Detroit Yard, Mich., including the electrical equipment thereof, is placed in charge of an advisory board of engineers consisting of Mr. William J. Wilgus, vice-president of the New York Central; Mr. Howard Carson, consulting engineer, and Mr. W. S. Kinnear, chief engineer of the tunnel company. The chief engineer will be in direct charge of construction, reporting to Mr. H. B. Ledyard, chairman of the board of directors, on executive and financial matters, and to the board of advisory engineers as to plans, specifications and methods of doing the work.

MR. W. M. PROBASCO, who has been associated with the McGraw Publishing Co. as assistant to the president, has resigned to become vice-president of the Search Light Publishing Co., which company has recently been organized for the compilation of data on all subjects, the publication of a weekly journal called "The Search Light," the handling of advertising and publishing accounts of important railroads, manufacturing and engineering firms, and the publication of books. Mr. Probasco was formerly assistant manager of the Westinghouse Companies publishing, advertising and exhibition interests; designer and organizer of the Westinghouse exhibits at the St. Louis Exposition; compiler and editor of the recent publication of the Interborough Rapid Transit Co. entitled "The New York Subway."

Obituary.

MR. JOHN BOYLE, founder and president of the firm of John Boyle & Co., manufacturers of cotton duck and awning materials, 112 and 114 Duane St., New York City, died July 9th, at Asbury Park, N. J. Mr. Boyle was born at Bolton, England, coming to New York late in the 50's, where he began to manufacture sails and tarpaulins. Under his direction the business has grown to its present size and will continue without interruption or change in policy or management.

MR. J. HOLT GATES, western sales agent for electrical and steam machinery, died at Chicago, July 13th, the immediate cause of death being heart failure. Mr. Gates was born in Brooklyn in 1862, served in the 7th and 23rd regiments of the New York National Guard, and in the United States navy for three years, which he left in 1885 to enter the employ of Westinghouse, Church, Kerr & Co. He remained with the Westinghouse interests until 1893, when he became sales manager of the old Siemens & Halske Co. of America, with headquarters in Chicago. In 1899 the firm of Gates & Randolph was formed to act as sales agents for several well-known electrical supply houses, which firm later dissolved and Mr. Gates continued until his recent death to act as sales agent.

Beaver Valley Traction Co. Property Sold.

The Pittsburg Railways Co. has purchased the property of the Beaver Valley Traction Co. and will soon begin work on extensions on the north and south sides of the Ohio river to connect the Beaver Valley lines with Pittsburg. The Beaver Valley Traction Co. operated 32 miles of track to and through Beaver Falls, New Brighton, Rochester, Beaver, Monaca, Colonia, Freedom, Conway, Vanport, Bridgewater, Sharon, Fallston and College Hill, Pa. The old officers of the company were Sydney L. Wright, president; W. F. Snyder, vice-president; Walter T. Bilyeu, secretary and treasurer; J. C. Lightfoot, Jr., assistant secretary and treasurer; Gay-

[illegible] general manager [illegible] succeeded by James D. Callery, president; S. LaRue Tone, vice-president; W. B. Carson, secretary; J. C. Lightfoot, jr., assistant secretary and treasurer; Gaylord Thompson, general manager

Work of the Illinois Tunnel Co., Chicago.

[illegible] Illinois Tunnel Co. with all the freight houses and yards down town of every steam railway. The most important connections are with the following:

Chicago & Northwestern Railway Co.; Pennsylvania lines; Chicago, Milwaukee & St. Paul; Chicago, Burlington & Quincy; Chicago & Alton; Illinois Central; Baltimore & Ohio; Chicago Terminal Transfer railroad; Wisconsin Central lines; Chicago & Western Indiana, and Chicago Great Western Railway.

While the tunnel company has 33 miles of subway constructed, the 6 to 8 miles which form the connections with the freight houses of the railway companies have received the most serious consideration during the last year. The company is now handling about 7,000 tons of freight daily, and its engineers estimate that the completion of the connections with the steam railways means immediately a doubling of that haulage.

Order for Air Brakes.

After an exhaustive test the United Railways & Electric Co., of Milwaukee, to equip all of its new high-speed cars with the Christensen straight air brake. These equipments comprise many new features of advantage, and during the test proved to be most efficient and reliable.

The new Taunton & Buzzard's Bay Street Ry. (formerly the Middleboro, Wareham & Buzzard's Bay), has made a reduction in fares to points on Cape Cod, and the fare arrangement permits the selling of round trip tickets from Middleboro to Onset Bay and Monument Beach, and from those points to Middleboro and return. This reduction, which took effect the latter part of July, has met with a hearty response by the public.

Suggestions for a Street Railway Bridge.

By Arthur B. Weeks.

The accompanying illustrations will be found useful as working drawings in the construction of strong, serviceable bridges over streams, gullies, roadways, etc., by street railway companies.

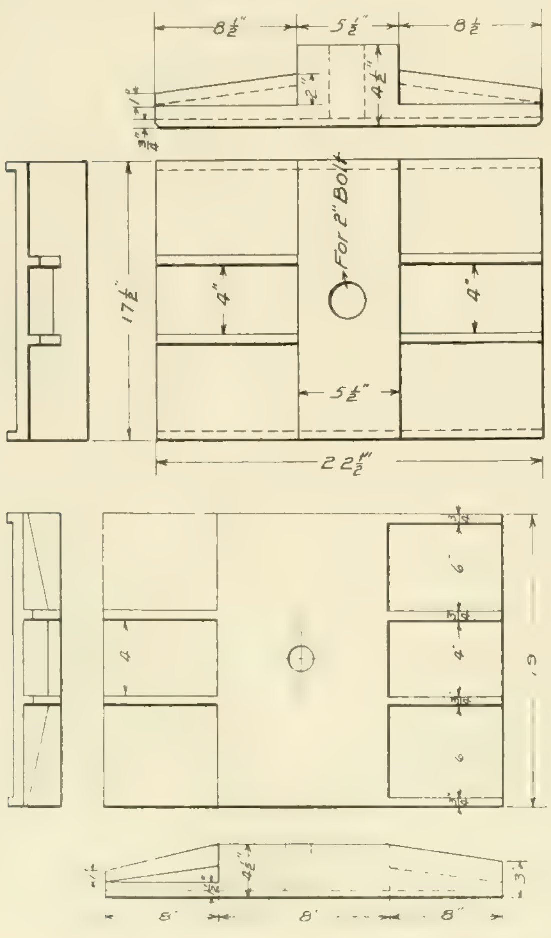
The entire length of the bridge as shown is 64 ft. Its extreme inside width is 12 ft., with the track centrally located within this

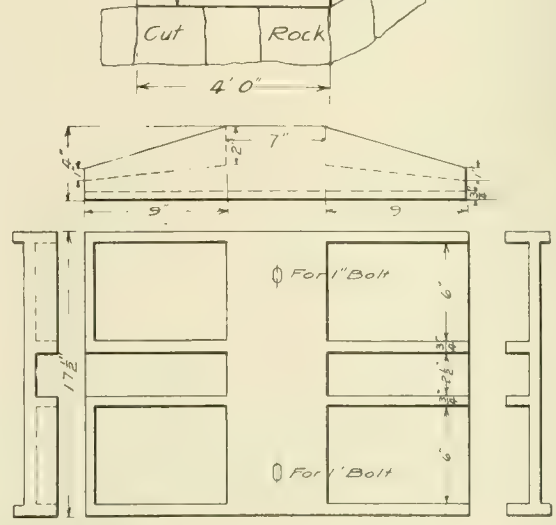
64 FT. TIMBER BRIDGE.

space. The cross ties for the T-rails which are laid to standard gage, are placed upon 8x14-in. pine timbers extending the full length of the bridge.

The timbers upon which the stringers rest consist of two 4x14-in. timbers bolted together; and a 2-in. rod passes through each of the nine timbers so formed. Each alternate timber has a brace extending from its outside extremity to the top beam of the bridge frame. Very large cast iron plates are used in connection with these bolts.

The top timbers, extending the entire length of the structure, have the following dimensions: The center one, 3¾x16 in., and the





DETAILS OF BEARING PLATES AND BUILT-UP TIMBER.

two outside ones 6x16 in. The distance from the extreme top to the wooden base is 7 ft. 3 in. The two vertical end timbers [illegible] the castings are 55 in. high by 6x8 in.

It will be observed that the 6x8 in. braces lean from each end of the bridge toward the center, and a 3x8 in. brace [illegible] in. between each pair of 6x8 in. braces, and a [illegible] in. bolt [illegible] the three braces where they cross each other. As few joints in the timber should be made as possible, and where they do occur [illegible] iron should be firmly bolted on each side of the joint [illegible] eral bolts.

VIEW OF TRUSS.

The castings for the 2-in. bolts which extend from the top of the bridge down through its base at regular intervals are 6x16 in. x 3-in. thick at the top of the bridge; those at the opposite end of the bolts, beneath the bridge, measure 6x8x2 in.

Three-quarter inch bolts should be used through the strengthening timbers wherever it is thought advisable. All the timber used in the construction of this bridge is sound pine.

Brooklyn Rapid Transit Co's. New Office Building.

The Brooklyn Rapid Transit Co. has recently completed the construction of its new ten-story office building at the corner of Clinton & Remsen Sts., Brooklyn. The building is fireproof throughout, built of brick and terra cotta, with floors of asbestolith, the style of architecture being that of the Renaissance. The building contains a large number of vaults, is served by electricity and automatic telephones. The arrangement of the offices in the building is such that ample room is afforded all departments and is as follows: Basement, local post offices, receiver's room, application and examining surgeon's office for the employment bureau; first floor, secretary and treasurer's department, main office of employment, etc.; second floor, general superintendent and operating staff; third floor, general attorney and claim department; fourth floor, comptroller and auditing department; fifth floor, attorneys and extra auditing department; sixth floor, president, vice-president, general manager and executive offices; seventh floor, purchasing agent, Brooklyn City R. R. offices and telephone switchboards; eighth floor, mechanical engineer, superintendent of power and assistants; ninth floor, electrical engineer; tenth floor, chief engineer; eleventh floor, roof house and blue print room. With its new and old buildings the company occupies the entire block on Clinton St., having a frontage of 184 ft.

The Lima Electric Railway & Light Co., Lima, O., has purchased lots at Main St. and Grand Ave., upon which it will erect a terminal station and office building.

Traction Merger in New York.

[illegible]

For Men in Charge of Men.

In addition to the [illegible] tion was made in the June and July issues of the "Review," Dr. Earl M. Pratt has prepared [illegible] is a large collection of booklets, folders, reprints, many original notices and data which he has collected since 1872 on resourcefulness. In speaking of this collection, Dr. Pratt says:

"It is a mental gymnasium and whatever you are trying to do, or doing, worth doing, this bundle is useful every day in some way. You can pocket a piece and read when you would never get to a big book. It has cost me money and trouble to win and the bundle is the story of the first third of a century of my accuracy researches. If you are not satisfied after looking the bundle through carefully and impartially I will prepare for you free, a $10 manuscript on any question you wish to ask me on personal [illegible]

The cost of the bundle is $10, express prepaid.

As Others See Us.

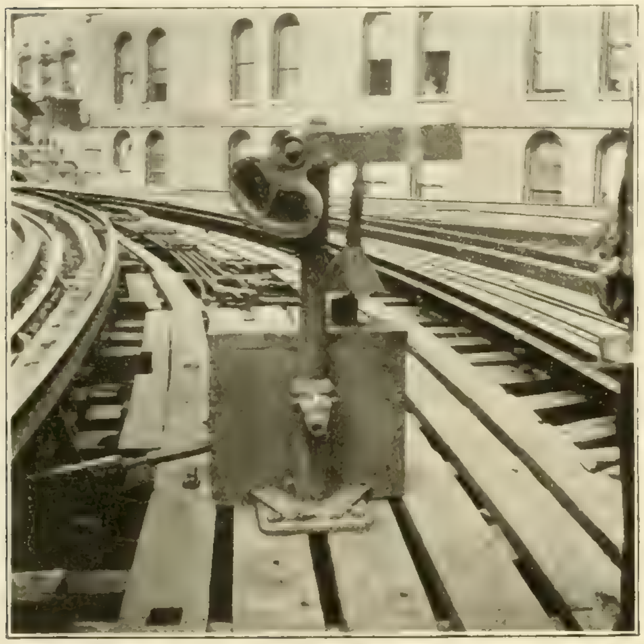
The following extract from the presidential address of Mr. Alfred Baker at the convention of the Municipal Tramways Association of Great Britain is interesting as showing how the Chicago traction situation is understood abroad. Mr. Baker said:

"Perhaps the most striking feature of the year, certainly one that has caused most widespread interest in the tramway world, is the announcement that the great City of Chicago has declared, by a majority of upwards of 25,000 [illegible] the municipalization of its street railways. It has been a very common thing for the opponents of municipalization of tramways to point to America in their endeavor to show that better results can be obtained from private enterprise. They have always asserted that the American citizens were far too 'cute' to undertake municipal ownership. Now, no one denies the 'cuteness' of the American, but it must be remembered that civic life in America is comparatively young, and it seems to me to be a sign of national good sense that, as opportunity arises America is not above taking a lesson from this country. Chicago is a city with an enormous mileage of privately-owned lines. It has been estimated that the cost of purchase cannot be less than eight million pounds. The city council is therefore face to face with the gigantic task of co-ordinating the various systems with a view to giving the city one complete scheme of tramways under proper civic control. It was little thought eight or ten years ago that the United States was likely to find an object lesson in tramway management in this country. Now that Chicago has set the example to her sister cities, we shall [illegible] widespread municipalization throughout America. Indeed, San Francisco has already won two elections in favor of its municipalization of its public utilities. In the early history of electric traction we had to go to America for all our knowledge. It speaks much for the engineering talent of this country that there is now no need to copy the United States any longer. It is generally acknowledged that, so far as the construction and equipment of tramways are concerned, we are not now so far behind—indeed, many people are of opinion that we can give points. However, whether this be so or not, we are grateful for what America has taught us in the past, and if our municipal experience is of any value to Chicago or any other American city, we shall be glad to place it at their disposal in the fullest and freest possible manner. Before passing from this subject, I think we may heartily compliment Glasgow on being invited to teach Chicago something of the art of successful municipal ownership and operation of tramways."

McGill Block Signal.

The Union Elevated Loop, Chicago, has interlocking signal plants installed at the three junction points, where trains enter and leave the loop tracks and as these plants are at the north-west, south-west and south-east corner of the loop, trains are protected from danger of rear-end collision at the five corner curves which the switch and signal systems control. There are no switches, however, on the north-east corner, nor on the inner track at the north-west corner, so that to protect trains at these three curves it was considered that a signal automatically operated was desirable.

The signal now in use on two of these curves is shown herewith, and is the invention of Mr. John J. McGill, chief electrician for the Loop. This was installed on the inner track at the north-east corner, Wabash Ave. and Lake St., in March 1902, and on the



THE MCGILL BLOCK SIGNAL

inner track at the north-west corner, January, 1903. Mr. F. J. Guernsey, superintendent of the Union Elevated R. R., advises us that these signals have operated in a very satisfactory manner since their installation.

Mr. McGill's signal, which has been patented, is a block signal that is set at danger by mechanical means, and released electrically. The design permits of the apparatus being used in connection with switch stands of standard type, as may be seen from the engraving.

At the entrance to the block is a track bar placed alongside the rail, which when depressed by the wheels of a passing car, actuates a train of levers releasing a detent in the signal mechanism, and the semaphore arm rises to the danger position. At the far end of the block is a section of track insulated from adjoining sections, and when the car passes over this section of track it closes an electrical circuit that energizes a solenoid in the signal box, drawing the semaphore to safety where it is held by a detent until again released by the depression of the track bar. Provision is made in the design of the mechanism so that a breakage of any part will release the semaphore arm and allow it to go to danger position by gravity.

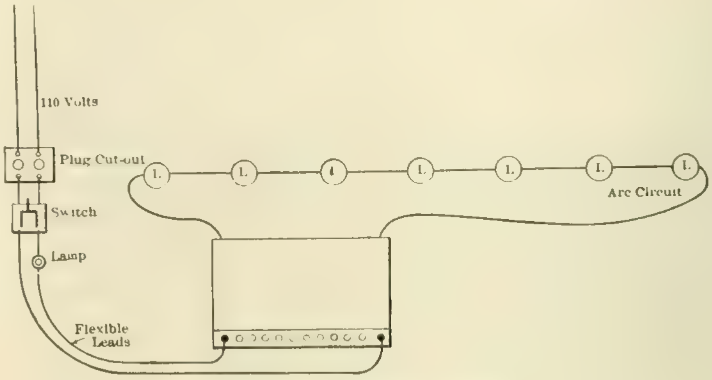
The electrical signal circuit is supplied with current from the third rail, suitable resistances being interposed to reduce the potential. The signal is in every way applicable to surface lines, current being taken from the trolley or feeder lines on other than third rail system, or operated with a battery on steam roads.

The Louisville Railway Co. is completing six new cars for its Fourth Ave. line. The cars are 40 ft. over all, have a seating capacity for 56 persons and will be equipped with two 50-h. p. motors. The cars are being constructed in its shops and it is stated to be the intention to build all of its cars in the near future.

Locating Breaks in Series Arc Circuits.*

OLD COLONY STREET RAILWAY CO., NEWPORT, R. I.

The following is a simple method of locating broken wires or bad connections on series arc circuits. First, it is necessary to run two wires from a lighting circuit of 110 or 210 volts to a point at or near arc switchboard, connecting same to a suitable fused cut-out and switch; second, connect two flexible wires to switch, having them long enough to reach all circuits in board and placing a lamp of 16



CONNECTIONS FOR LOCATING BREAKS

or 32 candle-power in series on one of the flexible leads, as shown in sketch. In case of trouble, such as an open circuit, connect flexible leads to ends of circuit and throw in switch.

The lineman, in looking for trouble, should be provided with a test lamp of proper voltage, with leads long enough to reach across hoodboards and lamps. On placing the ends of test-lamp wires across lamps at doubtful poles, his lamp will light at once provided the break is at this point; if the lamp should not light he will, of course, know that there is no trouble and will go on until he finds defective wire.

As soon as trouble is remedied, the lamp at station will at once light, showing operator at station that the trouble has been fixed.

The lineman will report to station before circuit is plugged in, or, if there is no telephone at hand, an understanding between lineman and switchboard operator allows a certain amount of time after light is lit before throwing circuit on line.

The Turbine Business Growing.

During the six months ending June 30th, 1905, the Westinghouse Machine Co., exclusive builder of the Westinghouse-Parsons type of steam turbines, has contracted for no less than 82,000 kw. in turbo-generating machinery, averaging nearly 1,175 kw. capacity per turbine unit. These machines range in size from 200 kw. to 7,500 kw. The latter will be the largest turbines in the world, and three units of this size are under contract for Greater New York railway and lighting power stations. In the distribution of these machines among the various industries, the electric railway has claimed the largest number of machines, averaging 1,496 kw. in capacity; next in order, industrial plants, averaging 571 kw. capacity, and light and power plants, averaging 1,529 kw. capacity. In the order of total capacity, railway plants have required 38,900 kw., lighting plants 26,300, industrial 12,000, miscellaneous 4,800.

This list bears excellent witness to the increasing possibilities of the turbine, and presages a brilliant future. The equipments noted represent solely actual sales only and not including contemplated business or partially closed contracts.

The Muncie & Portland Traction Co., the controlling interests of which are owned by the Indiana Union Traction Co., has let contract to Mr. Clift Wise for the construction of its line between Muncie and Portland, Ind., a distance of 31 miles.

It is announced that James F. Shaw & Co., of Boston, owners and operators of the Boston & Worcester Street Ry., will begin construction on the Hartford & Worcester Street Ry. This new line is a part of the New York and Boston through trolley line.

*From N. E. L. A. "Wrinkles."

More Chicago Litigation.

July 26th the Chicago City Railway Co. filed a petition in the United States Circuit Court praying for an injunction to restrain the City of Chicago from building a competing street railway. The company in its bill alleges the following:

1. The Chicago City Railway Co. has lawfully acquired the right to operate its cars on 119 different lines until such time as the city may purchase the properties as provided by the ordinance of 1858.

2. The company has the right by statute to collect a 5 cent fare from each passenger and cannot be compelled to divide that fare with any other line belonging to another company.

3. The company has the right to operate the present cable and electric lines by cable and electricity respectively until 1958.

4. The company has the right to install the underground trolley on any of its 199 routes, if it so desires, and operate in this manner until 1958.

5. The several contentions of the city hostile to the rights of the company claimed under the 99-year act are all unfounded.

6. The city has no right to allow another company to operate street cars in Adams, Washington, Harrison, Desplaines and Twelfth streets, or in any other street in which, prior to Nov. 16, 1863, it had authorized the complainant to construct a line.

7. The ordinance of Mar. 20, 1905, should be adjudged an attempt to take the property of the complainant without compensation.

8. Any attempt on the part of the city to bring about the construction of street car lines competing with the complainant should be adjudged an impairment of the contract obligations entered into by the state, city and Chicago City Railway Co. in various acts and ordinances.

9. In case the city should refuse to enact the proper legislation the court is asked to fix a reasonable compensation which the company shall pay for the continued use of the trolley rights which have expired.

A. S. R. A. Announcement.

Secretary Penington has issued the following circular regarding the plans for the forthcoming conventions:

The 24th annual meeting of the American Street Railway Association will be held in the South Building, Philadelphia Museum, 34th St., Philadelphia, September 25th to 30th. The American Railway Mechanical and Electrical Association and the Claim Agents Association will meet Monday and Tuesday, 25th and 26th; American Street Railway Association, Wednesday and Thursday, 27th and 28th; Accountants' Association, Thursday, Friday and Saturday, 28th, 29th and 30th.

The report of the Re-organization Committee will be presented and acted upon, a new Constitution and By-Laws have been prepared and it is the desire of the Executive Committee that as many of the members as possible be present to consider them. Papers will be presented on "Gas and other Engines," "Organization," and "Single Phase System for Street Railways." Our allies, the Manufacturers' Association, will have the largest and best exhibition of appliances ever shown at any convention. As this will be their first exhibition they will make it a great success. The Hall has over 60,000 sq. ft. of space.

The passenger associations have granted us rates of fare and one-third on the certificate plan. Be sure and get a certificate from the ticket agent when you purchase your tickets and leave it with the clerk when you register. It will be ready for you before the meeting is over.

The Headquarters will be at the Bellevue-Stratford Hotel. Rates are as follows, European plan:

Single rooms, without bath, $2.50 per day and up.

Single rooms, with bath, $3 per day and up.

If two persons occupy a single room, the rate will be $1.00 more.

Double rooms, without bath, two persons, $3.50 per day and up.

Double rooms, with bath, two persons, $4.50 per day and up.

Reserve your room before you leave home. Philadelphia is noted for its good hotels, many in close proximity to the headquarters.

To reach the [illegible] to 34th St. Stages will be in waiting to [illegible] without charge. A light lunch will be served at the [illegible] all may stay there until the meetings are over. The annual banquet will be held Thursday evening, at the Bellevue-Stratford Hotel. Tickets will be sold to all at cost.

The following [illegible] Executive Committee:

"The secretary is directed to request the chief executive officers of the different companies to [illegible] departments representing their respective companies at the coming convention that they will be expected to be present and take part in the discussions at every session during the convention."

We expect to have a profitable and pleasant meeting with a large number of delegates, but we need you [illegible] to make it a success. Will you come?

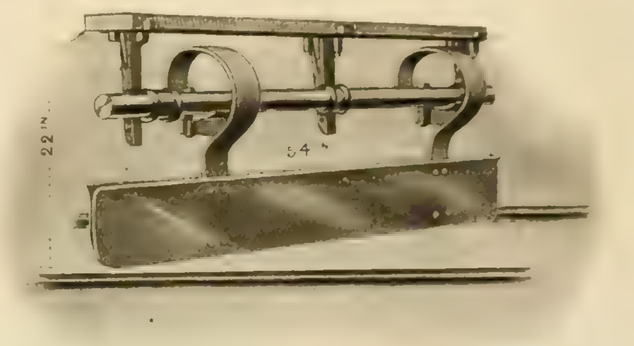
Yours very truly,

Approved:
W. Carlyl Ely,
President.

J. C. Penington,
Secretary.

The Root Railway Scraper.

Among the devices invented during the old horse car days upon which recent improvements have been made to meet the requirements of today, is the snow scraper, the accompanying illustration being that of the Root railway scraper, manufactured by the Kalamazoo Railway Supply Co., Kalamazoo, Mich. The advantages claimed for these scrapers are that they will meet all conditions of



NO. 6 FAN SCRAPER

snow; they adapt themselves to any type of rail; they require less space to install and can be installed and operated on any car that is made. The No. 6 fan scraper shown is especially designed for clearing snow from the middle of the track. It is installed as a fixture and does not need to be operated, all parts being held rigid, except the yielding springs, which allow the scraper to pass over any rigid object in the roadbed. It is installed in front of the track scrapers on either end of a double truck car or on the rear end of a car running always in one direction. The shaft holding springs are held rigid by keys so that the scraper can be set at any angle. The hanger board is about 22 in. above the rail when installed, and the shovels about 3 in. above the rails when the car is empty; this varies, however, with track conditions. Among a large number of companies using Root railway scrapers may be mentioned the Lansing & Suburban Traction Co., Saginaw Valley Traction Co., Toledo Railway & Light Co., Canton-Akron Railway Co., Rochester Railway Co., and American Railway Co., Philadelphia.

Any scrapers that the comany send out may be returned after a reasonable trial if they do not demonstrate the claims made for them.

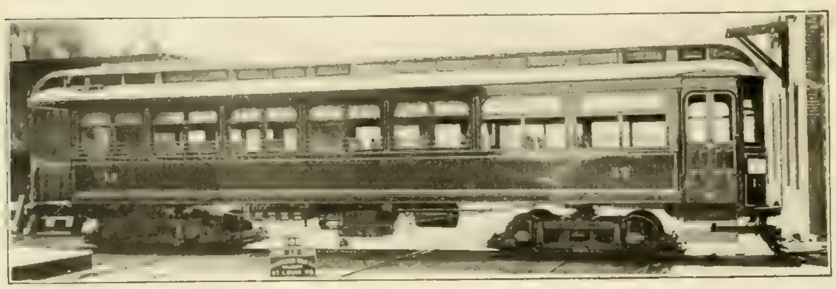
The Massachusetts Railroad Commissioners have authorized the carrying of baggage and freight by the Taunton & Pawtucket Street Railway Co. for the period of six months, beginning Sept. 1. This permit does not apply to such of the company's road as lies in the town of Attleboro, Mass.

High-Speed Cars for the Northern Texas Traction Co.

The American Car Co. has recently delivered to the Northern Texas Traction Co. two handsome combination passenger and smoking cars for high-speed service. Cars of this type built by the American Car Co. were furnished the railway company last year and have been operated since with excellent results. Six semi-convertible cars built by the G. C. Kuhlman Car Co. under the

INTERIOR OF CAR.

Brill patents have also been in operation a short time. The cars are mounted on the Brill No. 27-E-2 high-speed trucks having 75 h. p. motors. They are to be operated in one direction and only the front platform is vestibuled. The seating capacity is for 56 and the spring cane seats are stationary and have high backs. The length of the seats is 35¾ in. and the aisles are 19 in. wide. The smoking compartment in the forward end seats 16 passengers. The lower sashes of the windows may be held at any point by the locks being released against serrated bronze bars set into the posts. A toilet room of standard steam car character is placed in the corner



NORTHERN TEXAS TRACTION CO. CAR.

at the rear end of the car. The interiors are finished in cherry rubbed to a smooth dead finish and paneling inlaid with white holly and ebony. The semi-empire style of ceilings are tinted green and tastefully decorated in gold. Deep undertrusses are used in addition to inside trusses and sill plates constituting a substantial side. The general dimensions are: Length over the end panels is 40 ft. 9 in.; over crown pieces, 50 ft. 1 in.; from panel over crown, 4 ft. 8 in.; width over sills, including siding, is 8 ft. 5 in.; center to center of posts, 31½ in.; side and end, 5¾ x 7¾ in.; sill plates, 7 x ⅝ in.; thickness of corner posts, 4 in.; of side posts, 2¼ in.; height of steps, 16⅝ in. and of risers, 12 in. The Brill No. 27-E-2 trucks have a wheel base of 6 ft. 6 in. and 33-in. wheels. The equipment includes Brill angle iron bumpers, "Dedenda" gongs, folding gates, vertical brake wheels, etc.

The Massachusetts Railroad Commissioners have authorized the carrying of baggage and freight by the Taunton & Pawtucket Street Railway Co. for the period of six months, beginning Sept. 1.

Crane Co.'s 50th Anniversary.

The Crane Co. celebrated its 50th anniversary July 4th, all of the company's branch house managers being present. Monday the branch house managers went through the Crane Co's. factories; in the evening, at 7 o'clock, they were given a dinner and taken to the "White City," where an evening was spent visiting the various shows. Tuesday morning the managers went to Lake Geneva, Wis., where they were entertained by Mr. R. T. Crane at his summer residence that and the following day. Thursday, July 6th, the company gave to all its employes and their families a picnic at North Western Park. About 10,000 people attended this picnic. A brief history of this well known firm should be of interest, and this occasion offers appropriate opportunity for such.

In the spring of 1855 Mr. R. T. Crane came to Chicago and, after looking over the field and advising with his uncle, the late Martin Ryerson, opened a brass foundry in the corner of the latter's lumber yard. Work on the shop was completed July 3d. Being anxious to see how the furnace and sand would work, and having some patterns ready, Mr. Crane took off a heat the next day, notwithstanding it was the fourth of July. The sand used was found on the premises, and the first castings were couplings used in connecting lightning rods. Business prospects looking good, Mr. Crane sent for his brother, Charles S. Crane, who came in the fall, and who was connected with the business until 1871. Shortly after his arrival they decided to go into the making and finishing of brass goods. A foot lathe was purchased, and the manufacture of brass engine trimmings began. A few months later a room with power was rented, and the following spring a small three-story frame building was erected and equipped for power with a 6-h. p. portable engine. The next year jobbing in wrought iron pipe and fittings and steam warming work was taken up.

Little business was done in the three years previous to the breaking out of the Civil War because of the unsettled conditions prevailing. After the breaking out of hostilities the enormous demand of the government for all sorts of material created a boom in business generally. Soon the brass plant had to be enlarged, and the manufacture of brass globe valves, check valves, steam and gas cocks, begun. An iron foundry was started, and the building, in a small way, of machinery and the making of a few articles belonging to the steam fitting line was undertaken. About the same time a small butt-weld pipe-mill, the first mill west of Pittsburg, was built on the ground where the Crane Co. still has a pipe mill. In the same year (1864) the property where the present brass department is located, known as No. 10 North Jefferson St., was purchased and the first malleable iron foundry outside of the eastern states started. This foundry was on the second floor and is said to be the first instance of a foundry being placed above the ground floor. The manufacture of both malleable and cast iron fittings was commenced. The fitting industry was then in its infancy in this country. Most of the fittings used were wrought iron fittings imported from England. Not more than six or seven concerns were in the business in the United States and their total output was small. About this time the three-way tapping machine was invented. Two, with some original improvements, were built by the Crane Co. and installed in their shops, one for tapping ¾-in. and smaller, the other for tapping one to two in. The few fittings required above two in. were threaded in a lathe. In connection with the fitting business the company early took up the manufacture of dies and die plates.

In 1865 the business was incorporated by Richard T. Crane, Charles S. Crane, Martin Ryerson, Eliphalet W. Blatchford, Charles N. Holden, and the name changed from R. T. Crane & Brother to the North Western Manufacturing Co. This name was retained until 1872, when the title Crane Brothers Manufacturing Co. was adopted, which was changed in 1890 to Crane Co.

By 1870 the business had grown so that further extensions were necessary. The land west of the property at No. 10 North Jefferson St. was purchased and a building erected thereon. Fortunately the company escaped the big fire of 1871, and the large increase that had recently been made in facilities enabled the company to take advantage of the heavy demand for goods created in the re-building of the city.

In 1881 another pipe mill was erected on property purchased at West 12th place, where there were excellent railroad facilities. One lap-weld and two butt-weld furnaces were erected. In this mill Siemens gas furnace was employed in the manufacture of lap weld pipe. Some years later the machinery in this mill was transferred to a mill in Pittsburg and ultimately was sold to another concern. The mill was then re-built, and the malleable iron and grey iron fitting department were transferred to it, leaving larger space in the old buildings for the brass shop.

Although the Crane Co. was concentrating upon the manufacture of valves and fittings, the continued growth of the business demanded extensive additions in 1891, 1899, 1900, 1902, 1903, and this year a five-story modern office building has been erected. Not only has there been an immense increase in the floor space used for manufacturing purposes, but all departments have been equipped with the latest improved machinery, much of which has been designed and built by the company.

Westinghouse Railway Type Circuit Breaker for Direct Current Uses.

The Westinghouse Electric & Manufacturing Co. has recently placed on the market the street railway circuit breaker shown in the illustration, which combines in one piece of apparatus a safety device and main switch, as it automatically opens the circuit on overload or short circuit, and can be operated by hand to disconnect the car from the trolley circuit. It is intended to be installed over the motorman's head, in the place usually occupied by the canopy switch, but may be placed elsewhere if desired. It can be quickly closed, thus avoiding the inconvenience and delay incident to replacing a fuse.

This circuit breaker is intended for direct-current use, and is made for capacities of 60, 100, 150 and 200 amperes, with a range from 90

WESTINGHOUSE RAILWAY TYPE CIRCUIT BREAKER.

per cent to 225 per cent of normal rating The mechanism is mounted on a cast iron base and enclosed by a pressed metal cover. The handle for resetting projects conveniently from the side of the case, and the plunger for tripping by hand extends through the cover and is provided with a composition handle for the hand to strike against. The resetting handle is connected to the switch lever through a compression spring, which insures a firm pressure and good contact, regardless of the natural wear to which the parts may be subjected in service.

The arc is broken in a powerful magnetic field which effectually opens the circuit under the most severe conditions. The contacts on which the arc occurs are surrounded by a shield of insulating and arc-resisting material, which prevents the arc from being communicated to any other part of the breaker. The contact is made up of copper strips separated by spaces, each acting independently of the others, and in this way a slight irregularity or burr will affect the individual strip only [illegible] strips [illegible] would be the case in a brush made in the usual way with laminations without space. [illegible] which can easily be removed and replaced by a new one, serves as an arcing tip. A feature of this breaker is the accessibility when the cover is removed.

The current adjustment [illegible] which engages [illegible] opposes the pull of the magnet on the armature. A trigger holds the switch in the closed position, and is in range with a projectile on the armature of the tripping magnet. When the armature is drawn down by an excessive current in the coil this projection strikes the trigger and releases the switch lever, which is opened instantly by a coiled spring.

The "Champion" Street Car Fender.

Among the well-known products of the Star Brass Works, Kalamazoo, Mich., manufacturer of street railway supplies, the "Champion" fender is attracting considerable attention. The operating details of this fender are shown in the accompanying engravings,

FIG. 1 FENDER LOCKED DOWN

Fig. 1 showing the fender locked down and Fig. 2 showing a rear view of the car when the fender is not in service. The fender when in operation is about eight inches from the ground and is dropped to the track instantly and positively by a slight touch of the foot and locked down automatically, thus making it impossible

FIG. 2 REAR VIEW OF [illegible]

for a body to get under it. There is a rod attachment, which may be noted in Fig. 1, that returns [illegible] without the motorman stopping or leaving the car. This fender, which is constructed of angle steel thoroughly braced and riveted together, is light but very strong. It is provided with a spring bumper which prevents serious injury to a person struck by a car. The fittings are adjustable to accommodate different styles of cars and its construction and operation are so simple that it requires but little attention after being installed.

The Lehigh Valley Transit Co.

The reorganization of the Lehigh Valley Traction Co. and underlying companies, the Lehigh Valley Passenger Railway Co., Philadelphia & Lehigh Valley Passenger Railway Co. and the Allentown & Slatington Street Railway Co., has been completed and the companies have been merged into the Lehigh Valley Transit Co. The capital stock of the new company will consist of $3,000,000 common stock, $5,000,000 preferred stock and $7,500,000 of 4 per cent bonds, of which it is stated $2,000,000 will be expended on improvements. These will include new car equipment, a new power house and car barn at South Allentown, Pa., and the general reconstruction of the lines, work on which will begin at once.

At the meeting of the receivers and reorganization committee held in Philadelphia, July 26th, the following directors were elected: H. C. Trexler and George O. Albright, of Allentown; Mayor Tom L. Johnson, of Cleveland; William F. Harrity, George H. Frazier, Edward B. Smith and Arthur E. Newbold, of Philadelphia; Edward M. Young, of Allentown, and David Young, of Newark, N. J. The officers of the new company are: President, Col. H. C. Trexler; vice-president, Edward M. Young; secretary and treasurer, George H. Frazier; general manager, Warren S. Hall.

Kansas City-Leavenworth Railroad Co.

The properties of the Kansas City-Leavenworth Railroad Co., which operates 40 miles of interurban track between Kansas City and Leavenworth, Kas., and the local city lines in Leavenworth, have been purchased by the Gregory-Holmes syndicate. Those interested are Robert L. Gregory, Walton H. Holmes, C. F. Holmes and C. F. Hutchins, Kansas City; C. J. Pack, Cleveland, O., and Fisk & Robinson, New York, who have in hand the work of underwriting the bonds of the reorganized company. Mr. Conway F. Holmes has assumed the presidency and management of the company and the work of reconstructing the present properties will be under the immediate supervision of Mr. Daniel Bontecum, chief engineer, and Mr. Charles Grover, chief electrician, both of whom were formerly with the Metropolitan Street Railway Co., Kansas City, in a similar capacity. It is stated that it is the intention to first reconstruct the present lines and then build to Atchison and St. Joseph. New equipment has already been ordered and the company will soon establish a freight and express business on its lines.

The Pennsylvania Lines to the Convention.

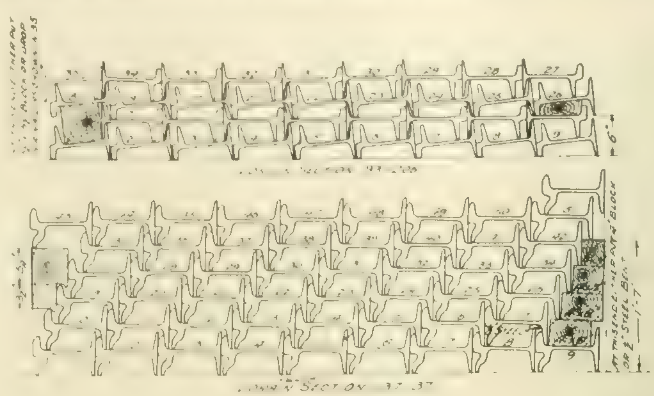
The Pennsylvania Lines have made special arrangements for the handling of western delegates to the street railway associations' meetings in Philadelphia the week of September 25th, particularly for the large number of street railway and supply men that are expected to attend from Chicago. For the convenience of the Chicago delegates, a special train, consisting of an observation car, club car and standard sleepers, will leave Chicago at 7:30 p. m., Monday, September 25th, arriving at Pittsburg the next morning, where cars from Cleveland, St. Louis and Cincinnati, carrying the Ohio, Michigan, western and southwestern delegates, will be attached to the train. The run from Pittsburg to Philadelphia will be made by daylight, reaching Philadelphia for 6 o'clock dinner. This will give all a daylight ride through a very beautiful country and enable all to spend a day in becoming acquainted.

The tickets for this trip will be on sale three days before the date of the meeting and these tickets going are good on all the company's regular trains, it being understood, of course, that where passengers take the extra fare trains they pay the extra fare. For further particulars regarding rates, sleeping car reservations, etc., communications addressed to Mr. C. L. Kimball, A. G. P. A., Pennsylvania Lines, 2 Sherman Place, Chicago, will receive prompt attention.

Mr. E. E. Downs, general manager Petaluma & Santa Rosa Railway Co., writes us that the company is now operating over 50 cars in freight service and that it is now endeavoring to secure additional freight cars on the Pacific Coast for immediate delivery.

A Good Method for Piling Rails.

The matter of piling rails in yards at first thought might appear to be so simple as not to require any special instruction. The Philadelphia Rapid Transit Co., however, finds that it is quite a serious problem to store rails in limited space in such a way as to have



RAIL PILE STANDARDS

them convenient for access, and accordingly, some years ago, went into the matter carefully and made drawings showing the most satisfactory way for piling two standard rail sections in its storage yards. These diagrams are reproduced in the accompanying drawings.

Curtis Steam Turbines in Japan.

July 29, 1904, the first shipment of steam turbines arrived in Japan via the "Korea" from San Francisco. They were of 500 kw. capacity of the Curtis type, and were for operating the Shigai railway in Tokio. Four weeks after their arrival the turbines were in full operation. As significant of the success of these first units, there have been ordered by the Japanese from the General Electric Co. of New York, 37 Curtis steam turbines with electric generators with a total normal capacity of more than 35,000 h. p. Of these, 11 units are now installed and in satisfactory operation.

The Japanese are using electricity for operating the street railways of their cities and for indoor and street lighting. In the use of electric power for machine shops, they are following only the best American practice, which, as a rule, requires electric motors mounted on each tool.

The coal mines of Japan will eventually be operated electrically. Some of the turbines mentioned above are intended for the Miike coal mines on the Island of Kyushu; these are owned by Mitsui & Co. and will use two 1,000-kw. Curtis steam turbines.

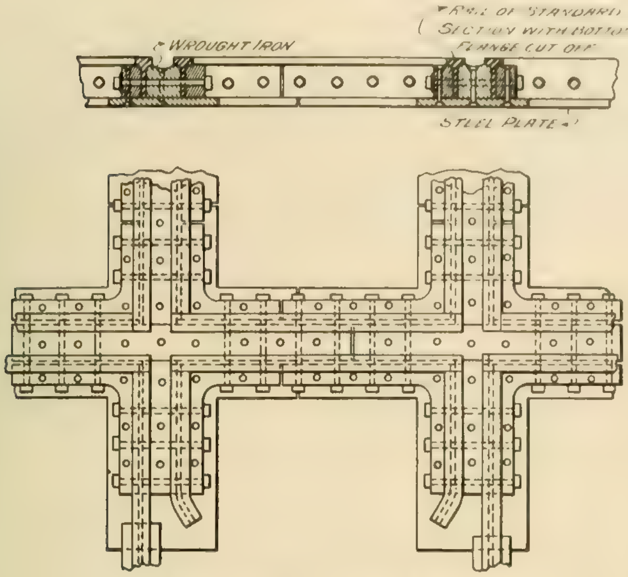
The Osaka Electric Light Co., which furnishes electricity to the city of Osaka with a population of over 800,000, is equipped entirely with American electrical apparatus, including six steam turbines of the same make.

One of the largest electrical interests in Japan which has ordered some of the machinery referred to above, is the Tokio Street Railway Co., which furnishes transportation facilities for the city of Tokio with a population of 1,440,000. Its Japanese name is Tokio Shigai Tedsudo. Its franchise runs until 1952, but provides that after the year 1932 the municipality may purchase the property of the company by paying a proper price for it. Although some English and German material is being used by this road, practically all the electrical equipment is American made. This includes five 2,000-h. p. Curtis turbo-generator units with power house equipment and railway motors furnished by the General Electric Co. Wheeler condensers and Brill trucks. Besides a small amount of German and English machinery such as boilers and trucks, there are a few small dynamos which were made in Japan.

The Portsmouth, Dover & York Street Railway Co., by arrangement with the Dover, Somersworth & Rochester, is offering patrons a round trip ticket at a reduced rate, covering a trolley ride each way between Portsmouth and Dover, and an admission to Central Park, Dover.

Improved Railway Crossing.

The accompanying illustration shows a design of railroad crossing recently patented by Mr. John J. McGill, [illegible] Elevated Railroad Co., Chicago, to meet the conditions in elevated service, where the special work not only wears rapidly because of the heavy traffic but where it is equally important that renewal be made without interference with regular trains. The idea will be readily perceived from the drawings. The foundation of the



PLAN AND SECTION OF RAILWAY CROSSING.

special work is of steel plates, to which are riveted filled blocks of proper dimensions, as shown in the cross section. The rails in the crossing which are subject to wear are of the standard section, except that the bottom flanges have been cut off so that the web of the rail rests upon the foundation plates, the web slipping into place between the filler blocks and being securely held by transverse bolts. To remove a rail it is only necessary to loosen the nuts, drive out the bolts and lift the worn rail, slipping another into its place. The same idea applied to frogs is covered by McGill's invention.

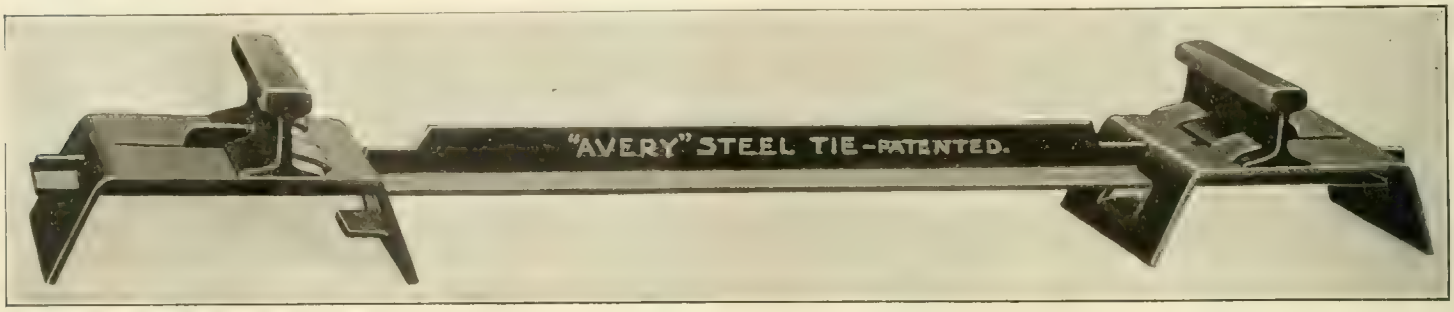
Mechanical Draft.

Messrs. Mills and Rowan, in their exhaustive work on Chemical Technology, make the following pertinent statements regarding the subject of mechanical draft: "The principles of what is now becoming well known under the name of 'forced combustion' have been repeatedly advocated during past years by those who have devoted throught and study to the subject. The position assumed by them—which is now finding favor amongst engineers—has been, in brief, that the air supply required for combustion in furnaces can be more economically furnished by mechanical power than by the action of chimneys, and that the mechanical method has other advantages which enable it to be preferred to the one which is older but more imperfect. One of these advantages is the higher temperature of combustion, which is equivalent, with a boiler of good design, to an increased evaporative power of the boiler, or to increased evaporative effect for the fuel. Another advantage, which has not been fully realized in any plan as yet introduced in practical work, is that the rate of travel and escape of flame and hot products of combustion is under control. It is thus possible to cool them more completely than can be done when chimney draft is used, and this means a saving of heat which would otherwise be uselessly dissipated.

"Mechanical or artificial draft thus presents to us a method of economically furnishing the air supply to furnaces and producing a more efficient combustion temperature, while it also renders possible further economies due to retarding the movement and escape of hot gases and to preliminary heating of the air supply by waste heat or otherwise."

The Avery Steel Tie.

In view of the decreasing source of supply of timber for wooden ties and the comparatively short life of ties, the need and demand for a steel tie is rapidly increasing. To meet this demand the Avery Stamping Co., general metal worker and manufacturer of "Never-Break" steel wares, Cleveland, O., has placed upon the market the



AVERY STEEL TIE COMPLETE

Avery steel tie, which is illustrated herewith. The general design construction throughout is of ⅜-in. steel for standard gage road and construction of the tie may be seen in the illustration. The and heaviest rail, the tie complete weighs approximately 100 lb. and the same amount of tamping surface is available as under an 8-ft., 8-in. face wooden tie. The company claims this to be the strongest and cheapest steel tie ever produced, easy to tamp and shim and equally efficient in all kinds of ballast. The locking device is most efficient when the load is on and both rails being held by the same solid tie bar, the spreading of rails is impossible and a true gage of rails is assured. While the first cost of the steel tie is considerably more than the wooden tie, the life of the steel tie, the decrease in maintenance cost and the salvage for scrap, when distributed over the time which the steel tie will last, in comparison with the life of the wooden tie, would show a saving, in addition to which the railways would be giving their patrons and employes assurances of safety.

Improved Wurts Lightning Arrester.

Although the well-known Westinghouse Electric & Manufacturing Co. Wurts non-arcing lightning arrester has been in service for over 12 years, it is only recently that the first change in its mechanical mounting has been considered desirable. The old type of this arrester is used extensively, both here and abroad, for all conditions of service, power, lightning, telephone service on high tension transmission systems and wherever protection was desired, within its range.

The new type has the same dimensions as the old Type C arrester, Style No. 1383, and the arrester unit itself may be used as a repair part wherever this device has been employed. One improvement is the method of securing the non-arcing cylinders to the porcelain supports. These are firmly held in place by machine screws passing through holes in the porcelain supports and screwed in the line and ground contacts. Porcelain supports are molded to shape with the cylinder centers exactly spaced, thus securing a perfect air gap adjustment. All the cylinders can be easily turned through any angle to present new surfaces for action. Line and ground leads are made in a very secure manner.

The assembled porcelain supports and cylinders are separated from the iron box by rubber covered wire. This makes an effective packing which insures the porcelain from breakage if the arrester be shaken or jarred, and the wire holds the packing in place. The cover is screwed to the box, rubber gaskets keeping out all rain. The arrester is of the line type designed for connection to overhead feeders and circuits, the normal rating being from 500 to 1,250 volts double pole and up to 2,500 volts single pole. All the best electrical operating characteristics of the old type C arrester are retained, the improvements consisting of improved mechanical construction and consequently longer life and ease of inspection and repair.

Electrical Feature at Buffalo During Elk Carnival, July 10th.

A unique feature of the electrical display at Buffalo during the 19th reunion of the Elks, July 10th, and one that marks a radical step in electric lighting for decorative purposes was a "Mercury Arc Tower" erected in Shelton Sq. This was a fluted column of staff 75 ft. high, studded with 100 mercury arc lamps, which produced a most startling effect, due largely to the characteristic greenish light of the lamps.

The mercury arc lamps were operated in two series of 50 lights each from 4-ampere brush arc machines located in the Wilkison St. station. As each lamp consumes only 160 watts, the operating expense was extremely low for so brilliant a spectacle. They are of the standard type for outdoor lighting as developed under the direction of Dr. Steinmetz and manufactured by the General Electric Co.

This luminous tower was a special contribution to the Carnival by the Niagara Power Co., the Cataract Power & Conduit Co., and the Buffalo General Electric Co. Mr. Charles R. Huntley conceived the idea and designs were prepared by the illuminating engineers of the General Electric Co. and this company furnished the material and superintended the installation.

Advertising Literature.

THE WEIR FROG CO., Cincinnati, O., is now distributing a very complete catalog of light-rail work, its catalog A. This publication includes descriptions and drawings of the many designed switch stands manufactured by this company, crossings, turnouts, frogs, portable track work, split switches, stub switch fixtures, switch stands, tie bars for light rail, tongue switch and mate, together with instructions to find the number of a frog, lead of turnout upon a circular arc, the center radius, etc. Besides the light rail work down in the illustrations the company will furnish special work in accordance with plans submitted.

H. W. JOHNS-MANVILLE CO., 100 William St., New York City, has recently published a new electrical catalog, its No. 14, with a view to better presenting its large and complete line of products. This is one of the most complete books of its kind and fully illustrates the extensive and varied line of electric railway supplies manufactured by this company. The publication is divided into 14 sections as follows: I, Trolley Line Material; II, Trolley Ears, Clips, Splicing Sleeves, etc.; III, Strain Insulators, Turn Buckles, etc.; IV, Pole Bracket Arms, Section Insulators, etc.; V, Pole Line and Third Rail Insulators, etc.; VI, Miscellaneous Material; VII, Tools; VIII, "Noark" Enclosed Fuses and Devices; IX, Moulded Mica Sockets; X, Electric Heaters and Electrotherms; XI, Vulcabeston and Moulded Materials; XII, General Information and Data; XIII, Telegraph Code; XIV, Indexes. The book is profusely illustrated and completely indexed and besides complete information grouped under the above heads, includes general suggestions regarding ordering materials, together with illustrations of the company's plants.

RAND, McNALLY & CO., Chicago, have recently published two very attractive folders, one for the Aurora, Elgin & Chicago Railway Co. and the other for the Union Pacific Railroad Co. The latter publication is a very attractive description of the Lewis and Clark Centennial Exposition, profusely illustrated with half-tones of the various buildings, grounds, etc. Besides this it includes im-

portant information to visitors regarding reaching the grounds, as well as time tables, rates and other information relative to the Overland Route to Portland.

"NEVER BREAK" ELECTRIC LIGHT GUARDS for either single incandescent lights, clusters or arc lights are described in a recent pamphlet of the F. Bissell Co., Toledo, O. The publication includes data as to sizes and prices as well as descriptions and illustrations of the different guards. Another very novel and effective method of advertising this company's products was used at the recent telephone convention in Chicago, where very attractive scarf pins showing the company's trade mark were distributed.

WESTINGHOUSE DIRECT CURRENT MULTIPLE ARC LAMPS for 110 and 120 volts are described and illustrated in Circular No. 1102. This lamp is of a new and improved design and it fully meets all requirements for both indoor and outdoor service. It is of the direct lift type and the parts are so arranged as to secure uniform even action over the entire lift.

THE GOLDSCHMIDT THERMIT CO., 43 Exchange Place, New York, is distributing a pamphlet entitled "The Thermit Process in American Practice," being a paper read by Ernest Stutz at the annual meeting of the American Society for Testing Materials, held recently at Atlantic City, N. J.

THE JULY EDITORIAL IDEAS in Hartshorn's Roller are of interest to those in the market for shades and awnings, while the paper also abounds with hot-weather reading. The title of the double-page drawings is entitled "Mythology Up-to-date."

GENERAL ELECTRIC CO. PUBLICATIONS that have been received since those mentioned in the July issue of the "Review" are as follows: Folder 3328, electric flat irons for laundry and household purposes; Flyer 2153, candelabra adapter, permitting the use of candelabra base lamps in standard Edison base sockets; Flyer 2146, single-pole snap switches; Bulletin 4412, electric hoists for building operations and general construction work; Bulletin 4413, the CQ motor.

THE OHIO BRASS CO., Mansfield, O., is distributing Vol. 1, No. 1, August, 1905, of its monthly bulletin, which will be published every month in the interest of electric railway companies and mining companies using electricity for haulage, lighting, etc. In this first issue are contained articles on single phase line construction, the Nichols-Lintern air sander, self-feeding drill for coal mines, examination of a hoisting rope, electricity vs. air for coal cutters, together with pertinent remarks regarding the bulletin and the company. The reasons for publishing the bulletin are given in an editorial, which [illegible] we have as our aim the purpose of getting more closely in touch, if possible, with those interested in electric railway construction and operation, as well as in coal mines and industrial plants using electricity for light and power. We would be glad to have all our readers take an active interest in this enterprise and we offer our columns for the publication of all articles of interest, whether technical or personal, to those for whom this paper is published. All articles or news items addressed to the editor will have recognition in the order received."

THE ANNOUNCEMENT OF THE CANADIAN WHITE CO., LTD., Montreal, Canada, has been made in a very attractive publication, the office of the company having been recently opened in the Sovereign Bank Building, Montreal. Besides this announcement, the publication includes a partial list of engineering and construction contracts completed or in progress by J. G. White & Co., New York. The Canadian White Co., Ltd., will carry on a general contracting and engineering business and will undertake any civil, mechanical, electrical, hydraulic and building work. It will be fully equipped to handle large construction contracts for steam or electric railways, and will be prepared to design, build, equip and operate electric lighting plants and power installations, gas works, water supply, sewage systems, piers, docks, harbor works, office buildings, apartment houses, hotels, etc. Mr. H. C. Hitch, who has been for several years connected with the Thompson-Starrett Co., of New York, as superintendent, has been engaged as superintendent of building construction.

THE B. F. STURTEVANT CO., of Boston, Mass., has just issued a second edition of its Bulletin No. 63, showing generating sets in a full line of 36 sizes ranging from 3 to 100 kw., and equipped with vertical simple, vertical compound or horizontal engines, ac-

[illegible] All of these engines are equipped with forced lubrication, watershed partitions and oil tight cases.

"INTERURBAN RAILWAY CONSTRUCTION" is the title of an artistic bulletin just issued by J. G. White & Co., Inc. The bulletin is illustrated with several interesting half-tone reproductions of various phases of interurban railway work, as executed by the White company. The reading matter in this bulletin describes the organization and scope of the J. G. White Co. and the three associated White companies—J. G. White & Co., Ltd., London, England; Waring-White Building Co., Ltd., London, and the Canadian White Co., Ltd., Montreal.

"DISTRICT STEAM HEATING" is the subject of a recent attractive publication of the American District Steam Co., 101 Elm St., Lockport, N. Y., manufacturer of the improved Holly system of direct and exhaust district steam heating for cities and villages, through underground mains. The publication is an exhaustive treatise on steam heating as a business enterprise and is illustrated throughout with a number of half-tones of heaters and fittings, curve sheets and meters, as well as a number of diagrams of recent installations made by this company. The success of the system and district steam heating is attested by the number of plants now in operation, 250 of which this company has installed.

Columbus, Ohio.

The Columbus Railway & Light Co. is distributing a very attractive pamphlet describing and illustrating this thriving western city, the center of 18 steam and 8 electric railways. The publication describes the early history of the city, its rapid growth and development, the manufacturing interests located there, the banks, libraries and other public buildings. In speaking of the electric railway development there and its effect on the city's development, it says:

"That 'Greater Columbus' is largely indebted to the stimulus the advent of these interurban traction systems has exercised, will be accepted without argument. Its geographical limits, as a municipality of four miles from center to circumference, have, under their ægis, become expanded, for purposes of close business and social intercourse, to a distance of 70 miles or more; and no one instrument today is acting so potently in stimulating the continued commercial growth of the city. The steam railroads have served, and will continue to serve, their useful purpose in upbuilding; but that most wonderful and facile agent of modern civilization, electricity, may be expected to advance and perfect transportation and intercommunication along channels never before conceived, or even dreamed of. Let it be borne in mind that transportation is the vehicle upon which every nation, state and city depends for its commerce. That the free flow of traffic is the life of the city; and that by virtue of her location 'Greater Columbus' must continue to remain in the very forefront of this wonderful development."

The pamphlet is certainly an attractive one and is a publication of no little merit. The Columbus Railway & Light Co. is to be congratulated upon this publication.

From the West, East.

The New York Central Lines offer a fast express service between the west and the east that, for speed and luxury is unsurpassed. It includes the world's famous 20th Century Limited and Lake Shore Limited, and many other splendidly appointed fast trains.

Travelers who recognize the best in railroading select the New York Central Lines for their trips.

Summer Vacation Tours.

The Michigan Central, "The Niagara Falls Route," to the Thousand Islands, St. Lawrence River, Adirondacks, Lakes George and Champlain, Catskills, Hudson River, White Mountains, Forests and Lakes of Maine, New England Sea Coast, Michigan Resorts, etc. For copy of illustrated booklet describing the above resorts address O. W. Ruggles, G. P. & F. A., Michigan Central R. R., Chicago, Ill.

The Illinois Valley Railway Co. is now building the extension from Ladd to Princeton, a distance of 16 miles, and has placed the orders for material for its 6-mile line from Marseilles to Seneca. The surveyors have begun on the permanent location of this latter line.

STREET RAILWAY REVIEW

Vol. XV — SEPTEMBER 15, 1905 — No. 9

The Philadelphia Subway and Elevated Railroad.

Description of the New Market St. Trunk Line of the Philadelphia Rapid Transit Co.—Engineering Features of the Subway and Elevated Divisions—New Bridge Over the Schuylkill River.

An ordinance for the construction of the Market Street Elevated Passenger Ry. was approved by the city of Philadelphia, Apr. [illegible], 1902. By this ordinance the city granted permission to the applying company, of which the Philadelphia Rapid Transit Co. is now lessee, for the construction of an elevated railway structure along the Delaware River front north and south of Market St., a subway of two tracks from the Delaware River to the city hall, a single

NEW SCHUYLKILL RIVER BRIDGE OF PHILADELPHIA RAPID TRANSIT CO. PORTAL OF MARKET STREET SUBWAY AT LEFT

track subway loop about the business district east of the city hall, a four-track subway from the city hall west to the Schuylkill River and a double-track elevated structure from the river west to the city limits of Philadelphia at 63rd St.

Some of the conditions imposed upon the railway company were that conduit spaces should be furnished along the structure for city wires, sound caused by moving trains should be deadened according to the latest known engineering practice, provision should be made for catching all drips and falling substances from the elevated structure and that the railway company bear the expense of adjusting the location of all sewers, pipes, conduits and underground structures which at that time occupied [illegible] subway structure.

The reproduction of the map of the [illegible] Philadelphia between the Schuylkill and Delaware rivers has indicated upon it the route of the subway and of the elevated portion of the line extending along the Delaware River. The four-track portion of the subway is now built from the Schuylkill River east as far as the city hall. The bridge across the Schuylkill River is ready for the tracks and work upon the elevated structure from the river west towards 63rd St. is well under way.

One of the earliest problems in the preliminary engineering work for the construction of the subway and elevated structures was the plotting of the location of the existing underground structures so that plans could be made for the relocation of all underground sewers, pipes and conduits. It was possible for the engineering department to obtain the location of a large portion of these from the records of the Board of Highway Supervisors of the city of Philadelphia. For a number of years this board has been collecting all

and the information as to the location of gas mains, water mains, sewers, electric conduits and other underground structures. These data the board has compiled and had plotted. As new structures are placed in the streets information is gathered from time to time so that gradually the records are becoming more and more complete. In a number of cases the company made excavations for the purpose of locating pipes, etc., which were particularly close to structures that the company contemplated building. Test holes were dug along the proposed location so that data would be vailable as to the nature of the soil and material to be excavated for the subway and for the piers of the elevated structure.

Subway Division.

For convenience the entire subway and elevated work which it is proposed to first build is divided into 11 sections. Section No. 1 comprises the bridge across the Schuylkill River carrying the two surface car tracks and the two inclined tracks for the joining of the grades of the subway and elevated portions; Section No. 2 comprises the double-track elevated structure from the west end of the bridge along the center of Market St. to the terminal embankment about 700 ft. west of 63rd St.; Section No. 3, the 4-track subway from the west house line of 15th St. to the west house line of 22nd St.; Section No. 4, the 4-track subway and incline from the west house line of 22nd to and including the west abutment of the Schuylkill River bridge; Section No. 5, comprises the loops at the City Hall Sq. and extending to Arch St. on the north, 13th St. on the east, Walnut St. on the south and joining with Section 3 at the west house line of 15th St.; Section No. 6, the double-track subway from the west house line of 13th St. to the east portal at Front and Third Sts.; Section No. 7, the incline from the east portal to the beginning of the elevated structure at Arch St. and Delaware Ave.; Section No. 8, the single-track subway on Walnut St. between Broad and Fifth Sts.; Section No. 9, the single-track subway on Fifth St. from Walnut to Arch St.; Section No. 10, the single-track subway on Arch St. from Broad St. to Fifth St.; Section No. 11, the double-track elevated structure along the Delaware River front from Arch and Water Sts. to South St. and Delaware Ave.

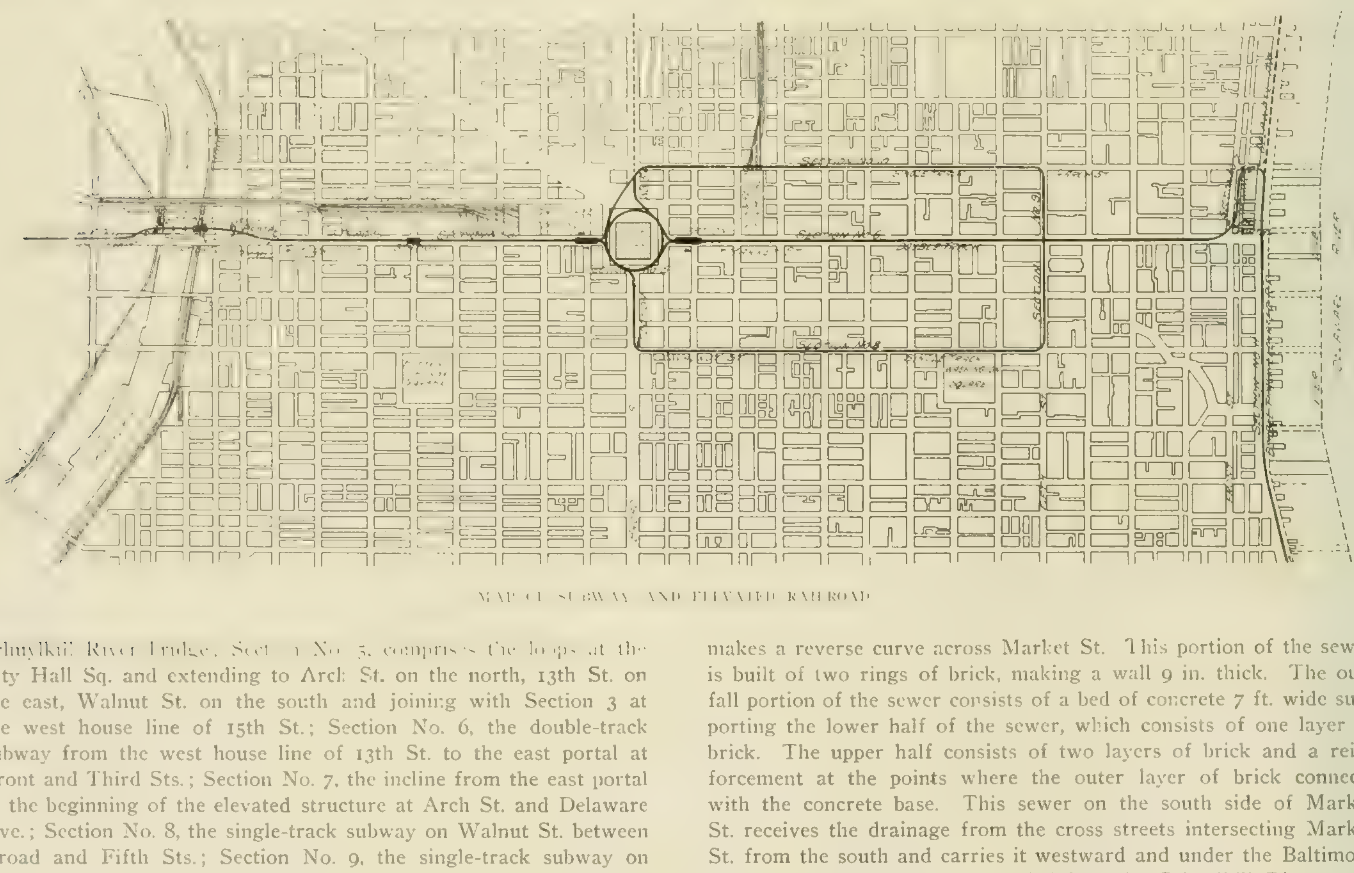
The contract for the construction of the four-track portion of the subway from the Schuylkill River bridge east to the city hall was let to the E. E. Smith Contracting Co., Apr. 1, 1903, at which time active work was begun. This contract included the reconstruction of the sewage system on Market St. between 15th and 22nd Sts and the building of the outfall sewer from 22nd St. to the Schuylkill River.

Most of the old sewers on Market St. drained north by way of the intersecting streets to a trunk sewer and outfall on Arch St. As the building of the subway would intercept the sewers on the north and south streets and thus shut off the outlets to the original sewers along Market St., which sewers fell within the subway location, it was thought best to build two separate sewers, one on either side of the subway, and provide a new outfall for the sewer on the south side of the street. To care for the inlet connections along the north side of the street, egg-shaped sewers were built along Market St. from 15th St. to 22nd St., thence north on 16th, 18th, 19th and 22nd Sts. to the Arch St. sewer. This sewer, which was built as the subway excavation proceeded, is of concrete steel construction with a brick invert. The inside cross-sectional area is egg-shaped and is 1 ft. 6 in. wide and 2 ft. 3 in. high. The concrete structure of the sewer is reinforced by 12 longitudinal formed rods ⅜ in. in diameter. These are spaced at equal intervals about the perimeter of the sewer and are approximately 2 in. from the surface. The transverse rods are spaced 3 ft. center to center. The transverse rods in the upper portion of the sewer are ⅜ in. in diameter and those in the lower portion ½ in. in diameter. The sewer has a flat base 3 ft. 10 in. broad and is 4 ft. ½ in. high, over all. This sewer was built of comparatively strong reinforced construction because of the probable settling of some portion of the street where large pipes had been relocated or where the sewer was in the back fill close to the subway wall.

The new sewer built along the south side of Market St. to replace the old sewer has a circular opening 3 ft. 6 in. in diameter at the eastern end and 4 ft. 9 in. in diameter near the outfall. East of 23rd St. this sewer is of reinforced concrete construction with a brick invert. At a point about 275 ft. west of 23rd St. this sewer makes a reverse curve across Market St. This portion of the sewer is built of two rings of brick, making a wall 9 in. thick. The outfall portion of the sewer consists of a bed of concrete 7 ft. wide supporting the lower half of the sewer, which consists of one layer of brick. The upper half consists of two layers of brick and a reinforcement at the points where the outer layer of brick connects with the concrete base. This sewer on the south side of Market St. receives the drainage from the cross streets intersecting Market St. from the south and carries it westward and under the Baltimore & Ohio R. R. track to the outfall into the Schuylkill River. An illustration is presented showing the sewer in process of construction at a point where it is offset from the line of the subway wall to pass a duct chamber.

The work comprised in the contract for sections 3 and 4 also included the widening of Market St. on the north side west of 22nd St., raising the grade of Market St. about 12 ft. at its intersection with 23rd St., repaving the driveways and sidewalk and also raising the grades and repaving the adjacent streets to meet the revised grade of Market St. as authorized by ordinances of the city councils approved Dec. 24, 1902.

The raising of the grade of Market St. was necessary to allow the tracks from the subway to make ascent to the bridge over the Schuylkill River and permit of sufficient clearance to pass over the tracks of the Baltimore & Ohio R. R., which parallels the east side of the river, without exceeding the established maximum for subway tracks, which is 5 per cent. With the street in its new position and



MAP OF SUBWAY AND ELEVATED RAILROAD

the subway as constructed the revision of grade has obviated a steep ascent to the east side of the city bridge over the river and 12 ft. of clearance beneficial to the subway grade has been secured.

The center line of the subway coincides with the center line of Market St. to a point 17 ft. west of 22nd St., where it deflects to the north on a reversed transition curve of 1,000 ft. center radius to meet the bridge over the Schuylkill River. The company's bridge is parallel with and 100 ft. north of the city bridge on Market St.

The western end of the covered subway terminates at a portal about 130 ft. west of 23rd St. From the portal the tracks ascend to the bridge between retaining walls of concrete.

The subway between the city hall and the Schuylkill River is built for four tracks, the two outer tracks to receive the surface trolley cars from West Philadelphia and the two inner tracks to receive the trains from the elevated structure extending west on Market St. from the Schuylkill River to a terminal outside of the city limits and in Delaware Co. near the West Chester pike. The connection between the subway and the elevated structure is made over a four-track four-span steel bridge across the Schuylkill.

The outer tracks of the subway for the use of the surface cars will connect with a loop around the business district via Walnut, Fifth and Arch Sts. so that the local cars eastbound in the subway will run on the south outside track and after encircling the loop return to the west by the north outside track.

The two inner tracks for the elevated trains will continue on east from the city hall as a double-track subway under Market St. The subway will extend eastward to a point between Water and Front Sts., where by an incline between the two latter streets the subway will terminate at a portal near Arch St. From the portal the track will pass onto an elevated structure leading to Delaware Ave. and extending southward along the Delaware river front to South St.

The four track portion of the subway has a width of 48 ft. 6 in. in the clear between the walls and is 14 ft. 6 in. high between the base of the rails and the lower side of the roof beams. Three intermediate lines of columns support the roof, which is designed to carry the heaviest street traffic liable in any municipality. The roof [illegible] are 20 in. deep and support the concrete jack arches, which have a rise of 8½ in. at the walls and 12½ in. at the center of the subway, giving a slope of 1 in. in 6 ft. for drainage.

The concrete floor structure is brought up between the lines of [illegible] roof supporting columns. The elevation of the top of these foundations or benches is that of the base of the track rail. The roof supporting [illegible] ⅜ in. angles riveted to a ¼ x 6 in. plate. At the tops of the columns where they join the roof beams additional plates to form the proper connection are riveted on and at the bases the columns are similarly reinforced. After a column is set in place the mass of concrete in the foundation is brought up above the bearing plate of the column so that with the dowels it is securely anchored. Plans for the placing of the columns included reinforced concrete bulkheads enclosing each alternate pair of columns to a height of 4 ft. 5½ in. above the base of the rail. This design was modified after the construction began and a system of reinforced concrete struts connecting the columns about ten feet above the bases was substituted. The drawing of a cross-section through tangent 4-track construction illustrates the general design of the subway walls and roof from 23rd St. to the river. At this location the tracks and subway structure are built on a reverse curve. The design for the straight track structure differs only in the thickness of the side wall, which in tangent 4-track construction is 3 ft. 5½ in. thick and in the special curved portions is 4 ft. 5½ in. thick.

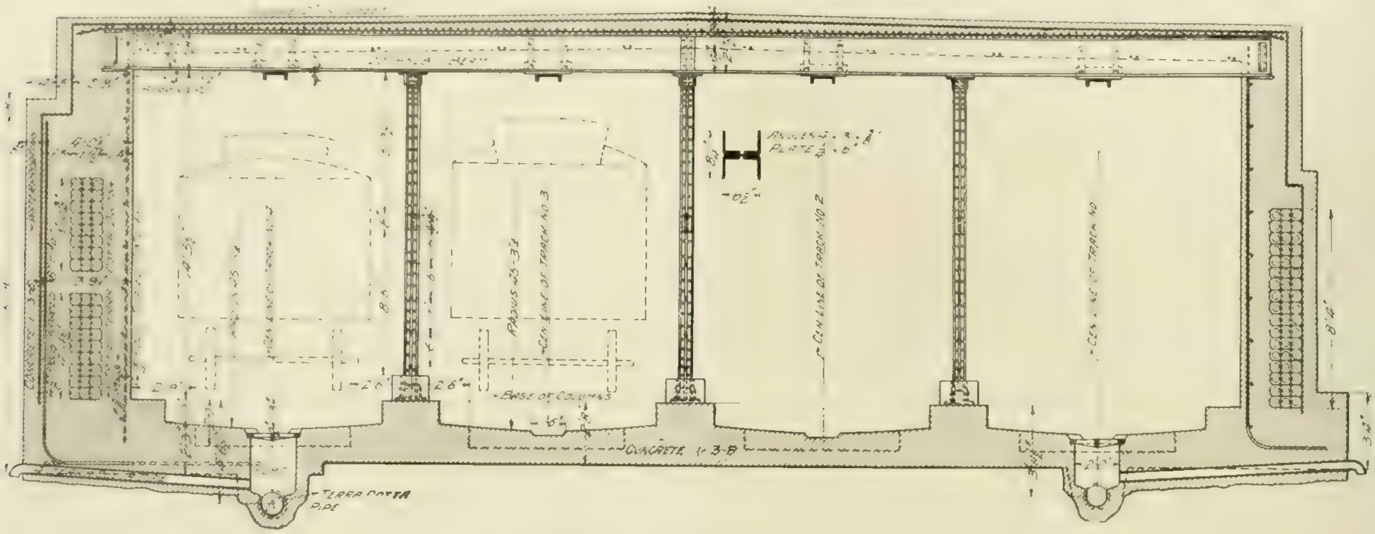
The roof over the entire subway is waterproofed with asphalt mastic. This waterproofing material is put on in two layers each 1½ in. thick and has a protecting covering of 3 in. of concrete. The average depth of back fill supported by the roof of the subway is 6 ft. The material used in back filling was taken from the subway excavation. In order to prevent any settlement of the street above the back fill is packed by means of flushing and hand tamping.

In constructing the subway one side of Market St. and the double

SUBWAY, LOOKING EAST FROM 22ND ST., JAN. 22, 1905.

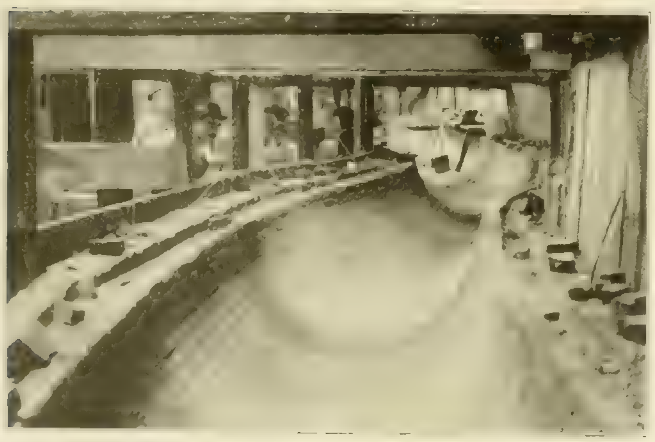
[illegible] line are kept clear at all times. As the work proceeds a trench is dug of sufficient width to accommodate the south wall of the subway, the sewer built just outside the wall and the south row of roof supporting columns. The dirt along the two sides of this trench is held in position by pine sheeting 2 in. thick and 12 ft. long. One first course of sheeting is driven down to its full length, then a second course of similar sheeting just inside the first course is driven down to the level of the subway floor as the roof arches are set. The concrete is mixed on the street level above and distributed by means of chutes extending through openings in the street surface to the forms below. The mixture used in the roof construction has the proportions of 100 lb. of cement to 3 cu. ft. of gravel or sand and 6 cu. ft. of broken stone.

As the excavation to the sub-level of the floor proceeds, the concrete structure of the floor follows. The mixture for the floor is of the proportions 1-3-6, the same as is used in the roof, except that



CROSS SECTION OF FOUR TRACK SUBWAY

the excavation proceeds. The sewer and subway construction are advanced at the same rate, using a short flume to turn the flow from the old sewer to the new as the bore advances. Following the construction of the south portion of the tunnel and at a distance of about three blocks in its rear is the excavation for the north portion and the construction of the north wall. As the two outer sections proceed and the walls and roof supporting columns between the lines of the track are erected the middle core is removed. Over the location of this middle portion of the subway are the two tracks of the Market St. surface line, which it is necessary to keep in operation at all times. In advance of the center core excavation, longitudinal timbers are placed under the ends of the ties so that they carry the weight of the track sub-structure over the middle core.



SECTION OF [illegible] CONCRETE SEWER, LINED WITH BRICK, SHOWING [illegible] AROUND DUCT CHAMBER

As the dirt is removed these timbers are kept blocked up under the tracks until there is room to insert posts and braces. These temporary posts supporting the tracks and street above stand on the floor of the excavation and remain in place until the center row of columns and the roof I-beams which they support are set. The long posts are then removed and the track supported by cribbing resting on top of the subway roof beams. Next the forms for

much of the sand and gravel for the floor mixture is obtained by screening the material excavated from the subway bore. This screened gravel is mixed half and half with broken stone grit before being put in the concrete for the column bases. The subway floor under the center of the tracks has an average depth of 11 in., upon which additional concrete will be placed in the track formation and due to the presence of a sub-drainage system no waterproofing is used in the floor.

In one of the illustrations which shows the cross-section of the subway may be seen the arrangement for draining the four tracks. Along the center of the two outer tracks and 50 ft. apart are built sumps with iron gratings covering the openings. Parallel with the track and two feet below it extends a 12-in. terra-cotta drain pipe for collecting the water from these sumps. Under the two middle tracks the sumps are located 500 ft. apart and are connected to opposite sumps under the outer tracks by 4-in. terra cotta pipe buried in the floor structure. Draining into each of the sumps along the outer tracks is a 4-in. terra-cotta pipe built in the floor structure and extending to an elbow outside of the subway wall. The mouths of these elbows are turned downward and protected by beds of broken stone. The purpose of these pipes is to drain any water from the soil and keep the tunnel dry.

In that portion of the subway now constructed from the city hall west to the portal at the Schuylkill all the drainage from this system of sumps is led to a collecting chamber at 22nd St. Directly over this chamber which forms an offset in the north subway wall is the pump house containing the machinery for removing the drainage water. Mounted on the floor of this pump house are two vertical motors which are direct connected to centrifugal pumps sunk in the suction chamber below. The motors of these pumps are controlled by floats in the suction chamber. The drainage water is lifted through a 6-in. discharge pipe to the city sewer system under the street above.

As the floor system was completed along the outer tracks the side wall was carried up to the level of the lower row of the ducts which form a part of the side walls. In the south wall there are 57 ducts for the railway company's cables and 21 for the Keystone Telephone Co's. cables. No ducts are in the north wall. After the base of the wall has been formed in place, the triple-duct vitrified pipes are set up in their proper positions and cemented together with a mixture of one part cement to two parts of sand. The individual rows of ducts are separated by ¼-in. layers of this mixture. The side of the ducts away from the subway is plastered with a layer of

this cement mixture upon which is applied the waterproofing. The waterproofing of the side walls consists of a first coat of "Cerion" waterproofing followed by one layer of burlap, then a second coat of "Cerion" followed by a layer of burlap, then a third coat of "Cerion," making in all three coats of the waterproofing material and two layers of burlap. This waterproofing is carried up the outside of the line of ducts to connect with the asphalt in the waterproofing in the roof of the subway. The tiers of ducts in the south

CONSTRUCTION OF CONCRETE ROOF AT 23RD ST.

wall form the core of the structure from the elevation of the base of the track rail to a height of about one foot below the roof supporting girders. This waterproofing compound called "Cerion" is a by-product obtained from the residuum in the process of refining petroleum. Outside of the waterproof covering for the cable ducts is a layer of concrete of the 1-3-6 mixture, 8 in. thick. The side walls are reinforced by horizontal ⅝-in. rods spaced 18 in. center to center, intersecting vertical rods 1 in. in diameter spaced 12 in. center to center.

Those portions of the north wall which are 3 ft. thick and carry no cable conduits have no waterproof covering. The underdrains will relieve the wall of the subway of any continued pressure from water in the sub-soil and it is therefore expected that the concrete wall 3 ft. thick will not be affected by water from the outside.

The duct chambers for the Keystone Telephone Co's. cables and the electric railway feeder cables are built side by side, but are not connected. The duct chambers for the electric railway cables are built as offsets or bays in the subway wall. The opening in the wall of the front of the duct chambers is 8 ft. 6 in. high by 11 ft. 6 in. wide. Two 15-in. I-beams set side by side and 9 in. center to center carry the upper portion of the subway wall over this 11 ft. 6 in. span. The ends of these beams extend 12 in. into the wall and the concrete mass of the wall above is built from the bottom of these I-beams upward to thoroughly anchor them and protect as much surface as possible from rust. The rear wall of the duct chamber is built as a segment of a cylinder with a radius of 8 ft. 3 in. for its inner face which interesects the subway wall on the line of the outer face. This arched wall is of hard-burned brick and is made up of a section 13 in. thick, then a layer of the standard subway wall waterproofing which is protected by an outer layer of brick 4½ in. thick. The floor of the duct chamber is on a level with and is accessible from the subway floor. This duct chamber floor has a slight slope so that it drains to the sump system extending along under the subway tracks. Entrance to the duct chamber may be had through 36-in manhole cover in the street above. This cover is supported on concrete walls resting on the subway wall and the brick wall of the duct chamber.

Each duct chamber is furnished with a pipe ladder, the lower end [illegible] side of the chamber. This rod is held in a vertical position by anchors of strap iron sunk in the subway wall close to the duct openings. The channel iron, just mentioned, supports a set of rollers mounted on a shaft parallel with and just below it. When it is desired to draw a cable through one of the ducts the rope is drawn through the duct from some other manhole or duct chamber along the subway wall and brought across the subway chamber and through a snatch block hooked at a suitable height on this vetrical pulling rod. From the snatch block so placed the rope can pass over the roller above and out through the manhole to the winch or system of blocks and tackle used for pulling.

The cables entering from any duct are carried around the curved portion of the duct chamber wall on adjustable malleable iron cable brackets supported on pressed steel racks. This arrangement allows the necessary amount of slack at the duct chambers for making splices for taps to the cables and yet permits their being placed on the racks permanently and with but slight bends from the original line as they diverge from the ducts to the arched wall to the chamber.

The duct chamber for the Keystone Telephone Co's. cables has a concrete bottom with brick walls similar to that of the electric railway duct chambers. The two chambers adjoin but are separated by a 12-in. wall of brick which is not pierced except by a 2-in. wrought iron pipe which leads the drainage from the bottom of the telephone duct chamber through the intervening wall and down to the floor of the Philadelphia Rapid Transit Co's. duct chamber. The floor of the telephone cable duct chamber is on the level with the top of the I-beams mentioned as supporting the wall over the opening from the subway to the first mentioned duct chamber.

The 21 telephone cable ducts terminate in their chamber in the same manner as the ducts for the power cables in the other chamber. The manhole covers used for the street openings to the two chambers are similar except for the lettering cast in the covers. Each manhole has two sets of covers, the lower one being designed to be waterproof and being provided with a 2-in. galvanized iron drain pipe which leads any water that may collect to the sump sys-

tes under the subway tracks. The pairs of duct chambers as just d[illegible] built about 200 ft. apart along the south wall of the subway.

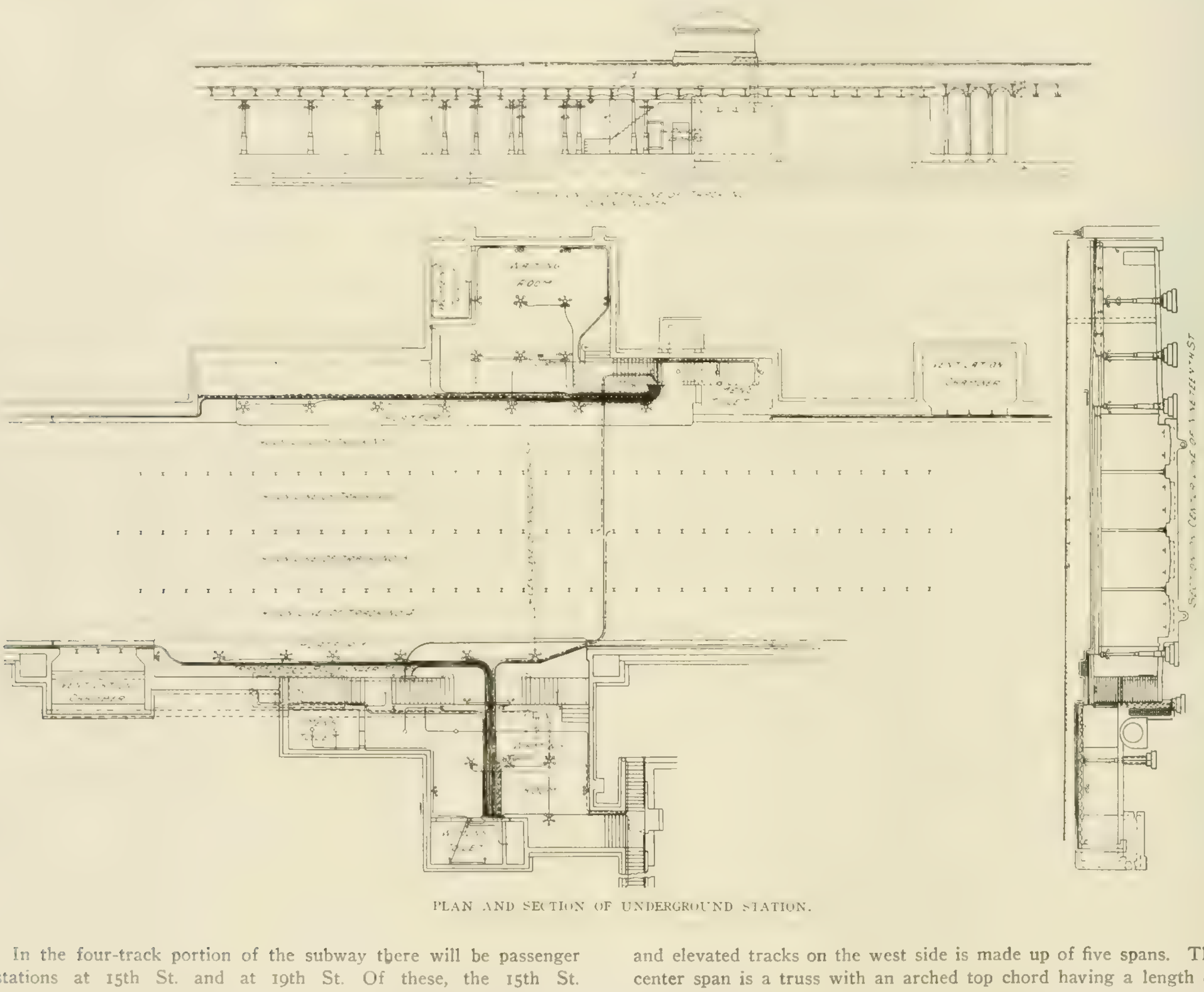
Provision has been made for ventilation of the subway by building chambers along the sides with connections to the outer atmosphere. These chambers are so designed that fans may be installed to increase the circulation if found necessary. At 15th St. there are two chambers in the north wall with an air duct connecting to a vent about 15 ft. high built against the face of the wall of the Pennsylvania R. R. train shed. There are two similar vents between 16th and 17th Sts. At either end of the 19th St. station there are simple vent chambers built as offsets in the north subway wall. These chambers are carried up to the sidewalk level and covered by iron gratings. At 22nd St. there is a ventilation chamber in the north wall with an air duct of reinforced concrete extending horizontally under the sidewalk to connect with the concrete foundations of an ornamental masonry stack 60 ft. high. This stack stands just inside the street line on city property leased to United Gas Improvement Co.; 400 ft. west of this stack is the portal of the subway.

along the tracks half way to the adjacent stations. A unique type of switch for the control of the main feed current for the lighting will be mounted on this panel. This switch is of the double-throw 6-pole type. With the switch in the upper position the lights in the station and along the subway will be fed from the secondary of a transformer located in a fireproof compartment under the station stairs. With the switch in its lower position the same lights and circuits will be fed from the direct current feeder cables.

The track in the subway will be laid with 90-lb. A. S. C. E. section rails. Current for the operation of the surface cars will be distributed by a No. 0000 grooved trolley wire flexibly suspended from wrought iron hangers which have been built into the concrete of the roof structure. The express tracks will be provided with a protected third-rail similar to that which is yet to be decided upon for use on the elevated structure.

Schuylkill River Bridge.

The 4-track bridge across the Schuylkill River connecting the incline from the subway on the east side of the river with the surface



PLAN AND SECTION OF UNDERGROUND STATION.

In the four-track portion of the subway there will be passenger stations at 15th St. and at 19th St. Of these, the 15th St. station will be the only one used by the express trains from the elevated structure. One of the illustrations shows the plan of the 19th St. station, together with a view of the platform and a cross-section of the subway at this point. At either end of the platforms of the 19th St. station provision has been made in the subway structure for the omission of enough of the roof supporting columns to permit of the laying of crossovers between the express and local tracks.

The stations and platforms, as well as the subway, will be lighted from circuits which may be fed from the direct current power feeders or from transformers taking current from the alternating current high-tension cables. At each station will be placed a panel board with the control switches for the station lights and those

and elevated tracks on the west side is made up of five spans. The center span is a truss with an arched top chord having a length of 212 ft. The spans adjacent to this one are each Pratt trusses, the one on the west being 87 ft. 8 in. long, and the one on the east being 95 ft. long. The spans at the east and west ends of the bridge are of plate girder construction, the west one being 79 ft. long and the east one 75 ft. long.

The piers of this bridge are built upon solid rock below the bed of the stream. The west shore pier was built with two pneumatic caissons, one under each of the pairs of trusses. On the caissons is a continuous pier of rock-faced coursed ashlar masonry with a concrete filling. An arched reinforced concrete bulkhead joins the concrete in the two caissons and supports the middle portion of the pier. On top of the wall connecting the two caissons are built two small piers with arched openings through their centers. Each of

these piers is of rock faced coursed ashlar masonry, with a filling of concrete and a coping of tooled granite. The entire height of this pier from bed rock to the bearing plates of the spans is about 64 ft. The two river piers supporting the ends of the long span and the two adjacent short spans are built of concrete below low water level. This concrete supports a rocked faced coursed ashlar masonry pier with a concrete filling. The river piers are built solid and have granite copings and seats for the bearing plates. The east shore pier is of construction similar to the two river piers. The east abutment supporting the end of the plate girder span over the Baltimore & Ohio tracks is built of concrete.

At the intersection of the south retaining wall along the subway incline with this abutment, provision has been made for concrete passageways leading from the local station platforms, which are on the east span, either to the street or to a covered passageway connecting this station with the platforms of the nearby Baltimore & Ohio R. R. station. The west abutment which supports the end of the plate girder span over the Pennsylvania R. R. tracks and also furnishes a footing for the columns supporting the upper spans, is of masonry construction resting upon a pile footing.

At the east end of the reverse curve by which the line of the subway is offset 100 ft. north to the line of the bridge the incline begins. The portion of the incline in the subway has a grade of 4.9 per cent for the local tracks and 4.76 per cent for the express tracks. At the face of the portal the grades break and the local tracks have a grade of 5.86 per cent to the east abutment and the express tracks a grade of 5 per cent to the same point. The reverse curve ends in the latter section 38 ft. east of the east abutment of the river bridge. The east approach span, which is of plate girder construction and supports the platforms of a local passenger station, has the same grade as the tracks which it carries. All four tracks have a grade of 4.63 per cent on this span, but the express tracks are 2 ft. 5 in. lower than the local tracks. At the east shore pier the grade of the express tracks changes to 4.323 per cent, which grade is maintained by these tracks across the east Pratt truss, the center span, the west Pratt truss and the deck girders forming the west approach from the elevated structure. The local tracks on the east Pratt truss are on a slight grade until the center span is reached, over which they are carried on a level grade. At the west end of the center span the profile breaks to a descending grade of 2.24 per cent along the west Pratt truss. At the west shore pier the grade again changes to a .66 per cent grade across the plate girder approach to the west abutment, where the tracks pass onto the street surface.

The drawing of the elevation and five cross-sections of this bridge shows the arrangement of the local and express tracks in the different spans. The east Pratt truss is a through truss with the track supported on stringers in the usual manner. The center span is also a through truss, but because of the elevated position of the express tracks the portal at the west end of the bridge was placed at the second panel. Over the west river piers the stringers of the express tracks are supported by a fixed bent. The high position of the express tracks on the west Pratt truss with the local tracks in the lower floor system makes this a double-decked truss. The lower west approach span, carrying the local tracks, is a through span. The upper west approach span is of deck construction with the ends of the girder supported [illegible] a tower at the west end [illegible] ture. The design [illegible] intricate because the tracks are on a reverse curve with the point of tangency about over the west shore pier.

Along the north side of the bridge, from shore to shore, is a sidewalk 6 ft. wide. [illegible] wall of the subway structure is continued across this bridge. The cables brought along the subway pass into a duct chamber in the east abutment, then [illegible] to a second duct chamber at the east shore pier. The construction of these ducts is similar to that in the subway except that they are supported in a special steel box. In the duct chamber on the east shore pier a reverse bend is made [illegible] into a straight line of ducts extending under the east-bound local track on the east Pratt truss and the long center span. At the west end of the center span a steel duct chamber or house is built and the line of ducts again offset so that they are under the eastbound express track on the west Pratt truss and approach. A standard manhole built against the west abutment of the bridge accommodates the transferring of the cables from the bridge ducts to the underground ducts in West Philadelphia. This bridge was built and erected by the American Bridge Co.

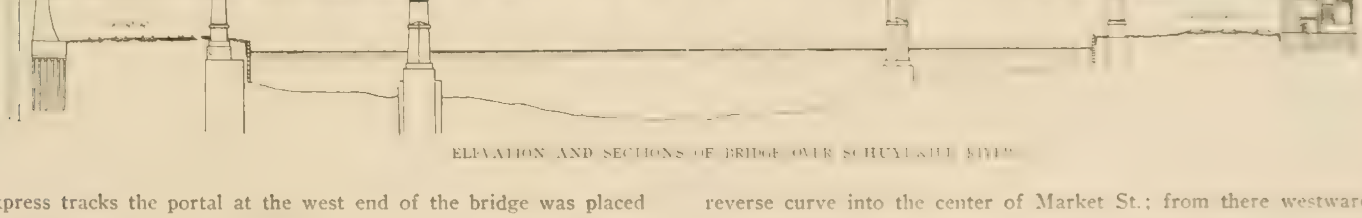
Elevated Structure.

At the west end of the Schuylkill River bridge the express tracks reverse to the south and center on Market [illegible] point 690 ft. west of 63rd St., where by an easy curve they reach the private right of way of the company and pass on to the new terminal station being built near 68th St. Throughout the length of Market St. in west Philadelphia the tracks are carried on an elevated structure of the lattice girder type with ballasted floor construction. At 63rd St., which is the western limit of the city of Philadelphia, the design changes to that of an open floor from this point to the abutment where the tracks pass onto the embankment on the private right of way. The entire length of the structure from the west end of the river bridge to the abutment where the tracks leave Market St. and pass onto the terminal property is 19,375 ft. The length of the portion built on the private right of way is 2,300 ft.

In designing all the structures for the Market Street Elevated Passenger Railway Co., a car was assumed 32 ft. 6 in. between truck centers and a wheel base of 5 ft. 6 in., each axle to carry 25,000 lb.

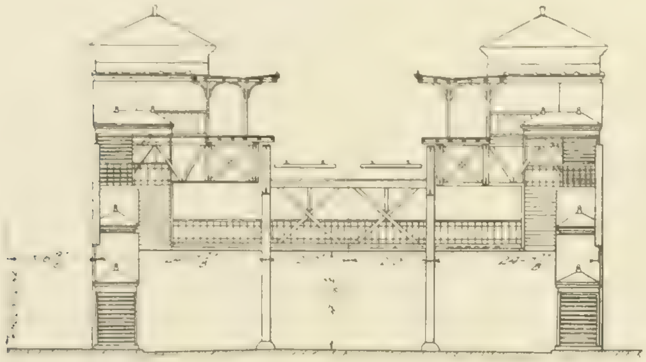
The elevated structure will support a double-track railway on a solid steel floor from the Schuylkill River bridge to 63rd St. From there westward 690 ft. to the abutment of the surface structure the tracks will be supported upon cross ties laid upon longitudinal stringers. Beginning at the west end of the bridge, the longitudinal girders will be of plate construction for a distance of 325 ft. on the reverse curve into the center of Market St.; from there westward the longitudinal girders will be of lattice construction. The standard longitudinal lattice girders are 50 ft. long. The width of the structure is 24 ft. from center to center of columns. The under clearance between head of the surface track rails and the lower side of the transverse girders has a minimum limit of 14 ft.

The foundations for the columns, a typical one of which is illus-



ELEVATION AND SECTIONS OF BRIDGE OVER SCHUYLKILL RIVER

trated, are of concrete with four anchor bolts to each column. These bolts are buried to a depth of 4 ft. 6 in. in the concrete mass of the piers. In many cases, gas and waterpipes are so close to the street surface that it was necessary to provide grillages with beams owing to insufficient depth for reinforced concrete construction to

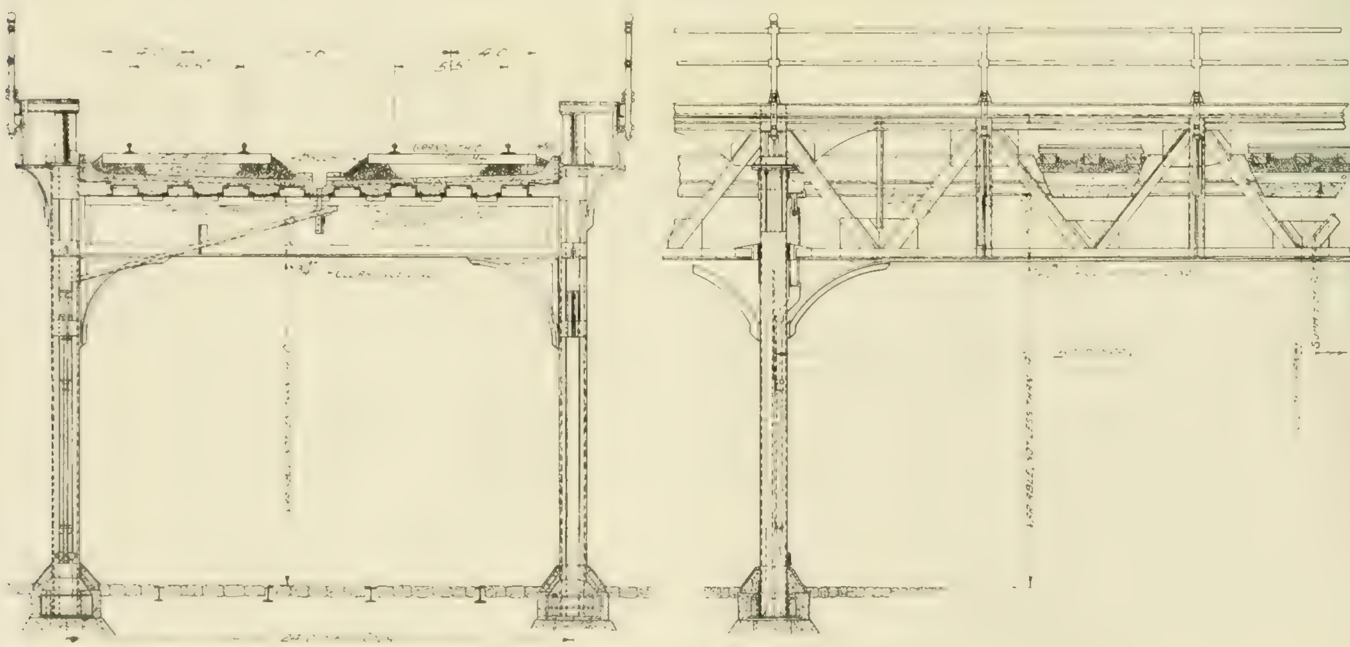


SECTION OF ELEVATED STATION.

carry the columns. All steel work in grillages of this kind is encased in concrete, the concrete being locked to the sides of the vertical surfaces to maintain permanent contact and prevent corrosion. On filled or soft ground special designs for foundations were necessary and spread footings of reinforced concrete were built to make the unit pressure low. When the bases of the columns are permanently set over the anchor bolts, a cast iron fender placed around the base of each column is filled with concrete. The upper portion of this fender is open to permit of the proper tamping of the concrete, and when the interior is filled the upper surface is troweled to a smooth finish.

The columns are I-shape and are made up of two 15-in. channels, to the axial line of which is fastened a 14 x 3/8-in. web, the connection between the parts being made by four 4 x 3½ x 3/8-in. angle irons. These columns have base plates 30 in. square and are reinforced at the bottom by two side plates 21½ in. high and the full width of the base plate.

The 50-ft. longtitudinal lattic girders have five panels each. The upper chord of the girders is made up of one web plate 8 in. deep by 5/8 in. thick and four angles 6 x 3½ x ½ in. in size. The lower chord is formed of two 6 x 6 x ½-in. angles and two cover plates 14 x 5/8 in. The vertical and diagonal members are angle sections riveted to 5/8-in. gussets which are in turn riveted to the upper and lower members of the girder.

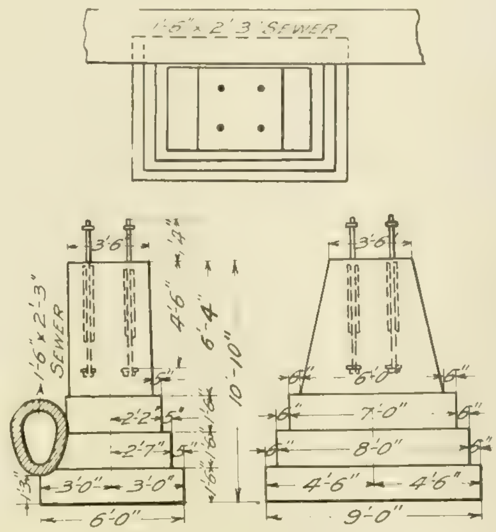


CROSS SECTION AND ELEVATION OF ELEVATED STRUCTURE.

The transverse members, which are spaced 10 ft. apart along the structure, are of plate construction consisting of a 34 x 3/8-in. web, and two upper and two lower angles each 6 x 6 x 5/8 in. in size.

Along each side of the structure a gangway is placed supported on curved brackets opposite the cross floor beams. The gangways are protected by pipe hand rails arranged so that there will be no rattling of the pipes. The use of threads for the pipe joints will be displaced by specially designed joints.

The transverse beams support a trough floor structure made up of Z-bars and plates. A special feature of the steel deck is the curved plate forming the bottom of each trough. Any water settling



COLUMN FOOTING.

through the roadbed above is delivered to the middle of these plates, whence it escapes through holes punched two or three feet apart along the center of the plates. These holes punched in the plate are specially made with a drip point about one-eighth inch in length on the lower side so that alkaline water will not run along the underside of the deck and destroy the paint. At the points where the steel floor joins with the cross floor beams small angles, called drip angles, are riveted onto the lower side of the troughs, so that any leakage which may occur at these junctions will fall off the structure from the drip angles and not run along under the steel work. Expansion joints are provided in the longitudinal steel work of the structure at points from 150 to 200 ft. apart. At expansion joints

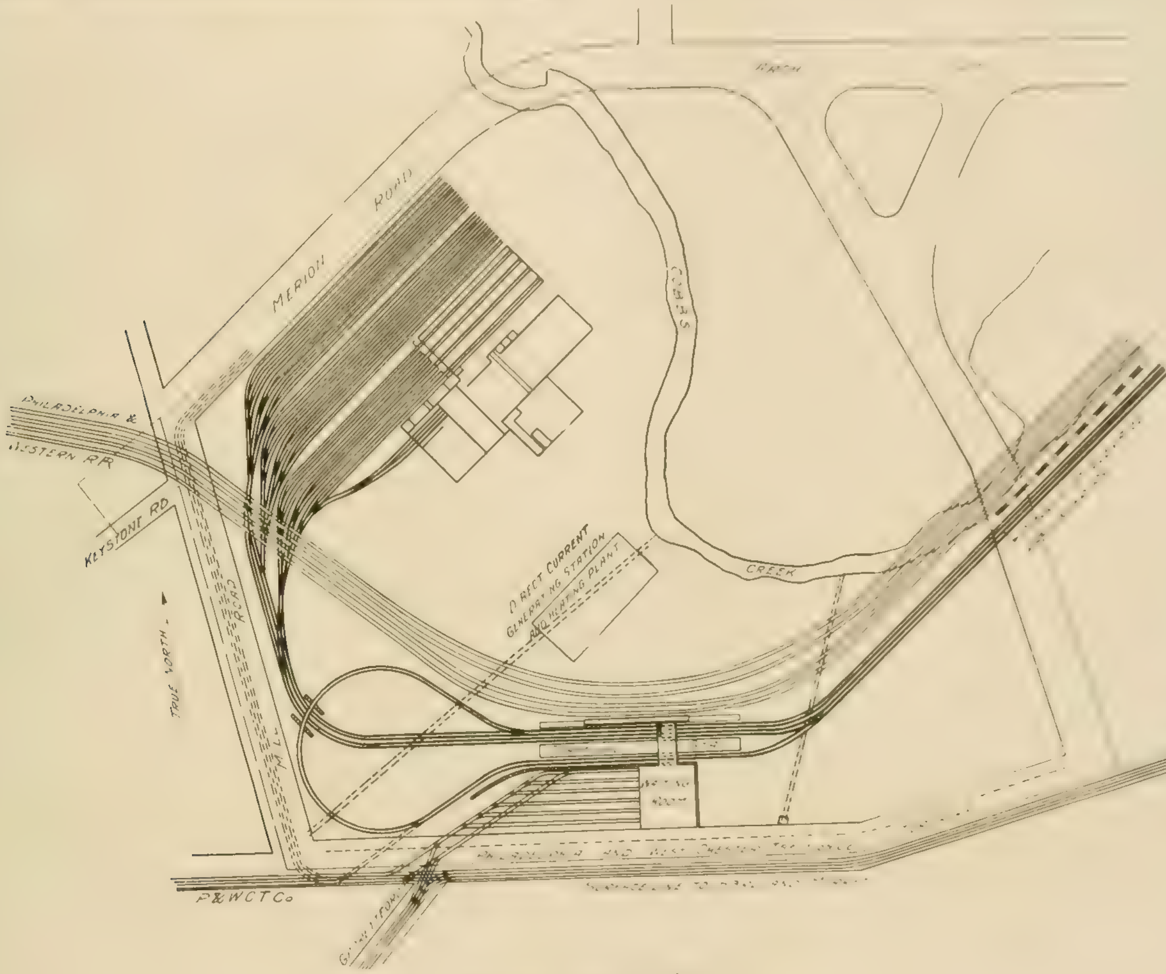
in the structure steel dams support the concrete, the concrete being anchored to the vertical surface.

The steel deck supports a floor of concrete reinforced with steel fabric. The upper surface of this concrete has a granolithic surface and the floor along the structure slopes toward a longitudinal gutter midway between the sides of the structure. This floor has a 3 per cent transverse grade. Steel work on the upper side of the floor system is covered with concrete. Wherever concrete is deposited against vertical or inclined surfaces a special method of locking is used. To such surfaces are fastened stud bolts, upon which wire is wrapped, acting as an anchor between the steel and concrete. In this way it is expected to secure the benefit of the protection of the steel by the concrete and also diminish the liability of its shaking loose and thus allowing water to reach the steel and produce corrosion.

A bed to confine the ballast transversely and thus maintain the alignment of the track is made by the concrete floor and two dam

The track construction [illegible] ballast formation [illegible] not under the ties to prevent [illegible] tamping tools. Where the [illegible] transverse ridges are made in the concrete bed at right angles to the line of the structure to prevent creeping of the track. A. S. C. E. section 90-lb. rails will be used and the third rails, which will be between the two tracks, will be supported by special insulators. The direct current cables for feeding the third rail will be under the structure and taps will be made between the cables and the rails at each expansion joint in the structure. These taps will pass up through the floor plates and be led to a suitable height nearly under the third rail through a special vertical pipe whose base will be buried in the concrete dam alongside the central gutter.

The elevated structure from Schuylkill River west will have eight passenger stations each with a platform on the north and south sides of the railway. These stations will be located at the intersection at



TERMINAL YARDS AT 69TH ST.

At the outside of the structure the concrete is brought up against a facia channel with its top on a level with the tops of the ties. The concrete is anchored to this channel by the steel fabric of the concrete floor, which is fastened to the channel by bolts through the web, these holding the fabric about 2 in. from the metal. The other side of the bed is made by a concrete dam, 8 in. high and 10 in. wide at the base, forming one side of the gutter in the center of the structure.

Frequent holes through the two dams forming the center gutter will allow for the draining of the granolithic surface supporting the ballast. The water thus collected in the center drain is led to cast iron spouts which pass through the center deck plates near transverse girders and dicharge into gutters fastened to the side of the girders and leading to cast iron conductor pipes down the sides of the columns. Where the railway is on a grade of 1 per cent or over the longitudinal gutter between the tracks has the same grade as the floor of the structure, but if the grade is less than 1 per cent the gutter is provided with a fall of not less than 1 in 100 by local inclination between the column bents.

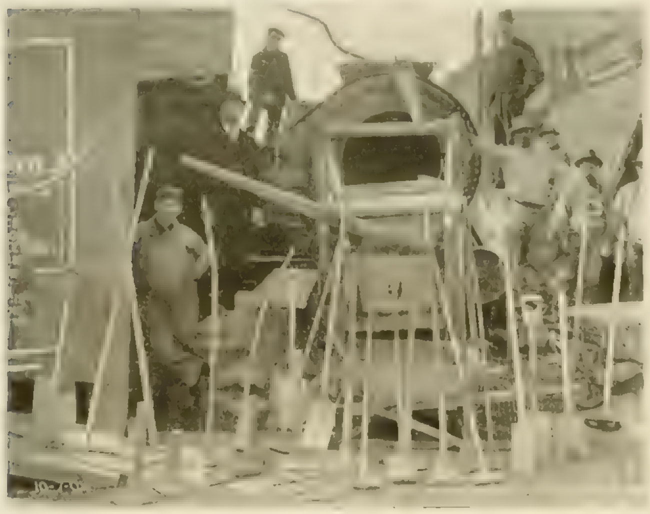
Market St. with the following streets: 32nd St., 36th St., 40th St., 46th St., 52nd St., 56th St., 60th St. and 63rd St. The illustration of the cross-section of one of these stations is typical of all the elevated railway stations except that at 32nd St., where the diverging of diagonal streets requires a special arrangement.

The station platforms are carried on separate girders to avoid vibration, these girders being supported on brackets from the outer side of columns. At stations where the railway is higher than other parts of the line the plate cross floor beams are replaced by lattice girders which serve as transverse bracing to stiffen the structure. Cross passages are provided under the tracks at each station to make connection between the two platforms. In order to gain room above the standard under clearance between the street surface and these platforms, the entire structure at the stations is higher than the adjacent portions of the line. The platforms at the stations will be 10 ft. wide and about 350 ft. long.

The entire structure will have three coats of paint, one put on before erection and two more after all the steel work is in place. The tints of these coats will be different, so as to be readily dis-

tinguishable. All recesses which would retain water or through which water could enter will be filled with cement and covered with a special waterproofing compound.

At Millbourne Mills the elevated structure terminates and the tracks pass onto a private right of way. This right of way follows an easy curve around a hill to the terminal and shop property at 68th and Market Sts. Here will be built a transfer station for the use of the patrons of the Market Street Elevated Passenger



CONCRETE MIXING OUTFIT AND TOOLS

Railway Co., the Philadelphia & West Chester Traction Co. and Philadelphia & Western Railroad Co.

The plan of the terminal property illustrates the track layout at the transfer station and shops. The two tracks of the elevated road pass between the two surface platforms of the terminal station. Just west of the unloading platform of the trains from the city, the westbound track divides and a loop permits the incoming car to return directly to the outgoing platform without the necessity of the motorman changing ends. The two tracks passing between the platforms continue west to Mill Road, then north to the storage yards and shops. These shop tracks pass under the loop track and under the four tracks of the Philadelphia & Western R. R.

The Philadelphia & Western R. R.'s four track line enters the terminal property from the west, crossing over the three ladders leading to the storage and shop tracks and passing the terminal station at an elevation 10 ft. above the tracks of the elevated road. The terminal station platform for the Philadelphia & Western passengers is located directly over the unloading platform of the elevated road.

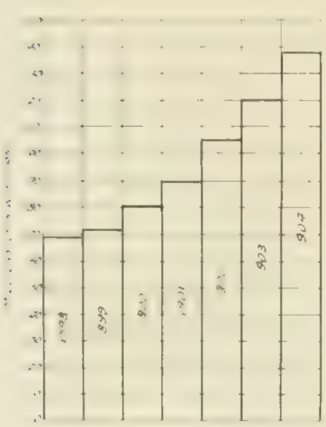
South of the eastbound track of the elevated road is a retaining wall supporting an embankment upon which are the storage and terminal tracks of the Philadephia & West Chester Traction Co.

On this terminal property will be the inspection shop and repair shop for the elevated railway cars. The inspection shop will be a concrete-steel structure 224 ft. long by 86 ft. 3 in. wide with four pit tracks extending the length of the building. Parallel with the inspection shop and 35 ft. from it will be the machine shop and jacking-up shop. The machine shop will be 112 ft. long by 86 ft. wide, and the jacking-up and truck repair shop will be 102 ft. long by 86 ft. wide, with five pit tracks and a small transfer table in the latter mentioned shop. In front of the jacking-up shop will be a large transfer table, and the car washing room and the general repair shop. This building will be 138 ft. wide by 139 ft. long and will also contain the offices and washrooms for employes. East of the truck repair shop and joining it will be a fireproof storeroom 86 ft. x 112 ft. in size. Steam and electric sidings will enter this wing. The space between the two main buildings, which is 35 ft. wide and 224 ft. long, will be served with an electric overhead crane for the handling of material and refuse.

The type of cars to be used on the elevated and subway lines in Philadelphia will be of a late design with enclosed platforms built along general lines of the cars now used by the Boston Elevated Railway Co. and the Metropolitan West Side Elevated Railway Co. in Chicago. Each car will be equipped with two G. E. 66 motors mounted on one of the trucks. All the equipment will be provided with G. E. automatic acceleration train control. The trains will operate throughout the length of the line at an average speed of 15 miles per hour.

Power Equipment of the Philadelphia Rapid Transit Co.

During the past year the operation of the entire system of the Philadelphia Rapid Transit Co. demanded a total of nearly 140,000,000 kw. h., this being an increase of 15.02 per cent over that required for the year 1903. One of the illustrations shows in a graphical way the growth in the amount of energy required for the operation of the railway system from 1898, when less than 70,000,000 kw. h. were used, up to and including 1904, when this amount was doubled.



ANNUAL OUTPUT OF POWER STATIONS.

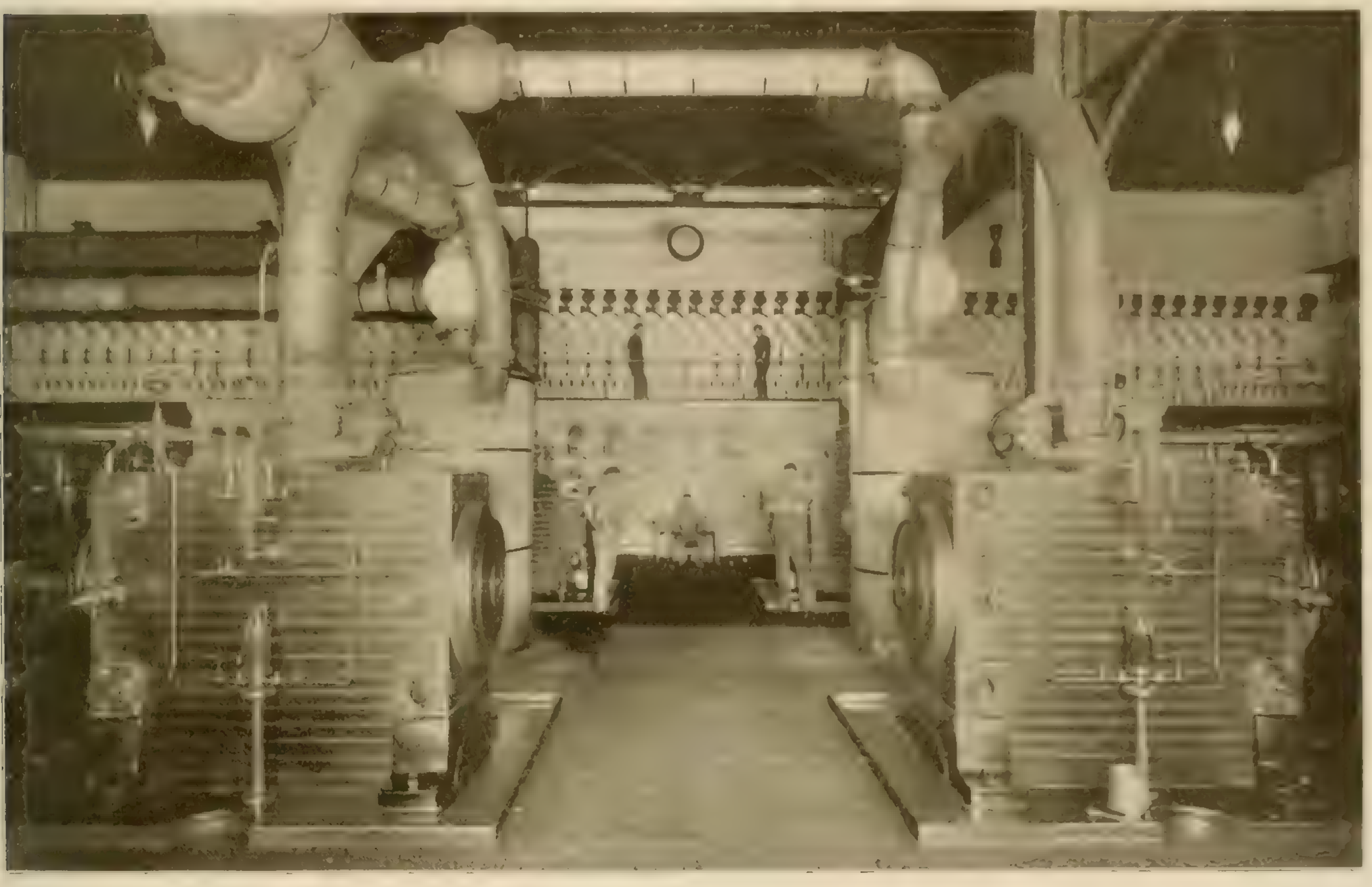
The power generating system of this company comprises 11 generating stations, 6 rotary converter sub-stations and 6 storage batteries. The generating capacity of the 11 stations as now installed is 33,600 kw. direct current and 8,000 kw. alternating current. With the exception of one station these power houses are all equipped with direct-current generators and slow speed engines, although a few high-speed engines are still in use as auxiliaries. The boilers are generally of the water-tube type, made by the Babcock & Wilcox Co., Thayer & Co., and the Parker Boiler Co. All of the stations with the exception of two are now operating with condenser systems. Originally, four of the stations were designed to run non-condensing, but water-cooling devices have been installed at two of these stations. Of the 11 generating stations, the more important ones are those at 13th and Mt. Vernon Sts., Beach and Green Sts., 33rd and Market Sts. and Second St. and Wyoming Ave.

Direct Current Stations.

The station at 13th and Mt. Vernon Sts. is equipped with five 1,500-kw. Westinghouse, direct-current generators direct connected to Wetherill horizontal, cross-compound, corliss engines. This building is constructed of brick, concrete and steel and is absolutely fire proof. The five engines are arranged in two rows with the cylinders on either side of a center aisle extending the length of the engine room. The switchboard is of interest because it is the distribution board for feeding the central and most important part of the city system. In one of the engravings may be seen the aisle between the two rows of cylinders with the switchboard in the background. The central portion of the lower half of this board consists of the machine panels for the generating units. The rest of the lower portion of the board and all of the board in the gallery are made up of feeder panels. The switchboard is arranged with upper and lower bus-bars. In ordinary operation, the lower bar is continuous throughout the whole board and all feeders taking current from generators in this station are connected to the lower busbar. For flexibility this lower bar is provided with several sectionalizing switches. The upper bus-bar is divided into five sections by similar sectionalizing switches so that it may be made continuous if desired. From four of these sections of the upper bus-bar heavy

tie line cables connect this station with four other direct current generating stations. The upper bar can at will be divided and one portion of the feeders diverging from the station be fed independently from one of the other stations by means of the sectionalized upper bus bar. By means of these tie lines the company is thus enabled to keep the engines in these several stations properly loaded at all times of the day.

The boiler room of this station is equipped with nineteen [illegible] h. p. Babcock & Wilcox boilers and one 400-h. p. Parker boiler. These boilers are hand fired. The coal used is brought to the station in wagons and after passing over weighing scales is dumped from the bottoms of the wagons into the hopper of a Link-Belt coal elevator. This elevator carries the coal to the top of the boiler room, where by means of chain conveyors it is distributed along and into a Berquist suspension bunker. From the bottom of this sheet steel bunker tubular chutes direct the coal to the floor of the boiler room in front of the boilers. The ashes fall from the grates into pockets and are loaded into cars operating over a runway below the



POWER PLANT AT 13TH AND MT. VERNON STS.

boiler-room floor. These cars are pushed along the runway to two automatic ash elevators built at one end of the boiler room. The type of ash elevator used here is novel in that it requires no handling except the starting on the up trip. The ashes from the collecting car are dumped into the bucket and the elevator is started by pulling an end rope in the ordinary manner. When loaded and started the elevator requires no further attention. The bucket carrying about 1,000 lb. of ashes is raised to the top of the elevator which automatically dumps the ashes into a storage bin, rights itself and returns to the starting point at the bottom of the elevator shaft. This elevator was made by the Morse-Williams Elevator Co. From the pockets on the under side of the ash storage bin the ashes are loaded into specially constructed cars which have a capacity of 20 tons each and are used for collecting and distributing ashes from the several generating stations throughout the city.

The power house at Beach and Green Sts. is equipped with three 1,500-kw. General Electric generators connected to E. P. Allis twin tandem-compound engines; also one General Electric 500-kw. generator connected to an E. P. Allis single-cylinder engine. In the station are two engine-driven [illegible] and one motor-driven booster for use on some long feeders [illegible] station. The boiler room is on the [illegible] floor and is equipped with 12 Babcock & Wilcox boilers and [illegible] boilers. [illegible] is the only one in the direct-current stations which is equipped with stokers. This station is operated condensing. The condenser system includes one E. P. Allis direct-driven pump which draws the water through the condenser headers for all the units. This system has proved reliable and satisfactory.

The station at 33rd and Market Sts. is equipped with four Westinghouse 1,500-kw. direct-current generators two of which are direct connected to Wetherill cross-compound engines and two to Pennsylvania Iron Works Co. engines. There are also two 800-kw., direct-current generators connected to Pennsylvania Iron Works Co. tandem-compound engines.

This power house was originally a non-condensing station and has recently been changed to a condensing station by installing Barnard cooling towers. [illegible] house. The exhaust from the engines is led to three surface condensers but no attempt is being made at the present time to use the condensed water. Water for cooling is taken from the city mains and after passing through the condensers, as much as is needed is automatically divided and taken for boiler-feed purposes at an average temperature of 120° F. The rest of the circulating water is forced to the cooling towers by centrifugal pumps driven by De Laval steam turbines. The cooling towers are each equipped with two fans driven by a 40-h. p. motor. One of the illustrations is a card showing the results obtained with this cooling tower. This illustration is a combination of two cards, one taken from a recording thermometer at the intake of the cooling tower and the other from a recording thermometer at the outlet of the tower. The average reduction in temperature in the summer time is about 16 degrees.

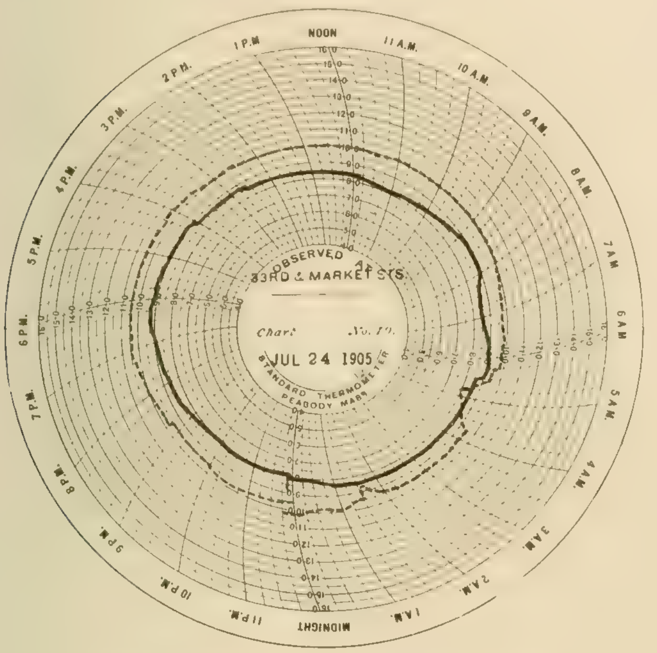
The Wheeler Condenser & Engineering Co. installed a battery of five Barnard cooling towers at this station in 1903. Each of the five towers is fitted with two 10-ft. fans. This equipment cools water to condense 180,000 lb. of steam per hour. The company

MAP OF THE PHILADELPHIA RAPID TRANSIT SYSTEM SHOWING LOCATION OF POWER PLANTS AND SUB STATIONS

furnished two Wheeler surface condensers, each having 9,000 sq. ft. of condensing surface, for this station. The air pumps for this installation consist of two Edwards triplex pumps with 18 x 12 in. cylinders. The pumps are driven by two 30-h. p. Westinghouse motors and this condensing plant maintains a vacuum of from 26 to 27 in. the year around. The cooling towers are arranged with doors at the bottom so that in the winter the fans, which are driven by belted motors, are disconnected and the tower is operated under natural draft; without fans in the winter, a vacuum of from 25 to 26 in. is maintained.

Coal is delivered to this station by wagons and after passing the scales is dumped into the hopper of an elevator. When elevated the coal is distributed by a rope conveyor into a 1,000-ton Berquist suspension coal bunker similar to the one at 13th and Mt. Vernon Sts. The ashes are taken from the ash pits beneath the boiler and conveyed to concrete ash storage bins by an automatic elevator similar to the one at the 13th and Mt. Vernon Sts. station. These storage bins are fitted with under pockets for loading the special 20-ton ash collecting cars used throughout the system.

The switchboard in this station is double decked. The upper deck is used for feeder panels and the lower deck for the generating panels. All instruments are mounted on Tennessee marble, oil



THERMOMETER RECORD—33RD AND MARKET STS.

finish, and the board is equipped throughout with aluminum bus-bars.

The Ogontz generating station on the York Road route to Willow Grove Park is equipped with three 800-kw. generating units and one 400-kw. unit. The boilers in this station are of the Berry fire-tube type. This station is operated condensing, the circulating water being taken from the nearby Tacony Creek. The flow of water is so low during the summer months that it becomes necessary to use some method of cooling. This is accomplished by pumping the water through a set of 10 spray nozzles placed at intervals of about 15 ft. along the cooling pond through which the waters of the creek flow. The water is pumped through these nozzles under a pressure of 15 to 30 lb. and returned directly to the creek. The result, besides the rather pretty fountain effect, is a reduction in temperature of from about 30 to 35 degrees.

At the station at 32nd and Dauphin Sts. the same type of nozzles is used as at Ogontz but the water is sprayed into a cement tank built between two car barns. The reduction in temperature in this case, on account of the restricted area, is not as great as at Ogontz but is found to be sufficient for the purpose. This station was originally operated non-condensing but is now equipped with jet condensers in connection with the cooling pond referred to. There are two 800-kw. and one 600-kw. direct-current generators at this station. Steam is generated in Berry fire-tube boilers.

Alternating Current Station.

The power [illegible] portant direct current generating stations. The alternating current [illegible] is located at Second St. and Wyoming Ave., about five miles north of the business center of Philadelphia. The building stands on a [illegible] storage tracks.

The station at Second St. and Wyoming Ave. is a structure built largely of concrete, brick and steel. The building consists of two main rooms, [illegible] boiler room has like dimensions. A partition wall of brick and concrete forms a fireproof barrier between the two sections of the building. The engine room has a clear height of 26 ft. between the machine floor and the lower chords of the roof trusses. These trusses are 8 ft. 1 in. deep at their centers. Purlins from truss to truss support a roof constructed of expanded metal and cinder concrete. This roof has a cover of slag and water-proofing composition and the cornices and angles are protected with sheet copper. Along the peak of the engine room roof, from end to end of the building, is a monitor built of steel angles supporting a concrete roof and fitted with pivoted windows for lighting and ventilating the engine room. That portion of the engine room between the outside wall and the row of columns which support the outer end of the roof trusses is occupied by the bus-bar compartments, switchboards and current handling apparatus. Under this portion of the building is a basement 15 ft. in height. The basement under the main portion of the engine room is 19 ft. 6 in. in height and of the full area of the floor of this portion of the building.

The boiler house has a clear height between the floor and the roof trusses of 43 ft. Two rows of steel columns support the trusses which carry a roof similar to that of the engine room portion of the building. In the portion of the boiler house adjacent to the engine room are the boilers and the stack, the fronts of the boilers being flush with the row of roof supporting columns nearer the engine room. The center portion of the boiler house is used as the firing floor and has the coal bunker above. That portion of the boiler house between the outer row of roof supporting columns and the outside wall is equipped for receiving coal.

The steam railroad siding which serves the power station extends into this latter mentioned section of the building. This track is supported on a floor structure of steel and concrete at an elevation of about 25 ft. above the boiler room floor which elevation is approximately that of the steam railroad tracks outside the power house. Near the north of the building a concrete hopper is built under this track so that one car may be placed over the hopper and its coal thus unloaded. The coal track was built throughout the entire length of the building so that several cars in a train might be unloaded without necessitating the switching of each car. After the first car has been unloaded it is pushed into the building on the extension of the track along the boiler room and a second car placed over the unloading pocket. Thus the empty cars are pushed ahead until the entire length of the boiler room track is filled. Then this empty train is shifted onto the outside track and a loaded train takes its place.

Coal dropping from the under side of the steam railroad cars is forced to pass through a screen which admits no large lumps that would clog the coal handling machinery. From concrete pockets in the bottom of the coal receiving hopper the coal passes through steel pipes to the hopper of a coal elevator manufactured by the Link-Belt Machinery Co., of Philadelphia. By means of this elevator, which has a capacity of over 60 tons per hour, the coal is raised to an automatic coal weighing machine placed in the monitor which forms a part of the roof system and extends throughout the entire length of the boiler house. This elevator is driven by a Westinghouse, 15-h. p., 500-volt, direct current motor mounted on the trusses which support the roof. From the weighing machine the coal is fed into a horizontal conveyor operating throughout the entire length of the monitor. The trough of the conveyor is placed directly on the top of the main roof trusses and inside the monitor. This horizontal conveyor is driven by a Westinghouse 10-h. p., 500-volt, direct current motor. At suitable points the coal is al-

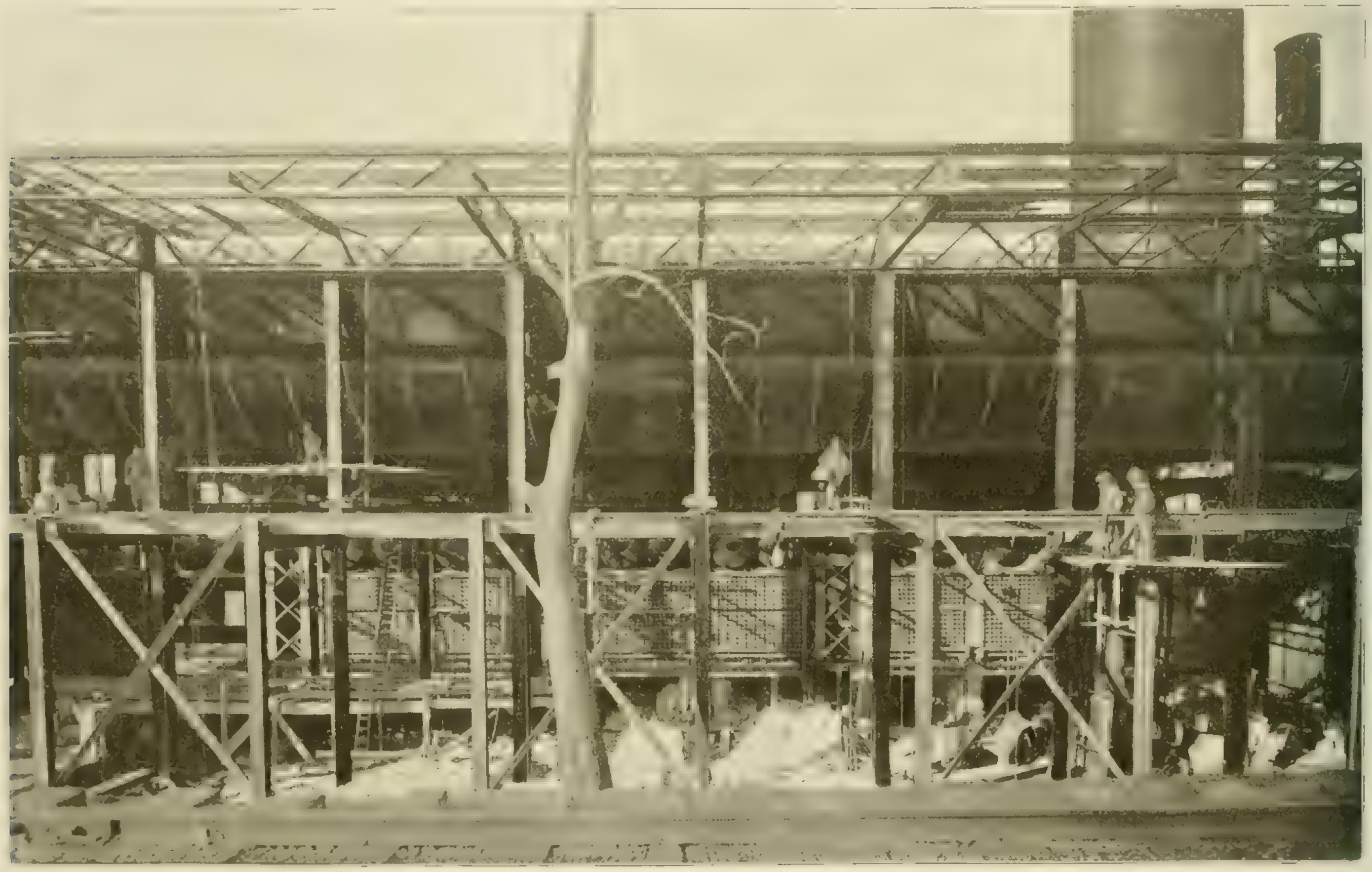
lowed to drop into a Berquist suspension coal bunker. A side view of this bunker as it appeared during the process of erection is included in the engravings. The length of the bunker is 240 ft. It is built entirely of steel plates and has a width of 22 ft. at the top where it is suspended from the columns of the building and a depth of 14 ft. 3½ in. along its center line. The storage capacity of this bunker is 2,000 tons. In addition to this storage capacity the company is equipping a coal storage yard near the north end of the boiler house. This yard will be of especially large capacity and coal will be handled by means of electrically operated cranes.

From the lower side of the suspension bunker, which extends along the fronts of all the boilers, coal is led by means of 12-in. steel pipes made flexible with two knuckle joints to the stoker hoppers on the double-end boiler fronts. The boiler equipment consists of 14 Parker, double-end, water-tube boilers of 700 h. p. rated capacity generating steam at 150 lb. pressure. Parker superheaters are installed with this boiler equipment and add about 100 degrees superheat to the steam at 150 lb. The boilers are arranged in a single line with the stack near the middle of the boiler house dividing the row of boilers into two batteries, one with eight boilers and the other with six. These boilers are equipped with Alfred Box stokers for feeding the two sets of grates. Each row of eight stokers is driven by two Westinghouse 10-h. p., 500-volt, enclosed motors. Each of the motors is connected to four of the stokers and a coupling permits the driving of the eight as one shaft with two motors or the driving of four with the individual motors.

A vertical section is reproduced showing the lower portion of one of the boilers and the boiler foundations which support the two sets of inclined grates. The ashes drop onto an inclined fire brick surface which leads to an ash hopper under the center and parallel with the fronts of the boilers. The hopper and its inclined wings are built of reinforced concrete with the exception of the loading pockets of which there are three for each boiler. These pockets are of cast iron and form a lower portion of the hopper which is directly over the center of a track extending along the floor of the ash tunnel whose walls support the hoppers and the boilers. In ordinary operation the ashes accumulate in the hopper and in these cast iron pockets which have discharge openings 12 x 15 in. in size. Trap doors closing the bottoms of the pockets will when pushed aside allow the ashes from the hopper above to discharge by gravity into a car standing on the track directly underneath. When filled this car is pushed along the track to an elevator outside the south end of the boiler house. By means of the elevator the ashes are carried to a concrete storage hopper built above a switchtrack outside the building, from which the company's specially built ash cars can be loaded by gravity.

It will be noticed in the cross-section of the ash tunnel that the arrangement of the boiler foundations and the walls of the ash tunnel form two air ducts, one on either side of the ash tunnel and parallel with it. By the use of concrete in the construction of the walls these ducts have been made air tight with the idea that if at some future time forced draft be necessary, the blowing fans can exhaust directly into these air ducts which are immediately under the grates.

At the present time the fires are burned under natural draft produced by a stack whose base rests on a foundation at about the middle point of the boiler house near the engine room wall. This stack has an inside diameter of 16 ft. at the top with an outside diameter of 22 ft. It is constructed as a plate steel shell with a lining of firebrick and extends to a height of 220 ft. above the boiler room floor.



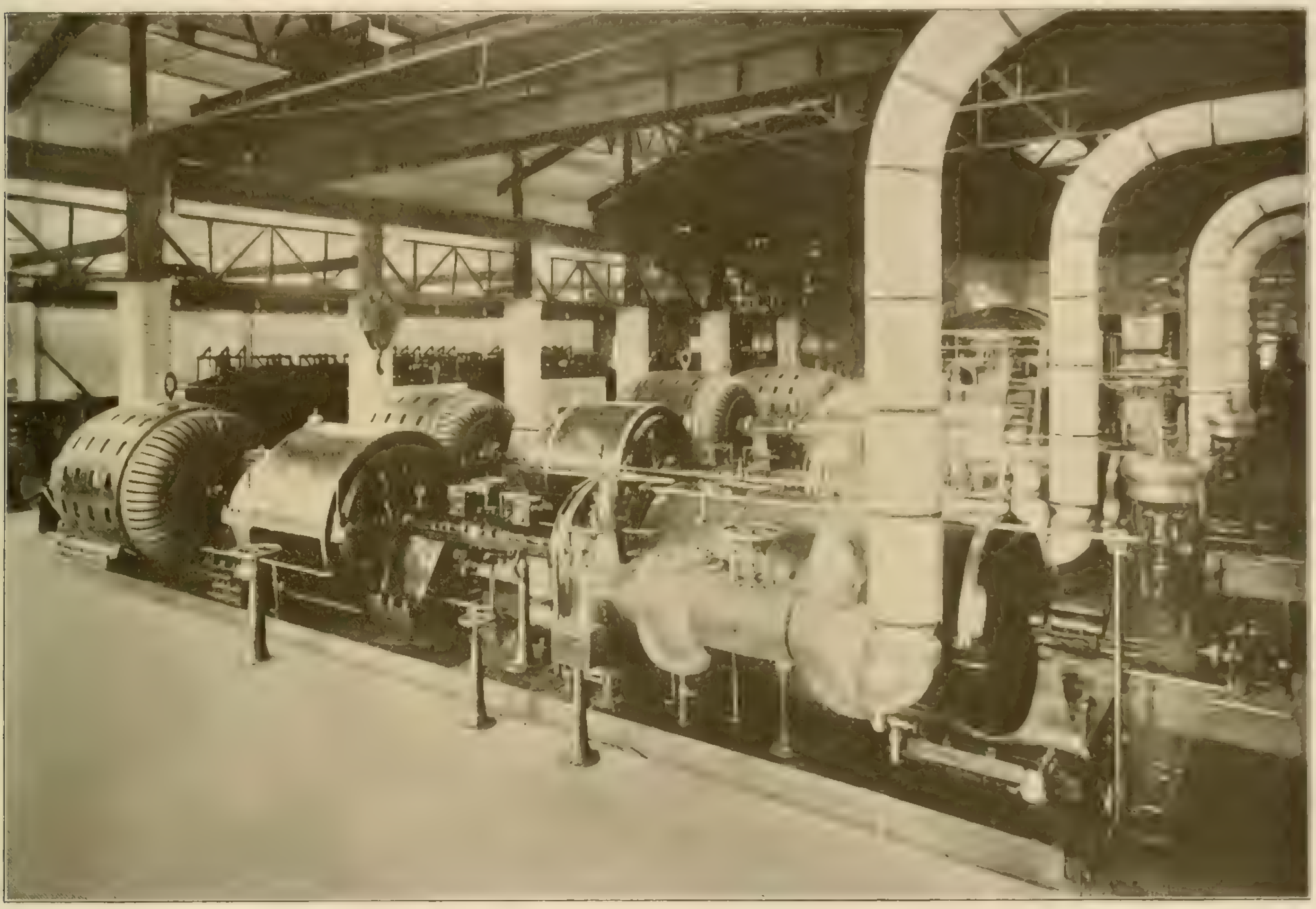
SUSPENDED COAL BUNKER

The main steam header which has an outside diameter of 14 in. and walls 7-16 in. thick with rolled steel flanges and extra heavy cast iron fittings is 17 ft, 3 in. above the boiler room floor and extends along the boiler room side of the partition wall. Fourteen-inch gate valves divide this header into four sections. Each boiler feeds into the top of the header through a long radius bend pipe. In each of these boiler connections are a gate valve and a Schutte stop check. Steam for the main units is led from the lower side of the header through Schutte angle valves and long radius bend pipes extending through the partition wall to the throttle valves.

The generating units include two horizontal cross-compound engines rated at 1,500 h. p. These engines have cylinders 28 in. and 56 in. by 48 in. in size. Mounted on the shaft of each of these engines is a G. E. 1,000-kw., 3-phase, 25-cycle, 13,200-volt alternating

current generator. In the steam connection to each of these engines is a separator but as the steam as generated in the boilers has about 100 degrees of superheat the separating function of these is not needed and they act as receivers between the engines and the main steam line, thus lessening any pulsations in the main steam header which might be caused by the reciprocating engines.

Vacuum is maintained on the low pressure cylinders of these two engines by means of a condenser of the barometric type. Two Westinghouse, 30-h. p. motors drive two centrifugal pumps which furnish water for this condenser. These pumps are arranged with piping and valves so that they may be operated in series or in multiple. The pumps were manufactured by the Kingston Foundry & Machine Works, of Oswego, N. Y. All water for condensing purposes is taken from a creek nearby, being brought into the station through a concrete intake. After the water has been used it is returned to the creek or to a cooling pond through a discharge conduit similar to the intake.



INTERIOR OF POWER HOUSE AT WYOMING AVE. AND 2ND ST., 1500 KW. WESTINGHOUSE-PARSONS [illegible]

The bearings of the two reciprocating engines are equipped with the fittings of a gravity oiling system. Drips from all the bearings are led to the suction well of a steam pump which raises the oil to a combination tank and filter located near the roof of the engine room.

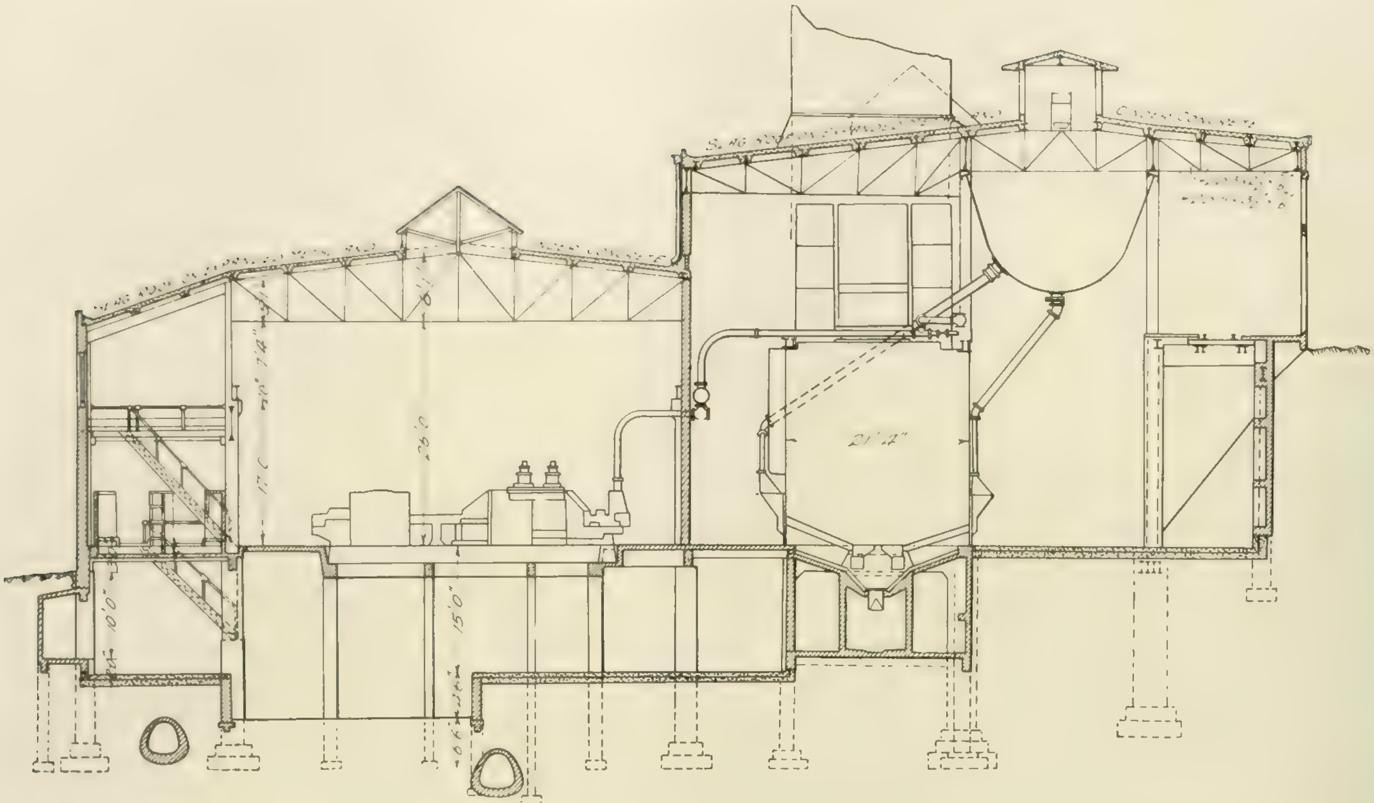
In the south half of the building there are at present installed four 1,500-kw. turbine-driven alternators and preparation has been made for the installation of two more units of like capacity. The two turbine sets nearest the center of the building are of the single-stage type, the other two are of the double-stage type, and the two which will soon be installed will be of the single-stage type. Each of these turbine sets is of the Westinghouse-Parsons type operating at 1,500 r. p. m. and driving the armature of a 1,500-kw., 13,200-volt alternator. The speed of the turbine units is controlled by governors which may be electrically regulated from the bench board near the main switchboard of the power house.

The turbines are mounted directly upon the reinforced concrete engine room floor and have for their support eight reinforced concrete posts placed at regular [illegible] turbine bed. [illegible] about 18 ft. between the basement floor and the engine room floor directly under the turbine units. The individual condenser for each turbine set is located in this space directly under the turbine.

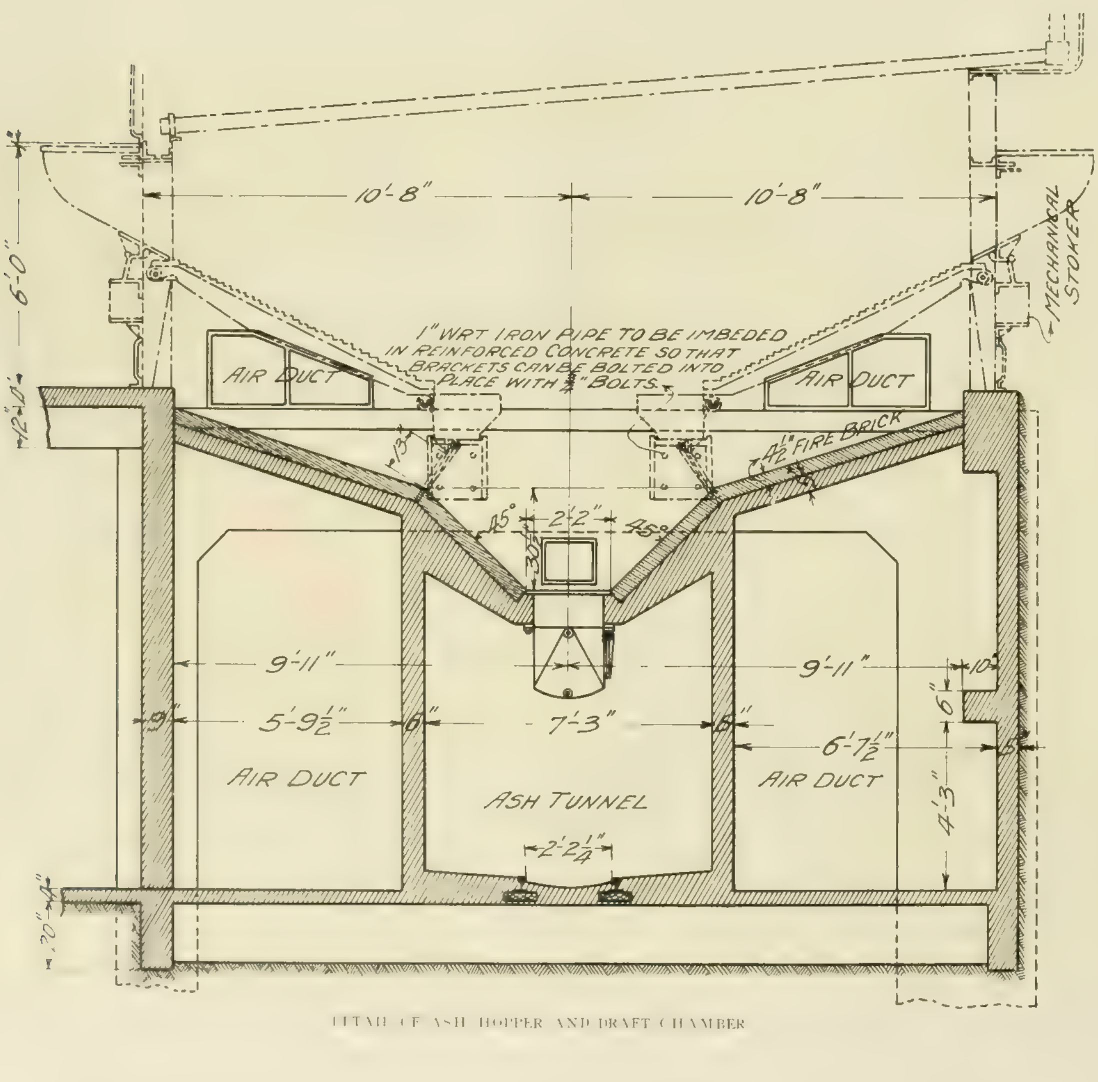
For the turbine units there are condensers of the inverted barometric type. Owing to the limited height at which the condensers are placed above the water level the customary tail pipe could not be used, but is replaced by a 12-in. centrifugal pump producing the same suction effect as a water column in a tail pipe. This keeps the condenser clear of water although the bottom of the condenser is only about 10 ft. above the water level in the discharge conduit. Injection water is brought into the building by a concrete tunnel under the engine room floor and is lifted into the condenser at a height of 18 ft. above the intake level by the vacuum established by the operation of the two dry air pumps. These pumps operate continuously while the condenser is in use and serve to remove any gases or vapors which are not removed from the condensers by the centrifugal pumps. The centrifugal pumps of these condenser sets are designed for removing water from the condensers under vacuum and are belt driven from extensions of the turbine shafts. The two dry vacuum pumps are on the engine room floor just north of the row of turbine units. These pumps are of the horizontal Corliss two-cylinder type with cylinder dimensions 10 x 24 x 24 x 24 in. Steam for their operation is taken from the main steam header by a connection passing through the boiler room partition wall.

Boiler feed water is taken from the condenser discharge or the cooling pond built at the south end of the boiler house. This pond is 40 ft. wide by 140 ft. long and about 15 ft. deep. For cooling purposes it is equipped with fifty 3-in. Schutte spray nozzles. The pond is built with a concrete bottom and masonry walls.

There are four boiler feed pumps; two of these are of the Scranton, horizontal, duplex, outside packed plunger type with cylinders 12 x 7½ x 12 in. in size, the other two pumps are of the Heissler,



CROSS SECTION OF STATION AT WYOMING AVE. AND 2ND ST.



DETAIL OF ASH HOPPER AND DRAFT CHAMBER

DISTRIBUTION OF POWER STATION FORCES

Station Number	1	2	3	4	5	6	7	8	9	10	D	11	12	13	14	15	16	17	18	19
Engineer in charge	1	1	1	1	1	1	1	1	1	1	1									
Assistant engineers	2	2	2	2	2	1	[illegible]	1	1	2	1									
First oiler	1	1	1	1	1	1	1	1		1										
Oilers	5	[illegible]	9	9	3	2	6	1		[illegible]										
Switchboard men	3	3	3	3	3	3	3	2	[illegible]	1		1	1	1	1	1	[illegible]	1		1
Generator men	1	3	3	3				1		3		1	1	[illegible]	[illegible]					
Pumpmen	1	3				1				2										
Water tender	3	3	3	3	3	3	3			3										
Firemen	11	6	6	11	3	2	3	1	2	6	[illegible]									
Firemen's helper			5		2	2	2	2	1	6										
Boilermen	1	1	1	1	1		1			1										
Coalmen	1	1	3	1		1		1		1										
Ashmen	2	3		2						[illegible]										
Boiler cleaners	3	2	3	3	1		1													
Janitors	1	1	1	1	1	1	1	1	1	1										
Engine room laborers		1	1				1													
Boiler room laborers		1																		
Screen men										2										
Laundry men			1																	
	41	37	43	41	21	18	25	15	[illegible]	46	4	2	5	3			[illegible]	3		

Nos. 8 and 9 operated in summer only.
No. 10. New A. C. Station.
No. D. Small country station.

Nos. 11, 13, 14 and 15. Battery substations.
No. 12. Rotary and Battery substation.
Nos. 16, 17, 18 and 19. Rotary substations without battery.

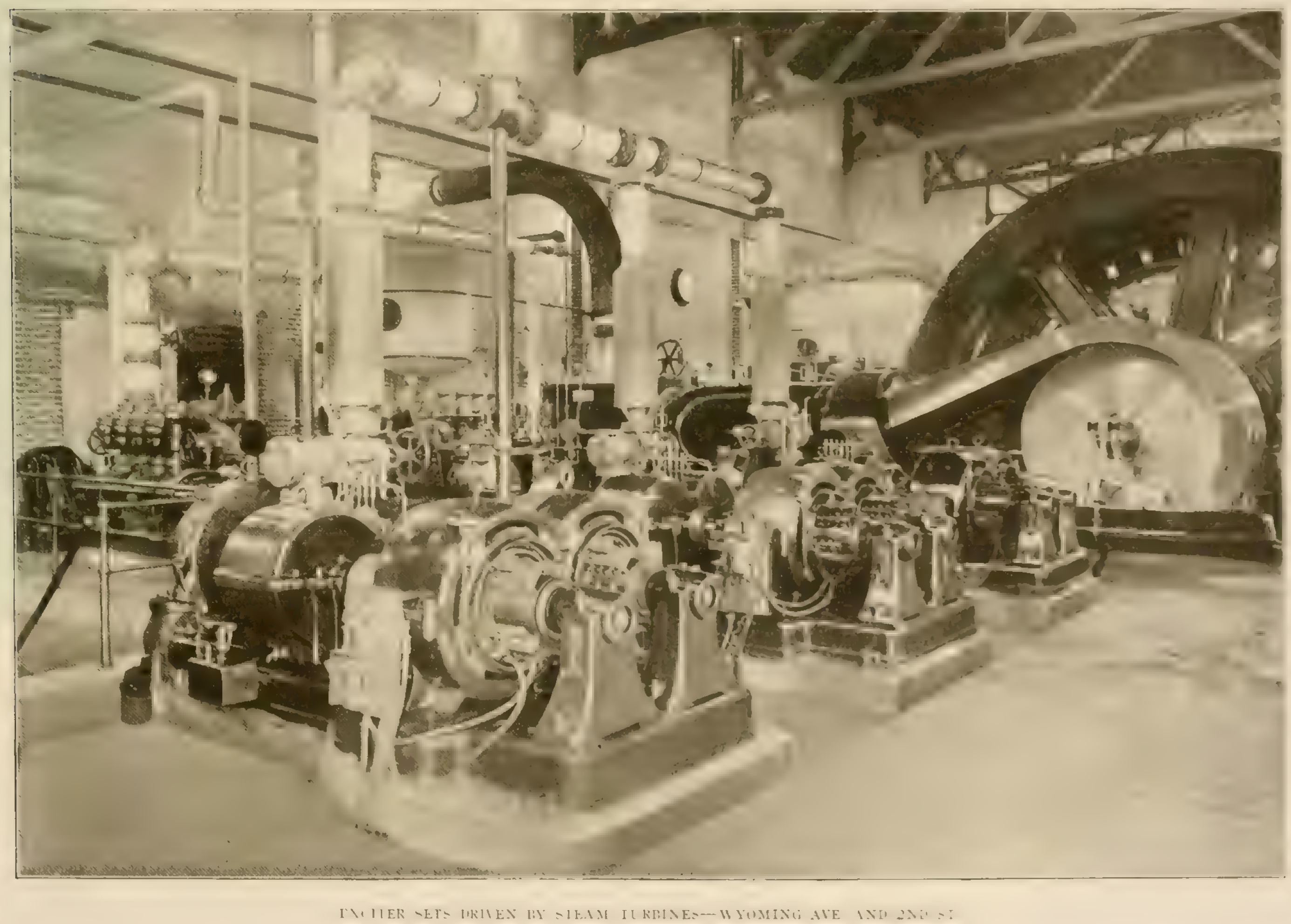
duplex, triple expansion type with 6 x 14 in. double-acting cylinders. All the boiler feed is heated in a 15,000-h. p. open heater which utilizes the exhaust steam from all the power station auxiliaries. This heater also uses the exhaust from two 300-kw., Westinghouse, "Kodak" sets which generate 500-volt direct current for feeding some of the trolley lines near the power house.

The steam drips from all parts of the engine room are collected in a tank in the basement and forced back to the boiler by a duplex steam pump governed by a float in the drip tank. An automatic blow-off is also installed for use in case the drip pump should be inoperative.

The exciters for the alternating current generators are located at the north end of the power house on the engine room floor. The exciting current is generated by three De Laval turbine sets of 100 h. p. each. The rotors of these turbines operate at 12,000 r. p. m. By means of a reduction gear the rotor shaft drives the armature of two 37.5-kw., direct current, 125-volt generators at a speed of 1,200 r. p. m. mounted on [illegible] turbine and reduction gears. In connection with these three turbine exciter sets there is being installed [illegible] single cylinder 13 x 14 in. in size. This engine will be direct connected to a 100-kw., 125-volt, direct current generator designed to run at a speed of 250 r. p. m. When needed this set will operate in parallel with the other exciter sets.

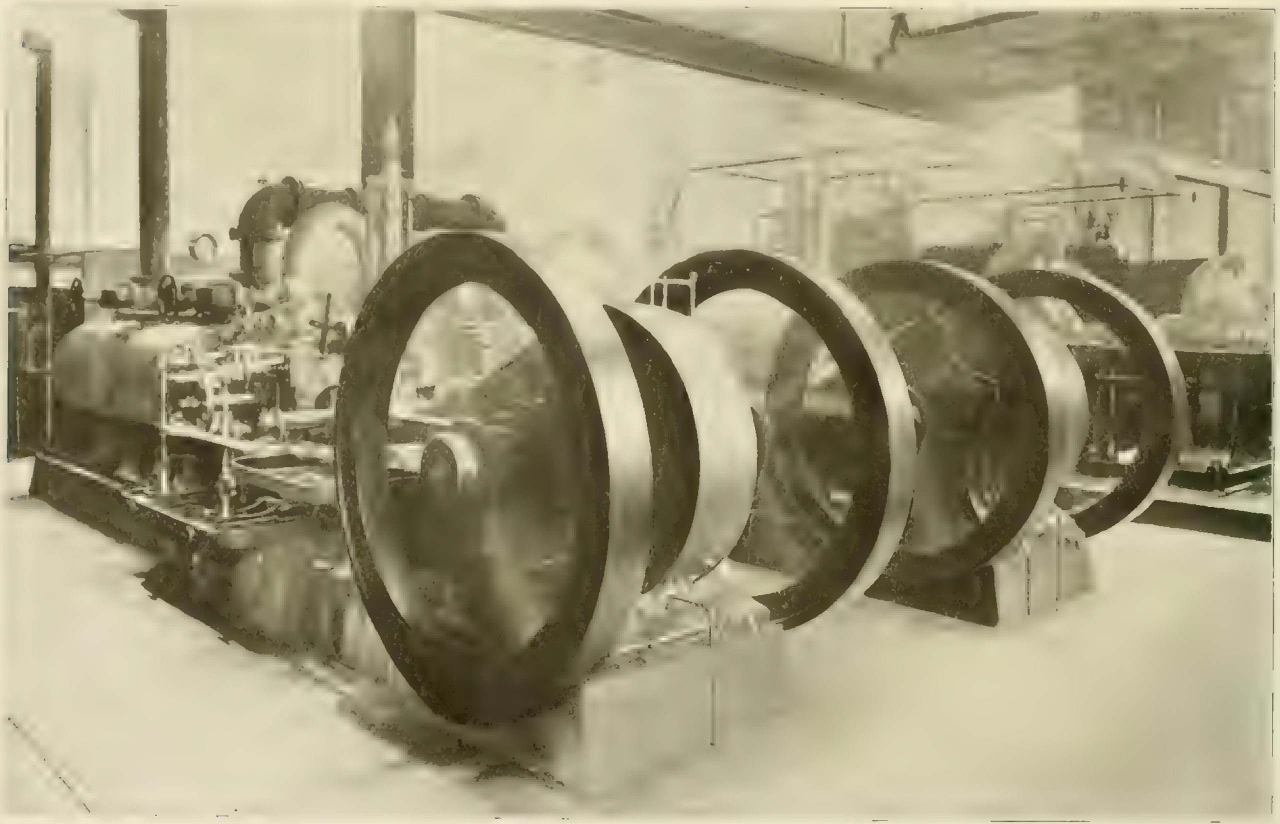
The entire engine room is served by an Alfred Box hand operated crane of 20-ton capacity.

From each of the 3-phase generators the current at 13,200 volts potential is led in cables to G. E. motor-operated oil switches built into the structure of the bus-bar compartments. This structure, which is made up of the machine switches, line switches and bus-bar cells with their sectionalizing switches, is built upon the engine room floor between the generator ends of the main units and the outside wall of the engine room. Red pressed brick and soapstone carefully laid form the walls so that the structure presents a



EXCITER SETS DRIVEN BY STEAM TURBINES—WYOMING AVE. AND 2ND ST.

[illegible] in the engine room. From the machine switches [illegible] passes by means of separate cables [illegible] through individual cells to connect with the main bus-bars extending the length of the compartments. The bars may at will be divided into sections by hand-throw knife-switches mounted on glass pedestals cemented into the soapstone barriers. The current for the outgoing high-potential feeders is taken through single conductor cables in individual cells connecting the bus-bar compartments with the proper cells of 10 G. E. motor-operated line switches whose walls form a part of the general bus-bar structure. From each of these line switches the three conductors enter the terminal bell of



AIR PUMPS FOR TURBINE CONDENSERS—WYOMING AVE. AND 2ND ST.

a standard underground lead and paper insulated feeder cable which leaves the building through underground ducts with openings in the power house foundation wall directly under the line switches.

The bench-board for the control of these motor operated machine and line switches, together with the marble panel switchboard for the instruments and for the switching of all direct and low voltage current, is located parallel with the outside wall of the engine room and at a point about opposite the reciprocating engine units. On the bench-board are the control switches for all the motor operated machine and line switches, the control switches for the governors on the generating units and the control switches for the motors operating the shafts of the field resistance boxes of the alternating current generators. The top of this bench-board is of gray marble and has set in it green and red pilot lights for indicating the position of the machine and line switches.

The switchboard consists of 41 marble panels about 8 ft. high by 20 in. wide. These panels are fitted with the indicating instruments and trip coils for the alternating current generator and feeder switches and also the control switches, circuit breakers, rheostats and instruments for the direct current generating units, the exciters, the motor operated oil switches, storage battery and the several auxiliary lighting and power circuits throughout the station. The synchronizing instruments are mounted on a panel 18 in. high by 96 in. long directly over the alternating current machine panels.

Sub-Stations.

The six sub-stations now in operation contain 14,000 kw. capacity in rotary converters. The current feeding these sub-stations is with one exception transmitted by means of underground cables from the alternating-current generating station at Second St. and Wyoming Ave. This exception is the rotary converter sub-station at Willow Grove Park terminal. The high potential feeders for this sub-station are carried as an overhead line from the Glenside sub-station to Willow Grove Park. One of the engravings is an exterior view of a new rotary converter sub-station at 52d St. and Lancaster Ave. in West Philadephia. At the present time this station contains three 1,000-kw. Westinghouse rotary converters with the necessary transforming and switching apparatus for their operation. The building is entirely of brick and concrete and the machine room is equipped with an overhead crane to facilitate the handling of large pieces of machinery. The interior arrangement of the Glenside sub-station, described elsewhere, is typical of that of all the Philadelphia Rapid Transit Co's. sub-stations now in operation. A new sub-station, for supplying direct current to the network of trolley feeders in the center of the city, is being completed at 9th and Sansom Sts.

The Sanson St. sub-station now in the course of erection will be a rectangular shaped building 105 x 108 ft. in size. The building, with the exception of the exterior walls, will be entirely of reinforced concrete construction. The exterior walls, which are now in place, are of brick. The main floor of the building will be undivided and will contain eight 1,500-kw. rotary converters placed in two rows and four each along the center of the room.

A line drawn through the center of the machine floor divides the room into two similarly equipped sections, each with four rotary converters. Each converter will have three transformers standing near it, the 12 transformers in each half of the building being arranged in a single line parallel with the center line of the rotary converters. Betwen the line of transformers and the wall of the building is the brick and slate chamber with compartments for three high tension bus-bars and brick cells for four machine switches and four line switches.

The switchboard for controlling the electric apparatus will be built parallel with the rear wall of the building. The details of the switchboard and the two independent sets of bus-bar compartments will follow closely those of the Glenside sub-station. The two sets of bus-bars will be connected by means of conductors placed in

three separate cells built in the concrete of the machine room floor. This floor directly in front of the street door of the building will be depressed to facilitate the loading and unloading of material taken away from or brought to the station in wagons. An electric crane mounted on runways supported by two lines of concrete posts will serve the portion of the room occupied by the transformers and rotary converters. On the mezzanine floor at the northwest corner of the building will be two rooms; one will be used as a storeroom and the other will be furnished as a locker and wash room. In the basement of the building will be the two parallel air chambers built of reinforced concrete over which will stand the transformers on the machine room floor. The air for cooling will be blown into each of these chambers by two motor driven fans standing on the basement floor. One wall of the air chamber will be utilized for supporting the floor directly under the rotary converters. On the other side of each of the machines will be built a concrete pier 13 ft. long by 18 in. thick. As the building is in a closely built business portion of the city it is entirely enclosed by other structures and will be lighted by a skylight from above and a row of windows on the street side. This sub-station will feed the most important trolley sections located in the business center of Philadelphia, and the subway east of Broad St.

There are six storage batteries in use with a total capacity of 5,200 ampere-hours. A view of the front of a typical one of these battery stations is shown. This station is located at 3643 Germantown Ave.

BATTERY SUB-STATION BUILDING.

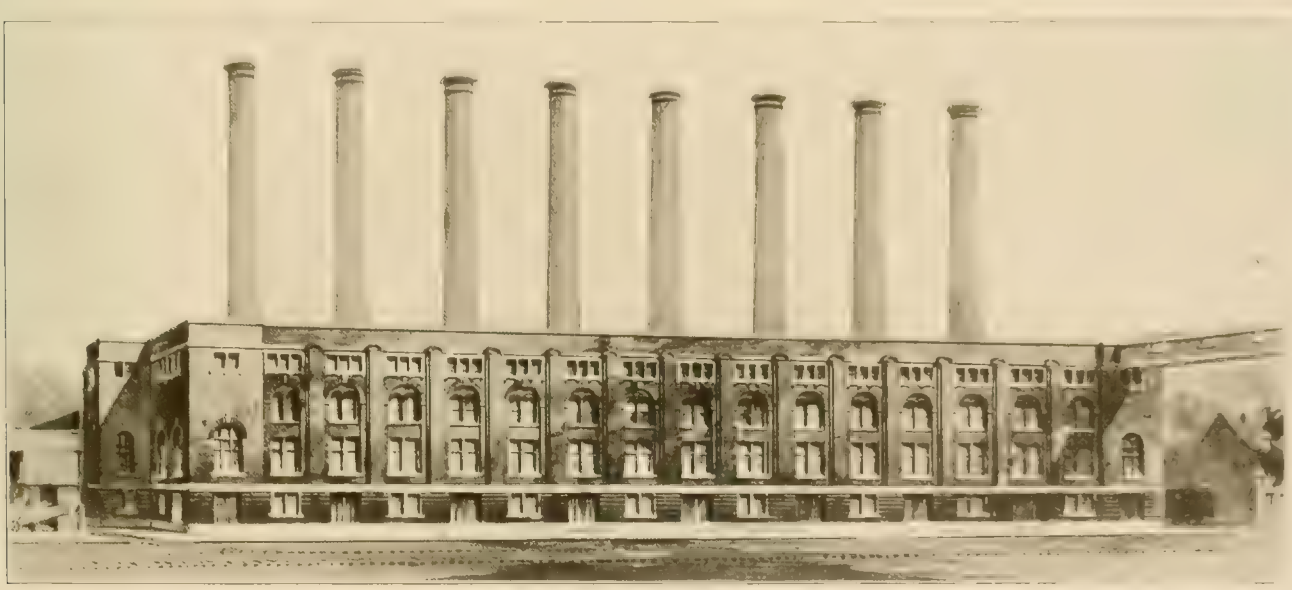
ROTARY SUB-STATION, 52ND AND LANCASTER AVE.

Delaware Ave. Power Station.

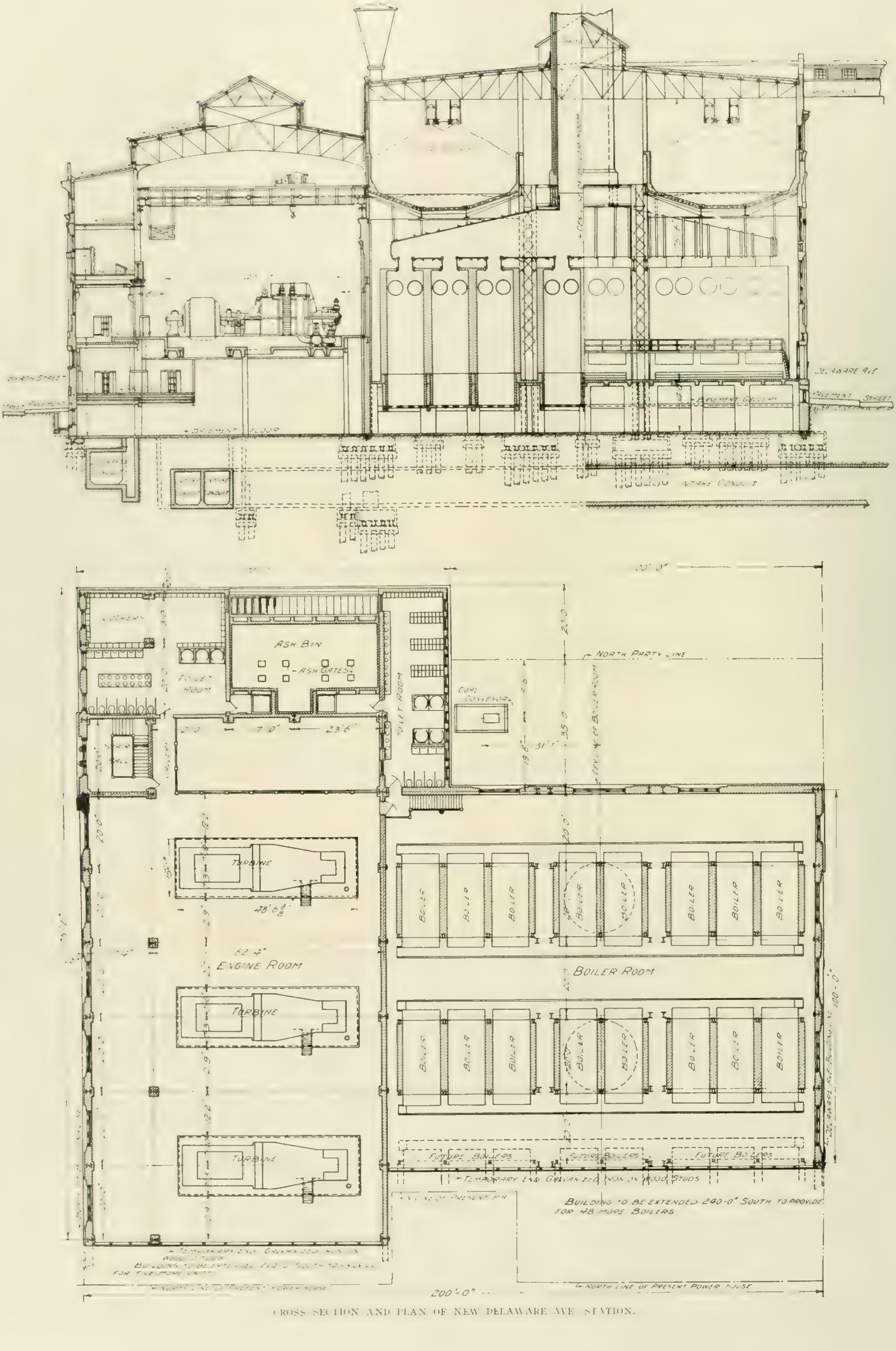
The present Delaware [illegible] river front of Philadelphia is a direct current generating station. Construction [illegible] of a 55,000-kw. capacity alternating current generating station to occupy the same site. The new building will be erected in two sections. The portions of the new building north of the north end wall of the present station will be built first and will be placed in operating condition, then the present station will be torn down and the remaining portion of the new building erected in the place of the old station.

The new power house will occupy a strip of land 200 ft. wide and 435 ft. long. This property is bounded on the west side by Beach St. Along this street is a steam railroad siding over which coal will be brought to a bunker and conveying apparatus whence automatic machinery will carry the coal across the street to the storage bunkers in the boiler room of the new station. There also will be three additional tracks on the west side of Beach St. for storing coal in steam railroad cars.

The east side of the new building will front on Delaware Ave., which is close to the shore line of the Delaware River. Opposite the north end of the building the company will construct a pier 82 ft. wide extending into the river. This pier will be built directly



NEW DELAWARE AVE. POWER STATION OF PHILADELPHIA RAPID TRANSIT CO.



CROSS SECTION AND PLAN OF NEW DELAWARE AVE. STATION.

POWER STATION CAPACITY AND PERFORMANCE

Station No.	Location	Capacity Kw.	Character	Output 1904 Kw. H.	Boilers	Coal per Kw. H.	Water per [illegible]	Feed Temp. F.	Steam Pres., lb.
1	13th and Mt. Vernon	7,500	Non condensing	[illegible]	Babcock & Wilcox	[illegible]	[illegible]	[illegible]	[illegible]
2	920 N. Delaware Ave	3,800	Condensing	[illegible]	Babcock & Wilcox	[illegible]	[illegible]	[illegible]	[illegible]
3	Beach and Green	5,000	Condensing	[illegible]	B. & W. and Heine	[illegible]	[illegible]	[illegible]	[illegible]
4	33rd and Market	7,600	Condensing	[illegible]	B. & W. and Parker	4.15	[illegible]	[illegible]	[illegible]
5	32nd and Dauphin	2,200	Condensing	[illegible]	Berry fire tube	4.39	5.08	[illegible]	145
6	27th and South	1,700	Condensing	[illegible]	Babcock & Wilcox	[illegible]	[illegible]	[illegible]	[illegible]
7	Ogontz	2,800	Condensing	[illegible]	Berry	[illegible]	6.52	[illegible]	[illegible]
8	Willow Grove	1,700	Non condensing	[illegible]	Wetherill fire tube	5.76	[illegible]		110
9	Chestnut Hill	600	Condensing	[illegible]	Wetherill fire tube	4.36			125
10	2nd and Wyoming	8,400	Condensing	[illegible]	Parker	[illegible]			175
D	Doylestown	300	Condensing	[illegible]	Sterling	7.10	5.99	121	[illegible]
Total or Average		41,600		[illegible]		4.14			

No. 2 is only station with economizer.

over the discharge and intake conduits for the station. On the pier will be suitable coal handling machinery for unloading coal from boats and conveying it to the storage bunkers in the boiler house.

A plan of the north portion of the new station is shown. The structure will be of the skeleton steel type with brick walls and reinforced concrete floors and will be divided by a fireproof partition wall into an engine room 82 ft. wide by 360 ft. long and a boiler room 117 ft. wide by 340 ft. long.

The engine room fronts on Beach St. and the boiler room on Delaware Ave. Owing to the soft nature of the ground so near the river front it is necessary to support the walls and piers in the building on special foundations. These are made by sinking clusters of concrete piles down to a firm bed, the heads of these piles being enclosed in blocks of concrete reinforced by grillages made up of a number of I-beams.

There will be installed in the completed station, eight turbine generating sets, the north three of which will be of 6,000-kw. capacity each and the other five of 7,500-kw. capacity each generating alternating current at 13,200 volts. These turbines which will be of the single-stage type will stand on the reinforced concrete floor at an elevation of 26 ft. 6 in. above the basement floor. A condenser set for each turbine will be installed on the basement floor directly under the turbine which it serves. Ten feet below the basement floor is the top of a pair of intake conduits which extend throughout the length of the engine room under the line of turbines. Each of these conduits has a cross-sectional area of 7 x 9 ft. Parallel with intake conduits and about ten feet distant is the discharge conduit which is 9 x 12 ft. in cross-section. These intake and discharge conduits are built of reinforced concrete and are rectangular in section. They extend along under the engine room serving each of the condenser sets and turn to the east near the north end of the building, passing out under the pier to their gates on the river front.

In the gallery along the Beach St. side of the basement will be built two rows of bus-bar compartments. On the main floor will be the turbines mentioned, the exciters and the oil switch compartments which will be built in a row parallel and near the west building wall. The bay in which these oil switches will be placed will be served by an overhead crane mounted on runways supported by reinforced concrete stringers built as a part of the outer wall of the engine room and the row of columns dividing the current handling compartments from the turbine room proper. The first gallery above the oil switches will contain the main switchboard for the power station and the gallery directly above this will be occupied by the rheostats. An overhead crane of 60-ft. span will operate on runways the entire length of the engine room.

North of the engine room are two tracks, one from the steam road and one of the Philadelphia Rapid Transit Co's., the former running directly into the engine room so that material can be unloaded with the engine room crane. The toilet and locker rooms are at the north end of the building on the level of the engine room floor; above these are the engineers' offices.

In the boiler room and at a position opposite each of the turbine sets will be the battery of boilers supplying this unit with steam. Each battery of boilers will be made up of eight 1,000-h. p. water-tube units set side by side in rows across the boiler house. Over the top of each of these batteries will be a sheet steel breeching leading the smoke to the bottom of a stack. The eight independent stacks, one for each battery of boilers, are of reinforced concrete construction mounted on a grillage supported on lattice steel posts directly over the middle of each row of boilers. These stacks have an inside diameter of 14 ft. at the base. This arrangement of stacks divides the upper part of the boiler house into two sections. In each of the upper sections along the entire length of the boiler house is a reinforced concrete coal bunker served by two distributing conveyors. From the bottom of the bunker [illegible] will lead to the stoker hoppers of the individual boilers. Along the peak of the roof and between the stacks will be a monitor [illegible]. A similar monitor and skylights will extend longitudinally along the center of the engine room roof.

General Data on Power House Costs.

Total power station output . . . . . . [illegible] kw. h.
Total coal (No. 1 Buckwheat) . . . . [illegible]
Cylinder oil, average for whole system, per 10,000 kw. h., 2.66 gallons, or . . . [illegible]
Engine oil, average for whole system, per 10,000 kw. h., 1.57 gallons, or . . . [illegible]
Pump and engine repairs, per 1,000 kw. h. . . . . 13.98 cents
Pipe repairs, per 1,000 kw. h. . . . . 10.74 cents
Packing and waste, per 1,000 kw. h. . . . . 3.86 cents
Boiler cleaning, per rated boiler h. p. . . . . 80.05 cents
Boiler setting repairs, per rated boiler h. p. . . . . 28.66 cents
Boiler repairs, per rated boiler h. p. . . . . 48.18 cents
Total boiler cost per 1,000 kw. h. . . . . 118.34 cents
Labor cost per 1,000 kw. h.—
Power houses . . . . [illegible]
Sub-stations . . . . 8.40 cents
Total . . . . [illegible]
Repairs coal and ash elevating machinery per long ton:
Tons handled at station [illegible] . . . . [illegible]
314,521 . . . . 1.10 cents
43,823 . . . . [illegible]
56,088 . . . . .80 cents
18,611 . . . . [illegible]
Cost handling ashes per 1,000 kw. h. . . . . 16.64 cents
Cost water per 1,000 kw. h. . . . . 11.15 cents
Electrical repairs and supplies, per 1,000 kw. h. . . . . . . 18.16 cents
Repairs economizers and heaters, supplies, tools, betterments and miscellaneous, per 1,000 kw. h. . . . . . . 17.73 cents

Station Equipment (Generators and Converters.)

No. Station, Generators, Size and Number.

1. Five 1,500.
2. Four 800; one 600.
3. Three 1,500; one 500.
4. Four 1,500; two 800.
5. Two 800; one 600.
6. Three 400; two 250.
7. Three 800; one 400.
8. One 600; two 250; one 200. (Two 500-kw. rotaries.)
9. One 600.
10. Two 1,000 (a. c.); four 1,500 (a. c.); one 400.

D. Two 150.

Rotaries—Size and Number.

12. (123 Chelten Ave.) Two 1,000; two 500.
16. (Frankford Ave. and Arrat St.) Two 500.
17. (13th and Snyder.) Three 1,000; two 500.
18. (52nd and Lancaster.) Three 1,000.
19. (Glenside.) One 1,000; two 500.

Note.—Stations No. 11 (Germantown Ave., Chestnut Hill), No. 13 (3943 Germantown Ave.), [illegible] No. 15 (5th and Lombard) are storage battery sub stations.

POWER STATION FORCE.

Operators:—		
Generating Stations	302	
Sub-stations	28	
Total		330
Repair Men:—		
Steam fitters and helpers	20	
Machinists	6	
[illegible]	10	
Carpenters and helpers	3	
Boiler maker and helpers	4	
Riggers and helpers	2	
Pipe coverers and helpers	2	
Conductors and motormen (ashes and freight cars)	10	
Storekeepers, watchmen, etc.	11	
Laborers	12	
Electricians and helpers	20	
Total		100
Grand Total		430

The distribution of the power station force is shown in the table on page 533.

Some Early Overhead Material.

Editor "Review":

The wooden cone-shaped trolley hanger illustrated in the "Review" for November, 1904, while one of the early forms of hanger, was not the first. There were at least three other styles that were used on early Van Depoele roads that came under the observation of the writer. What is believed to be the first hanger used on a "bona fide" or permanent electric railway is shown in Fig. 1. This consists of a piece of hard wood 2 x 4 in. in section and about 4 ft. long, channeled on the under side and beveled on the upper corners, as shown in the cross-section, in order to shed water more readily and provide dripping edges. This was secured to the span wire by two small hook bolts placed a few inches from either end fastened on the under side of the wooden piece by nuts with washers. In the first design of this hanger the span wire went through from pole to pole, but later, it was found necessary to

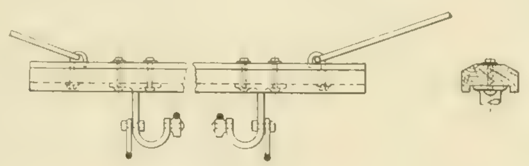


Fig. 1

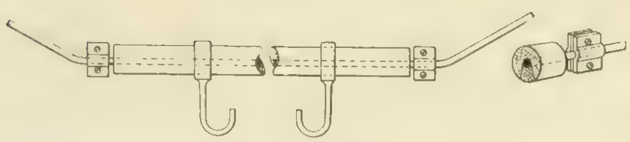


Fig. 2

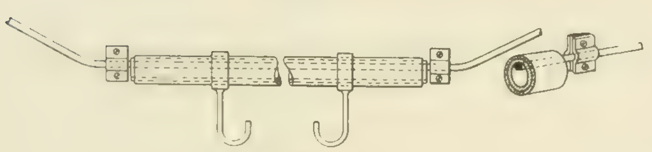


Fig. 3

cut the span wire and fasten the two ends to the hook bolts, as shown in Fig. 1. This was on account of the danger of the span wire short circuiting the bolts through wooden pieces which supported the two trolley wires of different polarities. To the under side of these wooden pieces were secured by these small through bolts, two castings terminating in hooks. For the over running trolley, the ear was bolted to the end of the hook, as shown. A modification of this for the under running trolley was to cut off the hook from the casting and drill a hole through the shank that was left. (Fig. 1 shows both the over running and the under running constructions.)

If the double trolley was used two of the depending hooks were, of course, required. This type of double hanger for double over running trolley was used at Appleton, Wis., in the spring of 1886; at Wheeling, W. Va., in the fall of 1887; at Jamaica, L. I., in 1887, and at other places.

The second type of hanger is shown in Fig. 2. The insulator consisted of a piece of wood a little larger than an ordinary broom handle, which was channeled out so that span wire could occupy the center, and the channel was then closed by another piece of wood. The hanger proper was similar in design to that shown in Fig. 1, except that it encircled the wood and was held in place by small bolts. This form was used at Ansonia, Conn., and at Lima, O., in 1887, and at Dayton, O., in 1888, and in other places.

The third hanger was of the same general type as the second, but instead of a section of wood, a ¾-in. gas pipe wrapped with tar paper was substituted. Clips to support the hanger were placed around this with the tar paper furnishing the insulation. This form was used at Montgomery, Ala., late in 1886, and at Scranton, Pa., in September, 1886. To prevent the forms shown in Figs. 2 and 3 from slipping transversely on the span wires, clips were placed on the latter close to the hangers. These clips were merely two pieces of metal clamped around the span wire and fastened by two stove bolts.

The wooden cone-shaped hanger was also used on "straight line" work in Port Huron, Mich., in 1886; Scranton, Pa., 1886; Lima, O., 1887; Ansonia, Conn., 1887; Wheeling, W. Va., 1888, and other places using the Van Depoele system.

"Strain insulators" of the early type were made of hard wood about 3 in. x 4 in. x 4 ft., with two eye-bolts at each end. These were used to anchor the trolley wires at the ends of curves and were held securely in place by guy wires running from guy stubs or poles to the eye-bolts in the ends of the wooden pieces. The strain plates used with these strain insulators had from three to five ears riveted to a 3/16 x 2 in. steel plate from 3 to 5 ft. long. This type of strain plate was fastened to the hangers by cap screws or bolts, the same as the ordinary ear would be. They were also used on curve work to give the trolley wire a more gradual curve than could be obtained by the use of single ears. These plates were used at Appleton, Wis., in the early summer of 1886; Port Huron, Mich., 1886; Scranton, Pa., 1886, and other places. In fact, the curve work in Port Huron and Scranton, which was of the single over running trolley type, was made up of nine of these plates 3/16 x 2 in. in section and each 10 ft. long, riveted end to end, thus making a continuous curve plate 90 ft. long, and as each of the 10 ft. sections had 10 ears riveted to it, there were 90 ears to each curve of single trolley wire wherever there was an angle of 90 degrees, or about that amount of curvature. While these methods answered the purpose, they were, like most pioneer matters of electrical or mechanical nature, very good at the time but appear crude at the present day. To quote from a letter regarding pioneer days, which I received about the year 1891 from Charles J. Van Depoele, the inventor of the system, and to whom all honor and credit is due; he wrote, "In thinking over those times, our trials, and the difficulties to be overcome, I sometimes wonder that we are still alive."

Thinking of these earlier railways reminds me that from time to time arguments will appear in the non-technical press as to location of first commercial electric railway in this country; by "commercial," I mean a road that was built, and operated continuously after its construction. Some claims are to the effect that Richmond, Va., was first; then again it will be Kansas City, or South Bend, Ind., but on investigation I think it will be found that the Van Depoele road at Appleton, Wis., which, I understand, has been in continuous operation since its construction in the spring or early summer of 1886, was one of the first if not actually the first commercial road in the United States.

It is true, there were a number of earlier experimental or exhibition railways, but they were run for a few days or a month over a short piece of track and then stopped for months, as was the case with Richmond, Kansas City, South Bend, Montgomery, Minneapolis, and other places; in fact, there were a number of the Van Depoele exhibition railways years before the Appleton road.

Yours truly,

C. E. Flynn.

Vice-Pres. and Gen. Mgr., Conneaut & Erie Traction Co.

Girard, Pa.

Distribution System of the Philadelphia Rapid Transit Co.

The distribution of power from the generating stations to the sub-stations and to the working conductors of the 555 miles of track now in operation in Philadelphia is made almost entirely through underground cables, which are installed in a network of underground conduits used exclusively by the company for its power and telephone circuits.

The distribution centers consist of 10 direct current generating stations, 4 storage battery stations and 6 rotary converter stations. At the present time there is but one alternating current generating station. This station is at Second St. and Wyoming Ave. and is described on another page. An alternating current generating station on the Delaware River water front is now in the early stages of construction and when completed will have a generating capacity of 55,000 kw. The Glenside sub-station which is typical of the rotary converter sub-station construction throughout Philadelphia has also been described. There are several new sub-stations now being designed and built.

EMERGENCY STATION, 13TH AND MT. VERNON STS.

In the underground distribution system there are over 1,000 miles of cable in use for distributing current used in the railway operation. This cable is laid in vitrified clay ducts which have been adapted as standard for all underground work. These are built in single-duct formation and are surrounded by a protecting wall and bed of cement concrete 3 in. thick. The standard manholes are 9 ft. long and vary in width and depth to suit local conditions of the street and the number and location of the conduits. Terra cotta drain pipes connect these manholes with the city sewerage system. The entire system of manholes is inspected and cleaned periodically. It is a rule of the company that a thorough cleaning shall be given each manhole once every two months.

Each rotary converter sub-station is connected with the generating plant by two or more high potential cables, which are of the three conductor type and vary in size from No. 0 to No. 0000. The insulation on high tension cable consists of a 6-32-in. saturated paper wall around each conductor and a 6-32-in. saturated paper belt around the three conductors which are twisted together. A lead [illegible] phases of the 3-phase alternating current circuits. Before such [illegible] difference of potential.

[illegible] is in use at any one time. Each cable is put into service every other day and is out of service on alternate days; this arrangement protects one cable to each sub-station from any excessive voltage surges that may occur on the system and insures the availability of a second cable in case the cable in use should break down from any cause.

The alternating current cable ducts are carried to the inside of the sub-station and power house walls. The cables emerging from the ducts terminate in cast bronze bells which are supported in the power stations and sub-stations immediately under the oil switches for disconnecting the lines from the stations. Connection is made to the oil switches by means of three single conductor cables insulated with rubber compound 14-32 in. thick and protected by double weatherproof braid. Each of these cables is spliced to one of three conductors of the lead covered cable in the terminal bell.

The high potential line between the Glenside sub-station and Willow Grove Park is carried on cross-arms and wooden extensions placed in the tops of the iron poles used for supporting the trolley spans. This line consists of three No. 0000 7-strand aluminum cables supported by 8-in. triple petticoat brown porcelain insulators. The wires are at the vertices of an equilateral triangle 42 in. on a side. This high tension line makes its entrance to the sub-stations through porcelain wall insulators in the tops of wire towers. In these towers are dead-end strain arms with three insulators for holding each wire. Below the ends of the line wires mounted on the inside walls of the towers are the lightning protective devices.

The standard sizes of direct current cables are 1,000,000, 1,500,000

and 2,000,000 c. m. cross-section. Rubber, jute and paper insulation are in use but the standard cable at present consists of a copper core of the desired cross section insulated by 5-32 in. of saturated paper insulation with a 5-32-in. wall of lead. In power houses and sub-stations this lead covered feeder cable is brought direct to the switch terminals on the board.

The network of trolley wires throughout the entire city is divided by means of line circuit breakers into a large number of independently fed sections, which vary in length of trolley wire fed from 1000 ft. to 5000 ft. Each section has a distinguishing number by

PHILADELPHIA RAPID TRANSIT COMPANY.

13th & Mt. Vernon Sts. Power Station, No. 1.

DAILY FEEDER TEST.

Station Voltage. Date. 190

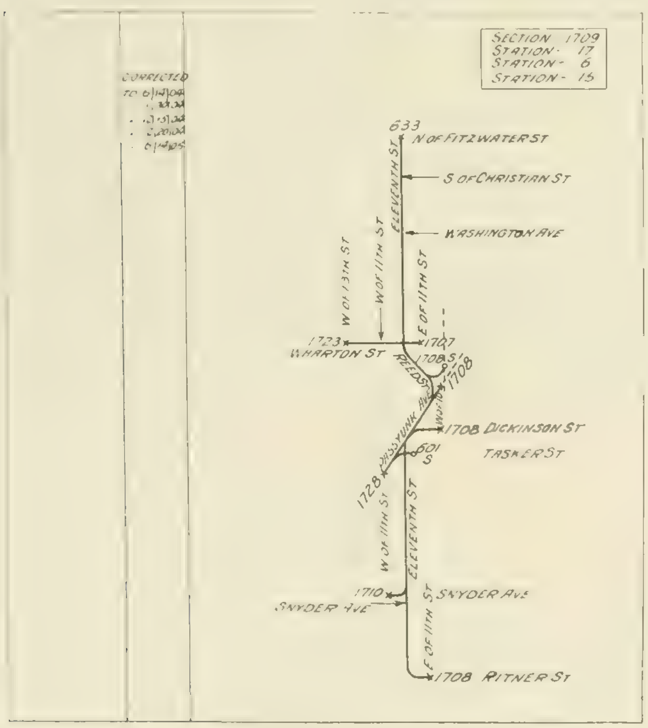
Weather. Voltmeter No.

Feeder	Deflection	Feeder	Deflection	Feeder	Deflection	Feeder	Deflection	Feeder	Deflection	Feeder	Deflection
1		31		55		85		114 s.		136	
2		32		56		86		115 s.		137	
3		33		57		87		115 s		138	
4		34		58		88		116 s		139	
5		34 s.		59		89		116 s		140	
6		35		60		90		117 s		141	
7		35		61		91		117		142	

REPORT OF FEEDER TEST (ORIGINAL 8½ x 14 IN.)

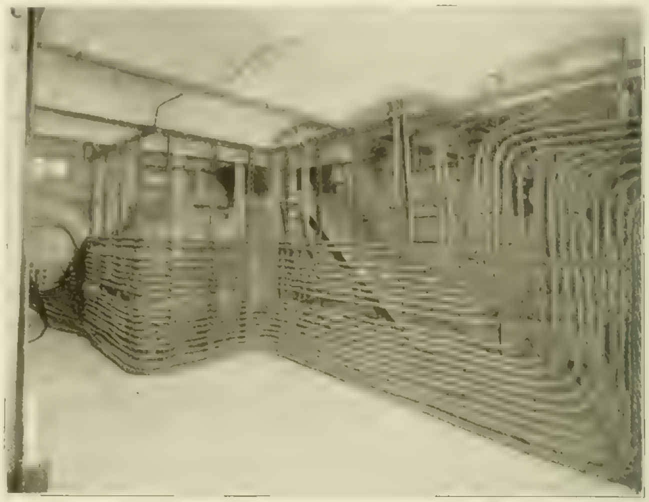
which it is recorded. This number is also given to the cable from the power house which feeds the section and to the feeder tap switches and the feeder switches in the power house. Single feeder cables connect the switches on the switchboard in the power house with each of these trolley sections. Taps from the feeder are taken off throughout the length of the section at intervals of approximately 1,000 ft.

These taps are led from the ducts underground through 2½-in. iron pipe strapped to the iron trolley poles. The cables used for the taps are insulated with 6-32-in. rubber compound covered with



PAGE FROM LINEMAN'S CABLE RECORD BOOK.

⅛-in. lead and the lead is protected with a weather-proof braid. At the top of the feeder poles are mounted cast iron switchboxes. The number of the feeder cable and trolley section is painted in white on the cover of the box. The tap from the underground feeder being brought up the pole in the iron pipe enters the bottom of the switchbox through a bushing. A lug soldered to the end of the cable furnishes the connection with a quick-break, single-pole, single-throw, knife switch in series between the feeder tap and the cable which forms the feed span. The feed-span tap has a similar lug on it and is bolted to the opposite pole of the switch. This tap passes out through the top of the switchbox to the span. From this same lug on the trolley side of the cut-out switch a wire is led downward through a bushing in the bottom of the box to



CABLE RACKS

connect with a lightning arrester clamped to the opposite side of the pole from the switchbox. The feed-span is dead-ended in the eye of a triple globe-strain insulator, which has its remaining eye bolted to the strap iron clamp encircling the top of the pole. The feed span is permanently connected to the trolley wire by a solid metallic hanger and a feed ear.

A lineman's cable book is kept as a method of recording the location and plan of each of these independently fed trolley sections. The pages of this book are blue-printed sheets and are kept in a manner similar to the sample page shown herewith. The size of the pages is 6½ x 7½ in. with a margin of 1¼ in. on the left side for binding after the loose leaf system. On the left of the page is a ruled space ⅝ in. wide in which are noted the dates when corrections have been made to the tracing of which any particular page is a print. In the upper right hand corner of the page appears the characteristic number of the feeder section outlined on the page. The locations of trolley circuit breakers insulating this section from adjoining sections are indicated by crosses and by the larger sized numerals denoting the characteristic number of the adjacent feeder sections with which this section shown could be connected and fed from in case of damage to its own feeder cable. As changes are made in the arrangement of these feeder sections the tracings are corrected and new pages issued to replace the old ones in the existing books. Complete sets of these pages bound in book form are carried on each emergency wagon and are supplied the line superintendents.

Twice each year the crews of the emergency wagons are examined as to their knowledge and familiarity with the topographic and the electric location of the feeder sections throughout the entire city. The percentages received by the linemen in these examinations are published and exhibited on bulletin boards in the emergency houses. Cash prizes are also awarded to those most proficient in these tests. At each emergency station is a general map of the lines, feeder outlay and distribution system. This map is a combination of the data given on the pages of the book as described.

In addition to the feeder cables for the trolley sections numerous tie-line cables are in use between the direct current generating stations. The switchboards of these stations are so arranged that the load may be distributed from any heavily loaded station to other stations connected with it by the heavy tie lines. These lines are especially valuable for maintaining service in case of break downs.

Each day the switchboard operators at the distribution centers take the readings as indicated by the record sheet, a portion of which is

reproduced in these columns. These sheets are printed for each of the power stations and are ruled for recording the voltmeter deflection when placed in circuit with the core of a feeder to the distribution end of which is connected a trolley section. The size of the sheet, only a portion of which is reproduced, is 8[illegible] x 14 in. On it are the characteristic numbers of all feeders coming into this station and opposite the feeder numbers space is left for the daily recording of the voltmeter deflection as read. The average station voltage is recorded at the top of the sheet and also the date, weather and the voltmeter number by which the person calculating the insulation resistance of the feeder can refer to the office records for the internal resistance of the station voltmeter. These daily feeder tests are recorded by the switchboard attendants, forwarded to the superintendent of motive power and after inspection by him are sent to the lines and cables department. By thus recording the insulation resistance of the underground feeders and trolley sections close watch is kept on the condition of all lines and any sudden decrease in insulation resistance quickly noted and disastrous burn-outs averted.

The standard overhead construction consists of a span wire supporting the trolley wire between the tops of two steel poles. These poles are built in sections of 5, 6 and 7-in. steel tubing and a 30-ft. pole weighs not less than 915 lb. At the point on the pole where it passes through the sidewalk a patented reinforcing sleeve 2 ft. long is placed around the tubing which in this lower section is 7 in. in diameter. On the more recently erected poles this tubing is built as a part of the pole.

A number of the lighter poles erected some years ago were not provided with the reinforcing sleeve and have become corroded at the sidewalk line. These poles are now being reinforced while in position. A sleeve 2 ft. long is slipped down over the pole and sunk into the concrete in which the pole is set. The space between the sleeve and the pole is then filled with molten sulphur, after which the concrete is replaced up to the sidewalk line. This method of reinforcing poles has been found to add very largely to their strength and it also adds a number of years to their life.

The standard span wire is a galvanized 7-strand steel cable insulated from the steel poles at its ends by giant strain insulators. A No. 00 hard drawn trolley wire suspended from soldered ears insulated by round top bells is used.

The overhead construction is maintained by the crews of six emergency wagons and two repair wagons. During the summer an additional emergency wagon is used. The emergency wagons are on duty 24 hours every day in the year and extra wagons are available in case of fires or other unusual occurrences. The type of wagon used for emergency work may be seen in one of the illustrations. These wagons are built in the shops of the company and designed to suit its special needs. The wagon consists of a strong running gear and box upon which is a telescopic tower of steel angles. By means of a crank and chains the upper portion of this tower may be raised so that its platform is at the proper height for working on any portion of the trolley wire. The extension [illegible] trolley wire with but little trouble to cars operating on the track, as will be seen from the illustration. Besides the materials for the usual line troubles these wagons carry tools for quick repairs to [illegible] cars.

SETTING POLE WITH TOWER WAGON

A view of the interior of the emergency house at 13th and Mt. Vernon Sts. is shown. The interior arrangement of this building is similar to that of a city fire engine house. The wagons stand on steel tracks near the wide front doors of the building. In the rear of each wagon are four stalls for the horses, two teams being for the day shift and two for the night. The wagons are equipped with drop harnesses. The second floor of this building is fitted up as a rest and amusement room for the crews.

EMERGENCY WAGON, [illegible]

Each emergency station is connected by a direct wire with an emergency dispatcher who has a so-called emergency telephone board in the main offices of the company at Eighth and Dauphin Sts. All reports of broken wires, blockades, fires or car troubles are reported to the emergency dispatcher by employes. He in turn dispatches the nearest emergency wagon to the location of the trouble. The dispatcher keeps a separate record sheet for the trouble calls during each 24 hours, and no wagon leaves its station except on orders from him. On this record sheet are noted the time of departure and number of the wagon sent, the locality and the nature of the trouble. When the crew returns to its station the time is also noted.

In connection with the underground feeder system the company has installed in its underground conduits about 60 miles of telephone cables. The cables center at an exchange in the general office building of the company at Eighth and Dauphin Sts. The switchboard for this exchange connects about 300 telephone instruments located in different parts of the city. This board and the emergency dispatcher's board are located in adjacent rooms. Ten trunk pairs connect the branch exchange of the Philadelphia Rapid Transit Co. with the central office of the Keystone Telephone Co. which has a large system throughout Philadelphia. All car barns, car houses, store rooms and shops are connected directly to the branch exchange. At important street intersections about the city small telephone sets enclosed in cast iron boxes are mounted on trolley poles and connected with the company's branch exchange at the general office. Street superintendents are provided with keys for these telephone boxes and in this way keep in touch with the emergency dispatcher as to the location of any trouble which may occur.

Glenside Sub-Station.

The construction of the new Glenside [illegible] from Chelten Ave., near the north boundary of the city, to the Philadelphia Rapid Transit Co's. Willow Grove Park made necessary the erection of a new rotary converter sub-station. The Glenside sub-station, located at about the middle point of the new line, is typical of the design of the several rotary converter sub-stations recently built by this company. The building faces the tracks and the exterior is of very pleasing appearance. Strict care was exer-

EXTERIOR OF GLENSIDE SUB-STATION

cised in the design and construction so that the building is entirely fireproof with the exception of the doors and window framing. The exterior design is artistic with walls of rough cut gray stone and tooled stone sills, cornices and copings.

The roof of the main portion of the building is of reinforced concrete with a covering of slag and was designed for a load of 80 lb. per sq. ft. From some of the accompanying interior views an idea may be gained as to the appearance of the reinforced concrete beams used for supporting the roof and floor. The main portion of the building containing the rotary converters, transformers and switchboard is 32 ft. 10 in. wide by 76 ft. long. Its clear height between the machine floor and the lower side of the roof girders is 22 ft. The interior is lighted by five large arched windows of frosted glass in the south side of the building and five large windows in the north wall above the crane runway.

This crane, which spans the machine room, is of 15-ton capacity. It is equipped with three motors. These are controlled by six ropes connected to the switches on the crane and provided with handles at a suitable elevation above the floor so that the operator can start and stop the motors from the floor. Thus no crane cage is required. The rails over which the crane runs are mounted directly upon reinforced concrete girders forming a part of the wall system of the building. In order to facilitate the handling of materials delivered in wagons to the sub-station, the floor directly in front of the large arched entrance is depressed to the level of the ground outside. With this arrangement a wagon can be backed part way into the building and its load lifted off by the overhead crane.

The opening of this arched door is closed by two ornamental oak doors hanging from a steel runway on the interior of the building. The smaller door in front of the building has an ornamental iron gate which opens into a vestibule. The walls of this entrance are of gray brick.

Adjacent to the north side of the main bay of the building is the bus-bar and oil-switch room, 15 ft. 6 in. x 61 ft. in size. A line of five ornamental brick columns between the two rooms furnishes the support for one of the crane girders and the wall above. A chain operated crane of one ton capacity spans this portion of the building. This crane is used in handling the heavy parts of the oil switches, potential transformers, etc. The vestibule, earlier mentioned, occupies a portion of the front of this bay. This leaves a space between the vestibule and building wall for a washroom 4 x 10 ft. in size.

Adjacent to the north side of the building and with its center 23 ft. back from the face of the building, is the wire tower for the exit of the high tension feeders and for the accommodation of the lightning protective devices.

The interior of the sub-station, whose walls are largely built of concrete, is tinted white. A wainscot of red pressed brick extends around the lower portion of the walls to a height of 7 ft. At the left of the main entry way an opening in the floor covered with removable iron gratings was provided so that any large apparatus,

BASEMENT, SHOWING FLOOR CONSTRUCTION AND THE CABLE SUPPORTS.

such as air fans, etc., may readily be lowered to the basement by the overhead crane. In this corner of the room are built a telephone booth and lockers of a pleasing design, using green-toned oak similar to that of the sliding doors of the main entrance nearby.

The basement occupies the space under the entire building and has a clear height of 8 ft. from the floor to the lower side of the machine floor girders. This basement is divided into two parts by the air chamber, which is 6 ft. wide, and extends from the rear nearly to the front of the basement. At the front end of the air chamber a steel door is fitted into the brick walls which form this chamber. A concrete-steel stairway leads from the basement to the floor above. An accompanying view shows the concrete construction of the machine floor as seen from the basement. In place of the usual box form of rotary converter foundations, each machine in this sub-station stands directly over a single reinforced-concrete column. These columns also carry their share of the other load upon the machine room floor. Openings are provided in the floor near the tops of the columns so that any dirt dropping inside the bed of the rotary may easily be brushed or will fall onto the basement floor.

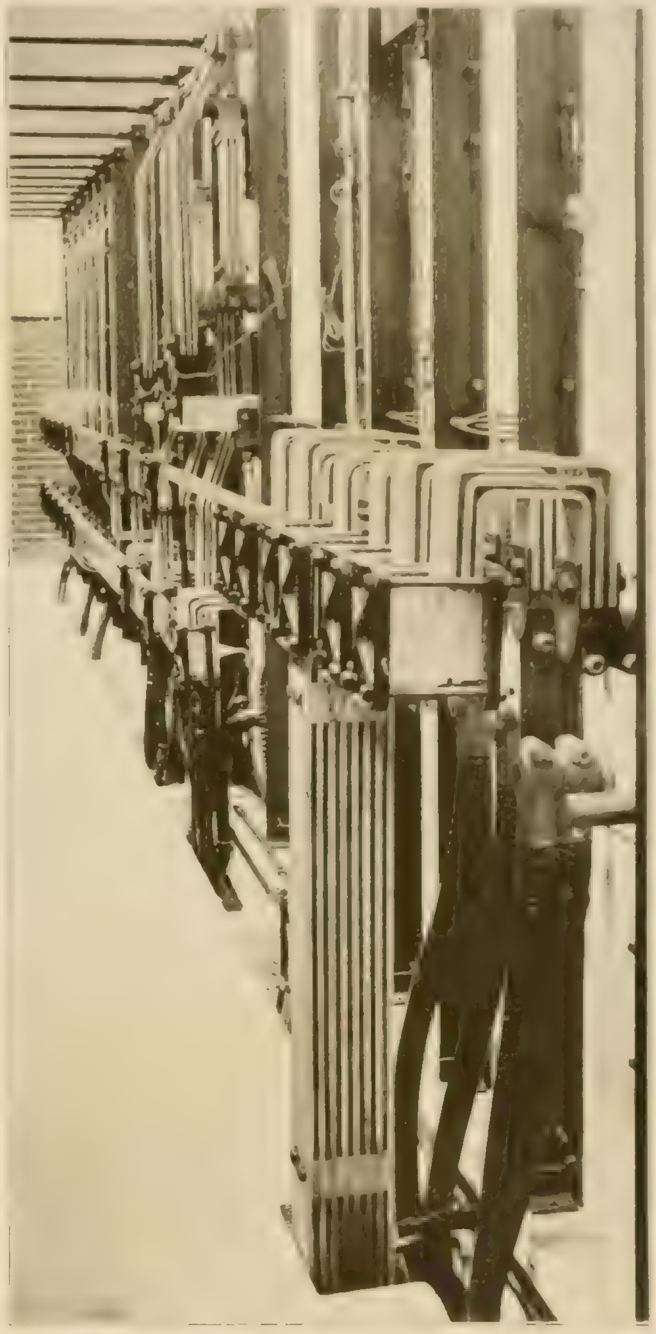
Current is transmitted through three underground cables from the generating station at Second St. and Wyoming Ave. to the Chelten Ave. sub-station, a distance of 27,000 ft. From the Chelten Ave. station to Glenside, a distance of 25,000 ft., there are two standard underground cables. The cables consist of three No. 00 7-strand copper conductors, each insulated with 6-32-in. of paper with a 6-32-in. belt of paper enclosing the three separately insulated conductors. This core has a protecting covering of lead 5-32 in. thick.

The feeder cables enter the sub-station from the conduits and are carried in terra cotta ducts along the north wall of the basement under the bus-bar compartments. These ducts are laid on a concrete bracket forming a part of the north basement wall. Nearly under the feeder switches which stand on the floor above, the ducts terminate and standard insulating terminal bells are used as outlets for the three conductors of the cables. Each of the three conductors rises to a separate duct-way formed in the concrete floor of the bus-bar room. These duct-ways which have removable slate covers contain the current transformers. From the current transformers the high-potential leads connect to G. E., Form H3, Type-FE oil-switches, whose three separate compartments are built as a part of the bus-bar chambers which extend throughout the length of the north portion of the sub-station and are at the level of the machine room floor. From the opposite side of the oil-switches, connections are made to the bus-bars by leads which pass through individual compartments to the disconnecting switches placed in separate brick and soapstone cells on the machine side of the bus-bar compartments and opposite the oil switches just mentioned. One of the illustrations shows the details of construction of the bus-bar compartments and the method of mounting the copper 3/8 x 2-in. strips of which the bus-bars consist. This view also shows the three sectionalizing switches which add to the flexibility of the bus-bar connections and are placed between the machine switches seen at the sides of the picture. The two potential transformers are shown standing on the top of the upper bus-bar compartment with their 3-pole double-throw instrument switch. In case of trouble this switch furnishes a means of quickly connecting the voltmeter and synchronizer with either one of the potential transformers.

These bus-bar compartments are of red pressed brick laid in white cement mortar with horizontal slabs of soapstone forming the horizontal barriers. The copper bus-bars are supported on glass pedestals to which they are held by specially designed clamps. The front of the compartments is closed by doors of asbestos lumber framed in wood and so designed that they hang upon an angle iron extending along the front edge of the top of the upper cell. Similar doors are used to complete the oil-switch cell enclosures. The machine switches are of the remote-control motor-operated type, similar to the feeder switches, but placed on the opposite side of the bus-bar compartments and connected to the bus-bars in a similar way but with a position exactly the reverse of that of the feeder switches.

The storage battery cells for operating the oil switches are placed in the battery compartment shown in the basement view, which is built of brick with soapstone shelves and wooden doors. It encloses 26 "Chloride Accumulator" [illegible] mounted on glass [illegible].

There are [illegible] compartment and three on the [illegible] side. [illegible] has been explained [illegible] the third is for the [illegible] feeds the Willow Grove [illegible]. This latter mentioned switch is directly opposite the base of the wire tower shown in the [illegible].

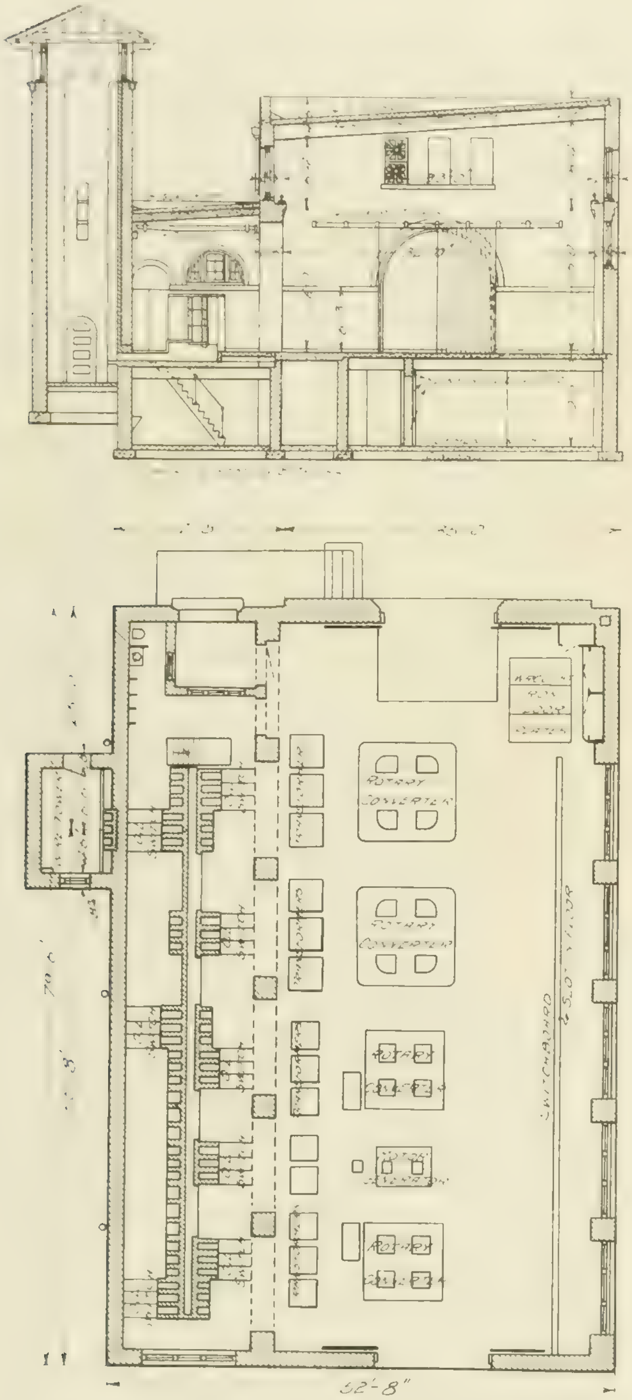


REAR VIEW OF SWITCHBOARD

From the lower side of the switch the high-potential wires are carried in separate duct-ways through the floor and building wall into the base of the wire tower. The entry through the wall into the wire tower is made by means of three Locke wall insulators set into the stonework. From the wall insulators each phase rises in a separate brick compartment to a Type-7, Westinghouse choke coil. These coils are held on a wooden rack supported by standard line insulators. Above the choke coils No. 0000 aluminum wires rise in the three separate cells to connect with the high-potential wires brought in from the out-of-door line through Locke wall insulators.

[illegible] is clearly shown in the exterior view of the [illegible] station. Above the choke coils, taps are made from each phase to a bank of Westinghouse low equivalent lightning arresters mounted on the wire tower wall opposite the choke coils.

Between the bus-bar compartments and the rotary converters are the Westinghouse air-blast transformers; these stand over openings in the machine room floor. The floor here is 8 in. thick and forms the ceiling of the air chamber. There are at present installed 2 sets



[illegible] STATION, VERTICAL SECTION AND FLOOR PLAN.

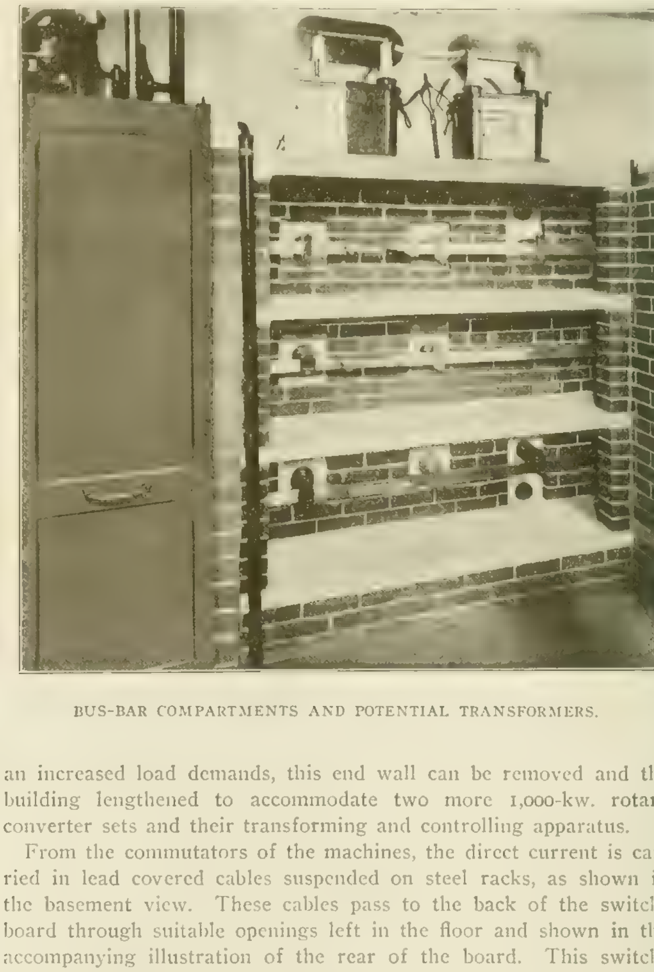
of three 175-kw. transformers, 1 set of three 375-kw. transformers and 1 set of two 37.5-kw. transformers.

Air for cooling the transformers is blown by two Sturtevant fans, as shown in the basement view. These fans are six feet in diameter and each is direct connected to a 13-h. p., Westinghouse Type-C induction motor, controlled by an auto-starter mounted on a slate panel forming a part of the fan-set foundation. A set of transfer switches is placed on the basement wall nearby, and these switches are so connected that either one of the fan motors may be thrown on the low potential side of any single set of machine transformers.

From the secondary side of the machine transformers the low potential current is led through two cables for each phase passing through terra cotta ducts in the floor and emerging within the enclosure of the rotary foundations. There are three 25-cycle Westinghouse rotary converters, one of 1,000 kw. capacity and two of 500 kw. capacity. These rotaries are shunt wound and are provided with ball end play devices.

A motor generator set, the motor of which takes its current from the two smaller capacity transformers earlier mentioned, is provided for generating direct current to be used in starting the larger rotaries when 600-volt direct current is not available from the line side of the switchboard. This starting set consists of a Westinghouse Type-C, 75-h. p., 710 r. p. m. induction motor direct connected to a Westinghouse 45-kw., 600-volt direct current generator. A 75-100-h. p. auto-starter controls the induction motor of this set.

There is sufficient room in the front end of the building and provision has been made for the addition of another 1,000-kw. rotary converter set. The rear end wall of the building and the bus-bar compartment and switchboard are designed so that if at any time



BUS-BAR COMPARTMENTS AND POTENTIAL TRANSFORMERS.

an increased load demands, this end wall can be removed and the building lengthened to accommodate two more 1,000-kw. rotary converter sets and their transforming and controlling apparatus.

From the commutators of the machines, the direct current is carried in lead covered cables suspended on steel racks, as shown in the basement view. These cables pass to the back of the switchboard through suitable openings left in the floor and shown in the accompanying illustration of the rear of the board. This switchboard, of which both front and rear views are shown, stands parallel with the south wall of the building and has its connections well lighted from nearby windows.

Commencing from left to right the first panel contains the controlling switches for the lighting and auxiliary apparatus. Six quick-break, single-pole, single-throw switches at the bottom of the panel are so connected that the auxiliary apparatus may at will be fed from any one of the rotaries that may be in operation, or from either one of the two direct current bus-bars. This feeding circuit is then divided by four similar but smaller switches which control the current for the overhead crane, air compressor motor, station lighting, etc. Each of these circuits is protected by a G. E. magnetic blow-out circuit breaker. The lighting circuit is again divided for convenience into eight circuits, controlled by eight small quick-break knife switches on this panel. These lighting circuits are also provided with four small G. E. magnetic blow-out circuit breakers.

The next panel controls the storage battery and [illegible] at its top on an edgewise marble panel a G. E. [illegible] indicator, lamps and two alternating current [illegible] nected that one indicates the difference of potential across the [illegible] tension bus bars and the other indicates the difference of potential across the terminals of the machine which is being started. The lower portion of this panel, as stated, is for the battery control and is fitted with a G. E. magnetic blow-out circuit breaker, Weston voltmeter, Weston ammeter, main switch which connects the battery terminals to the oil-switch control buses and a battery charging switch. This charging switch is arranged to place the basement lighting circuits in series with the battery cells so that a special battery charging resistance box is not required.

The next two panels are for the control of the [illegible] feeders, one of the panels being designed to handle two incoming feeders and the other panel to handle the two outgoing feeders. Each circuit is provided with a Thompson ammeter, time limit relay, a single pole double throw remote control switch. The upper position of this control switch closes the oil-switch and the lower position opens it. The position of the oil switch is indicated by the illumination of a green or a red glass pilot set in the face of the panel.

Next are two machine panels now in use and a blank panel for future use. The machine panels have G. E. time-limit relays, power factor indicators, ammeters, synchronizing plug sockets and oil switch control switches. On one of these panels is a push button which is so connected with the trip on the circuit breaker of the direct current starting panel that this breaker may be instantly tripped at the moment when the starting machine is up to synchronism and is being thrown onto the alternating current buses.

A single panel for the control of the motor-generator starting set occupies the next position in the board. This panel is fitted with a Thompson ammeter, Weston voltmeter, G. E. time-limit relay, oil switch control switch and the field rheostat for the direct current generator of the starting set.

The next three panels are fitted with the negative switches of the rotary converter and there are also mounted on these panels an alarm gong connected with the direct current circuit breakers, a recording direct current voltmeter and several small disconnecting knife switches for the instruments on these panels. From a horizontal tubular support extending from the top of the center one of these three panels are supported an illuminated-dial Weston station voltmeter and an illuminated-dial Weston differential voltmeter.

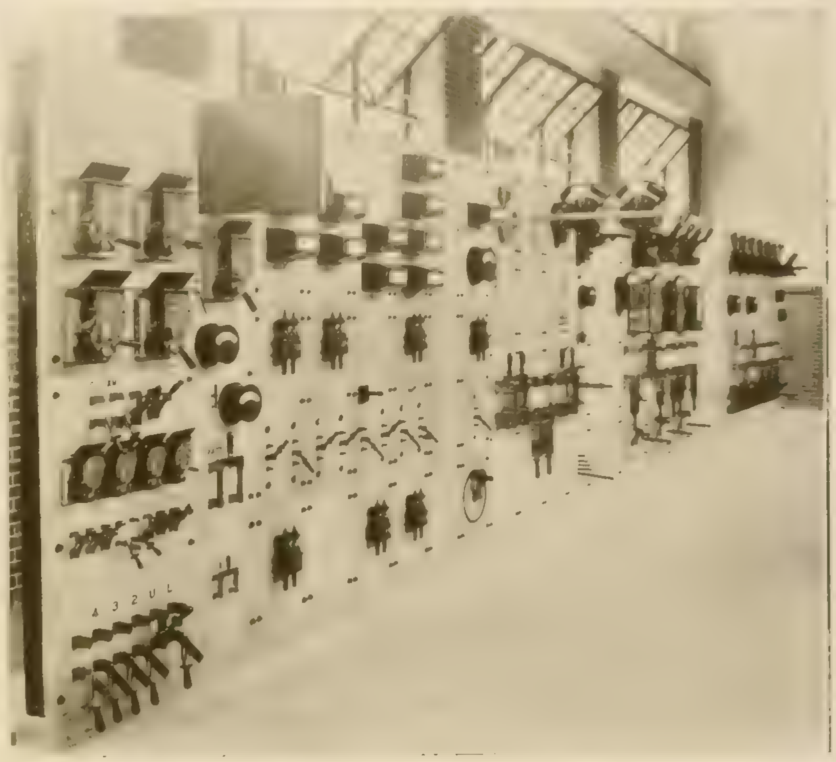
The next is the direct current starting panel and upon it are mounted an I-T-E circuit breaker, Weston ammeter, a wheel switch for connecting the differential voltmeter with the bus-bars or any single machine and a single-pole double-throw switch for connecting this panel with the bus-bars for starting or with the feeders from the starting set if there is no direct current available on the feeder or machine buses. At the bottom of this panel is the switch for controlling the starting resistance in series with the brushes on the direct current side of the rotary which is being started.

The next six panels are the direct current machine panels, three of which are now equipped. That panel controlling the 1,000-kw. rotary has an I-T-E circuit breaker with a reverse-current relay attachment and alarm-bell contacts. Under this are a Weston ammeter, a Thompson recording wattmeter, main switches for conecting the rotary with either one of two bus-bars, a 4-point field switch, the points in their order being "off," "discharge," "separately excited" and "self excited." On the bottom of the panel are the field resistance switch and a single-pole, double-throw starting switch in series with the resistance controlled by the switch on the starting panel. The other two machine panels are similar to the one just described, except that the circuit breakers and instruments are designed for the 500-kw. rotaries with which they are connected.

Next are six direct current feeder panels each arranged for con- [illegible] switch. This switch connects the feeders to either the upper or [illegible]

[illegible] lighting feeder circuits which furnish current for illuminating portions of the right of way. This panel is fitted with 2 I-T-E circuit [illegible] current bus bars.

[illegible] chine-conductor construction. These buses are all strap aluminum [illegible]



SWITCHBOARD, [illegible] SUB-STATION.

switches by specially designed copper lugs. The contact areas of these connections were calculated for a current density of 100 amperes per sq. in. from copper to copper and 50 amperes per sq. in. from copper to aluminum. The large negative bus shown in the foreground is made up of eight bars of aluminum 5 x 3/8 in. in section. This bus stands upon the basement floor. At its base are connected the four 1,000,000-c. m. bare copper cables which join the switchboard with the track. The positive feeders are of the company's standard type and after passing through the hole in the floor back of the board are carried on a steel cable rack to the entrance of the underground feeder ducts which parallel the track. The telephone cable which is of the standard lead covered type is also brought into the sub-station in one of these underground conduits and has its pairs distributed on a terminal board mounted on the foundation wall directly under the telephone booth. All the auxiliary wiring in this station such as light, battery, air compressor motor and crane circuits is carried in steel conduits bedded in the concrete structure. The compressed air supply pipes which have outlets at convenient points throughout the building are also imbedded in the concrete floor and a neat concrete base is provided near the entrance of the building for the National Electric Co. air compressor set. Underneath the switchboard on a steel rack are Garton lightning arresters for the protection of feeder circuits.

It will be noted that this sub-station and its switch-board do not follow the standard design of any manufacturer, but were arranged to suit the needs of the Philadelphia Rapid Transit Co. The design and erection of this sub-station and the plans for the arrangement of its apparatus were executed by the company's engineers.

Glenside Line and Willow Grove Terminal.

The Glenside line to Willow Grove Park starts at Hancock St. and Lehigh Ave., running west on Lehigh Ave. to 17th St., thence north to Chelten Ave., and from Chelten and Ogontz Aves. follows a northerly direction through Glenside and Crestmont to Welch Road where it unites with one of the tracks of the York Road line from the city and continues as three tracks along the private right of way to Willow Grove Park.

The distance from Lehigh Ave. to Willow Grove Park by way of the new Glenside line is about ten miles. That portion of this distance within the city of Philadelphia and some of the more thickly populated suburbs is built according to the Philadelphia Rapid Transit Co's. standard track specifications, with the 137-lb. beveled-head girder rail section. This type of construction uses the composite riveted-zinc joint with this type of heavy rail supported on yellow pine cross-ties 5 x 9 in. x 8 ft. in size. A special form of rail brace is used on every third tie to serve the purpose of the ordinary tie-rods. Wherever this type of rail and substructure are used on the Glenside line the space between rails and the devil strips are paved with brick. The gage is 5 ft. 2¼ in., the same as is used throughout the city of Philadelphia. The paved portion of the track is laid with 9-ft. 8-in. track centers.

GENERAL VIEW OF TERMINAL WILLOW GROVE PARK.

That portion of the Willow Grove track not in the paved streets is built with 90-lb. A. S. C. E. section rail joined with 6-hole angle bars and 8-in., No. 0000, "Protected" rail bonds, one to each joint. The rails are supported by 5 x 9-in. x 8-ft. sawed yellow pine ties bedded in rock ballast which extends to a depth of from 12 to 15 in. below the bottoms of the ties. The unpaved portion of the track is built with 12-ft. centers. This spacing of tracks allows room for a drainage ditch which, in those portions where the grade is at all heavy, is paved with Belgian blocks. Drainage for this ditch between the tracks is furnished by outlets of sewer pipe at frequent intervals. An accompanying illustration shows a portion of this track as built on a curve. At those points where the right of way is intersected by highways the crossings are paved with brick. One of the illustrations shows such a crossing where this line is intersected by the Old York road. All curves of short radius have both rails guarded with the Pennsylvania Steel Co's standard Z-bar section.

A portion of the line which is outside of the city limits is built upon a right of way which approximates 70 ft. in width for the entire distance. Care has been taken that the curvature be as small as possible and the grades as light as the hilly nature of the country traversed would allow. For a greater portion of the distance the right of way has been graded and surfaced to furnish a driveway on either side of the tracks and between the trolley poles. The waterways intersected are crossed by combination brick-stone culverts.

As the roadbed is 70 ft. wide on top it will be seen that the amount of earthwork necessary to obtain a low gradient is quite large. For those portions where the track follows the city's location and is in the center of a street or proposed street it was necessary for the company to pave the entire street from curb to curb with brick. The company is also obliged to maintain this pavement.

The working conductor of this line consists of a single No. 00 hard drawn copper wire, round in section and supported by soldered ears hung from round top bell insulators. The span wires are of 5-16-in. stranded steel. On the straight-line construction the span wires are attached to the poles by two globe insulators in series bolted to the collars which clamp about the poles. These poles are of the company's standard steel type with a reinforcing collar at the base. This reinforcing collar extends a short distance above the surface of the ground and into the mass of concrete in which the poles are set. On tangents the distance between poles is 100 ft.

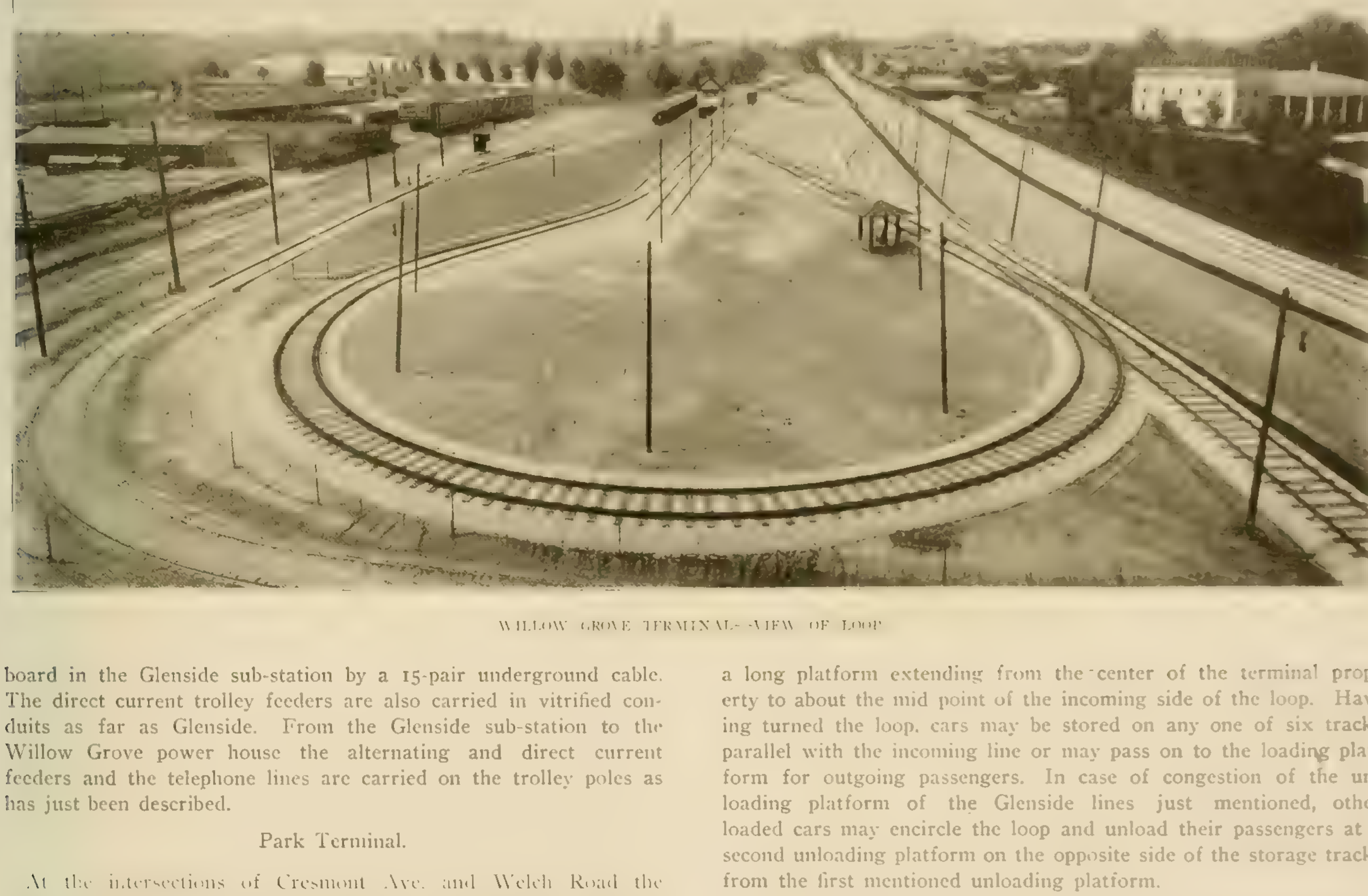
From the Glenside sub-station which feeds part of this line, a high-potential 3-phase overhead line is carried along the right of way from this rotary converter sub-station north to a second sub-station in the direct current power house at Willow Grove Park. This high potential line consists of three No. 0000 stranded aluminum conductors spaced 42 in. apart at the vertices of an equilateral triangle. The conductors which carry current at 13,200 volts are supported on 8-in. triple-petticoat Thomas insulators.

The insulators in turn are supported by wooden pins 1½ in. in diameter, the upper ones of which are fitted into wooden extensions inserted in the tops of the poles. The two lower wires are supported by a wooden cross-arm clamped to the extension. On the same pole as the high tension line and at a point about 18 in. below the pin wire supports are cast-iron cross-arms which carry the glass insulators for supporting a feeder line supplying current to the arc and incandescent street lights with which portions of the right of way are illuminated. On the line of trolley poles opposite those carrying the high-tension line and arc light feeders are two cross-arms; the upper one is of iron construction and supports the direct current cables which supplement the trolley wires from the sub-station northward, and the lower cross-arm which is of wood furnishes a support for the company's telephone wires to Willow Grove Park. There are four pairs of telephone lines carried on these arms, two above the cross-arms and two below. The type of insulator for supporting these wires is from a design specially made for the Philadelphia Rapid Transit Co. An accompanying illustration shows this design as made with one section for the insulator on the top of the cross-arm and another section for the insulator which is bolted up against the bottom of the cross-arm. The telephone lines from the company's city offices are carried to a

of way. After [illegible] two [illegible] a public [illegible] the terminal property [illegible] Germantown Turnpike.

One of the [illegible] with their adjacent platforms as viewed from an elevation near this latter mentioned curve. From the end of the curve at the entrance to the terminal the three tracks entend as tangents along the length of two [illegible] steel construction with braced steel posts bedded in concrete extend throughout the length of the platform space and between the tracks. The two platforms mentioned are for loading the outgoing cars and as the middle track is an incoming line the fences serve the double purpose of keeping the crowds on the incoming cars from interfering with cars being loaded and preventing people from crossing from one platform to the other except by means of the subway shown on the map of the terminal.

The incoming line passes between these two steel fences and down the middle of the terminal property to a loop which is shown in one of the illustrations. The loop [illegible] of 60 ft. Incoming passengers from the Glenside line are unloaded at



WILLOW GROVE TERMINAL—VIEW OF LOOP.

board in the Glenside sub-station by a 15-pair underground cable. The direct current trolley feeders are also carried in vitrified conduits as far as Glenside. From the Glenside sub-station to the Willow Grove power house the alternating and direct current feeders and the telephone lines are carried on the trolley poles as has just been described.

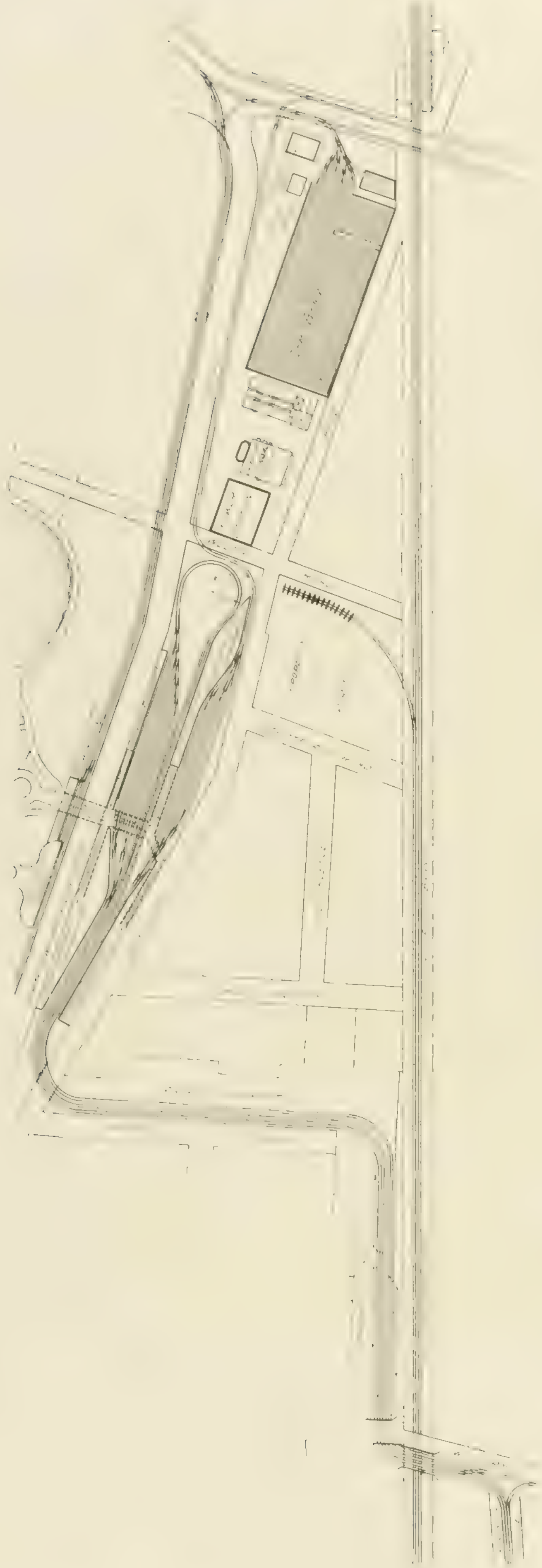
Park Terminal.

At the intersections of Cresmont Ave. and Welch Road the double tracks of the new Glenside line turn to the left. At this point these two tracks are paralleled by a third track which is used by the cars of the York Road route, leaving the parks for the city. While in ordinary operation no interchange of cars takes place between the two lines, yet at this street intersection mentioned a connecting curve and also a cross-over join the tracks of the two routes as may be seen in the map showing the general track outlay at the Willow Grove terminal. A short distance from Cresmont Ave. the three tracks turn to the north passing over a three-track steel girder bridge which spans a branch of the Philadelphia & Reading Ry. Near this point the Welch Road crosses over the electric tracks on a steel bridge. The foundations of this bridge are of concrete and extend along the sides of the right of way as retaining walls for the sides of the cut in which the tracks make their curve in order to parallel the steam railroad right

a long platform extending from the center of the terminal property to about the mid point of the incoming side of the loop. Having turned the loop, cars may be stored on any one of six tracks parallel with the incoming line or may pass on to the loading platform for outgoing passengers. In case of congestion of the unloading platform of the Glenside lines just mentioned, other loaded cars may encircle the loop and unload their passengers at a second unloading platform on the opposite side of the storage tracks from the first mentioned unloading platform.

As shown on the map the cars coming to the park from the city over the York Road route enter the terminal property at the opposite end from the Glenside route, crossing the steam railway track near its Willow Grove station, turning around the company's car barn and shop building and by means of a reverse curve across the new Welch Road in front of the power station reach the side of the unloading platform opposite that used by the incoming Glenside lines. Here are also five parallel storage tracks where extra cars may be stored or where through cars may pass on to the loading platform of the outgoing York Road lines.

These several platforms are constructed of red brick with a concrete curb extending along the track. Steel fences prevent the crowds moving except by way of the proper passages. Ornamental brick posts are built at the corners of the platforms and a concrete retaining wall extends along the Davisville side of the terminal



WILLOW GROVE LAYOUT

property with [illegible] slightly above the unloading platform. These four similarly built platforms, two of which are used for loading and two for unloading, are so enclosed by the fences that entrance may not be gained to them except by means of a large tunnel and inclines from the tunnel to the platform level. This tunnel has its portal inside the limits of the park proper and at the intersection of several broad avenues near the music pavilion. The portal [illegible] with long ornamental brick retain-

BRICK PAVED HIGHWAY CROSSING.

ing walls is shown herewith. This tunnel extends from the portal near the music pavilion, under the tracks of the Doylestown and Hatboro lines, the Germantown turnpike and the several storage tracks of the Glenside and York Road lines. The walls of the tunnel are of concrete, the roof is of reinforced concrete and the floor is paved with red brick. From the portal to the farther end of the tunnel a fence of steel rods divides the passageway into halves thus separating the incoming passengers from those going to the loading platforms. The several platform's are connected with the main tunnel each by a separate incline of low gradient with its portal in the side wall of the tunnel and its exit at the platform surface. The general arrangement of the tunnel and the

PORTAL AT WILLOW GROVE TERMINAL.

inclines may be seen from the accompanying map of the terminal tracks.

At the end of the larger unloading platform and near the center of this terminal is a rest house for the use of railway employes.

The double-track line from Doylestown and Hatboro which serves the park from the north enters it parallel with the west side of Germantown Ave. The terminal for this line is separate from that of the city lines and is located in the park proper directly across Germantown Ave. from the large terminal and near the

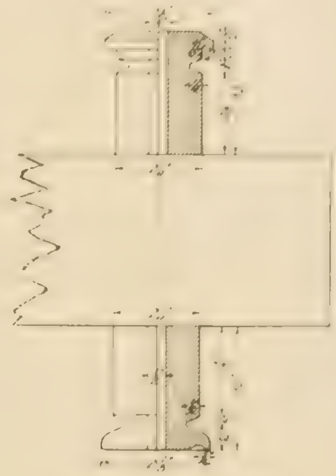
portal of the tunnel which serves the city line platform. As there is but one line of cars using the Doylestown and Hatboro terminal such an elaborate layout as has been described for the city lines is hardly necessary. The cars enter the park on one of the lines and on reaching the terminal building outlined on the map unload and reload in this same platform. When reloaded they pass to the outgoing one of the two tracks by means of a cross-over at one end of the terminal. For the convenience of visitors a large shelter shed has been built along the side of the tracks so that protec-

STANDARD UNPAVED ROADWAY AND TRACK.

tion from rain will be afforded a large number of passengers at one time. At the point where these tracks leave the York Road and enter the park near the car barn, a Y connects this line with the York Road line and with leads to the car barn and shop tracks.

As may be seen in the illustrations, the track work of the Willow Grove terminal has been built in a thorough and substantial manner. The same section of rails and the same sized ties spaced 2 ft. between centers are used for the terminal construction as in the construction of that part of the Glenside line occupying private right of way. A generous amount of rock ballast neatly shaped on the single track portions and flush with the tops of the ties in the storage yards completes the roadbed. All curves are guarded with the Pennsylvania Steel Co's. Z-bars which are bolted to the running rails and spiked to the ties.

The special work throughout this terminal was made by the Lorain Steel Co. Manganese-steel T-rail spring switches are used, sections of which are shown in one of the line drawings. In this the section AA' is 6 in. from the switch point; sections B and B' are 9 ft. 8 in. back and sections C and C' are 20 ft. 6 in. back of the point. The tongues are of cast manganese steel of such shape that they serve not only as the T-rail split switch tongue but also furnish a guard throughout the length of the tongue. The casting of the tongue and guard in one piece [illegible] the strength of the switch point. The groove between the [illegible] proper and the guard was designed to accommodate the flanges of M. C. B. standard wheels. Both rails of the switch curves are guarded with the standard Z-bar construction and the frogs are made up of short sections of manganese steel T-rail. [illegible] to the storage portions of the terminal where there are several switches from the ladder track to the parallel storage tracks small pavilions shelter the sets of levers by which these switches are operated. The pipe rods connecting the levers in the pavilions with the switch stands are mounted on concrete pedestals parallel with the track. Low switch stands with target lights are used.

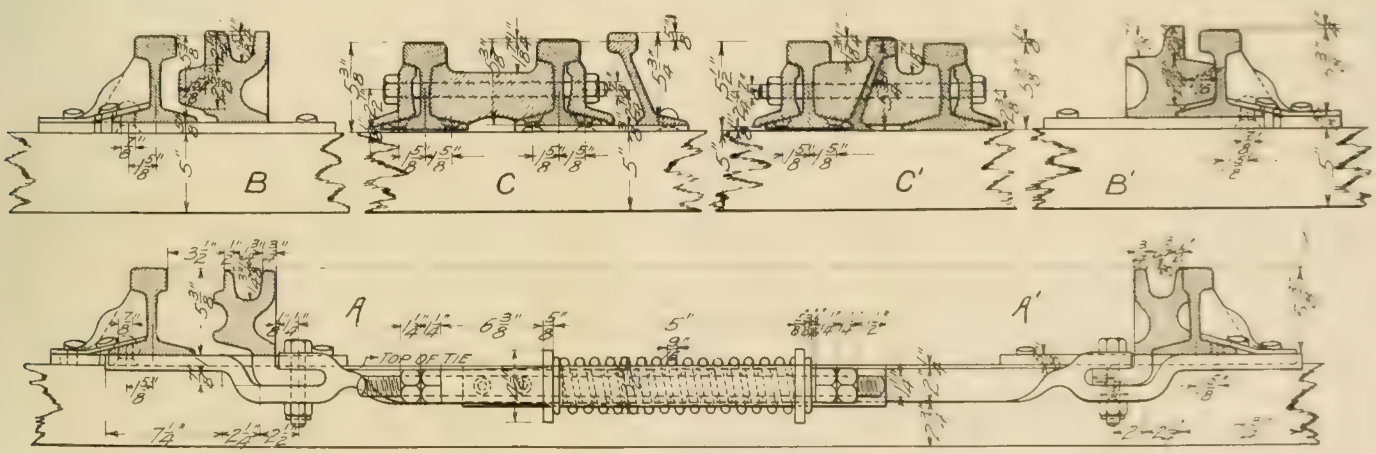


TELEPHONE [illegible]

Willow Grove Park.

Situated in Montgomery Co., 13 miles northward from the center of the city and at the terminus of six lines of cars reaching it over three separate routes, is the Philadelphia Rapid Transit Co's. Willow Grove Park. The limits of the park enclose an area of more than 100 acres whose natural beauties, enhanced by many artistically constructed buildings and much landscape gardening, make this park an ideal outing place. The electric railway terminal for unloading and loading the passengers to and from this park is worthy of special note and is elsewhere described in connection with the new Glenside route from the city limits to Willow Grove Park.

The superior quality of the music offered the visitors at the park is considered one of its chief attractions. This year concerts were given by the following well-known musical organizations: Sousa's Band, Herbert's Orchestra, Conway's Ithaca Band, Wheelock's Indian Band, Damrosch's Orchestra. The concerts are held in a large open air pavilion provided with a sound reflector and seats for 4,000 people. Outside of the roofed portion of the pavilion the sloping side hill furnishes an excellent location for



MANGANESE SPLIT SWITCH, GLENSIDE TERMINAL.

[illegible] additional seats arranged in the [illegible] of an amphitheater. The music pavilion is just south of two lakes which are in the north part of the park. This location affords an excellent view from the pavilion of the large electric fountain built in the center of the nearby lake. The programs of the concerts are so conducted that intermissions are included during which times the visitors are entertained by displays of the electric fountain. About the borders of these lakes is built a substantial stone retaining wall. Along the line of the wall are frequent lamp posts surmounted by frosted glass spheres enclosing clusters of incandescent lamps. These lamps illuminate the surface of the lakes and the paved paths which surround both lakes. Restaurant service is provided in a casino standing on an elevation so that from the broad porches, where tables are set as well as inside the casino, visitors have a commanding view of the lakes and other portions of the park. There are two well appointed lunch cafes, one in the upper part of the park where the amusements are located, and one in the lower part overlooking the lake and in full view of the electric fountain.

In the center of the large lawn which occupies the middle portion of the park is the ladies' building. This building is of ornamental design with large Moorish porches on either side. The porches are well supplied with comfortable rocking chairs for the use of ladies and children only. The administration building is a

WILLOW GROVE PARK, SHOWING SCENIC RAILWAY, FLYING MACHINE AND ADMINISTRATION BUILDING.

pretty structure of brick and stone fashioned after the colonial style of architecture. In this building are the offices of the park superintendent and park physician; the services of the latter are at all times at the command of the patrons. A corps of uniformed guards is maintained whose duties are to direct visitors, provide for their comfort and safeguard them from any unnecessary inconvenience.

On the left of the accompanying illustration may be seen the administration building. To the right of this is the "Captive Flying Machine." The operating parts of this machine are built entirely of steel. Briefly described, it consists of a central portion or tower of lattice-steel construction mounted on a step bearing. From the top of this tower extend steel cables supporting the diverging ends of 10 inclined lattice-steel struts whose bases are nested about the middle point of the vertical pedestal. From the end of each of these inclined arms is hung by slender steel cables an ornamental boat provided with cross-seats, protective rails and a wind shield. Each boat has a seating capacity for 10 people. The tower and its hanging "Airships" are revolved by an electric motor enclosed in the base of the tower and controlled by switches and a starting rheostat on the ornamental marble panel near the center of the loading platform.

The park illustration includes a view of a portion of the "Mountain Scenic Railway." Three-car trains, each car seating 10 people which are loaded and unloaded in the shelter pavilion shown in the foreground, operate at regular intervals over the tracks on the mountain. Each train is in charge of a gripman who controls its speed by means of proper grip levers and brakes. A car is first drawn by the cable in a circuitous route around and up the mountain until the summit is reached, from which point a fine view of the entire park and surrounding country is available. Then the cable is slipped and the car descends the mountain side, gaining speed as it approaches the bottom, at which point it passes to the tracks of a scenic railway extending to the right of the mountain. After traversing the scenic railway, the train again ascends the mountain on an incline and descends by a very winding route to the pavilion shown in the illustration. It is interesting to note that a complete set of electrically operated block signals control the position of these trains. The material of which the mountain is constructed bears a close resemblance to rough granite. The track with its paralleling row of telegraph poles passing through the rock and under falling water, helps to make this installation very realistic.

From the front of the mountain railway pavilion is a wide avenue known as "The Midway," which extends westward. The north side of this avenue is open to the broad lawn in the center of the park. Along the south side are the several other amusement concessions for the park visitors. Among these are a "Mirror-Maze"; "Willowgraph Theater", in which is exhibited a moving picture entertainment; "Photograph Gallery" of pleasing design, where portraits are made and park souvenir postal cards are sold; "Unique Coal Mine," a reproduction of the St. Nicholas mine in Pennsylvania, through which the passengers journey in imitation coal cars; "Candyland," a large artistically built booth whose roof is supported on many rough stone pillars and in which a large assortment of candies and confections are for sale, and "Ye Olde Mill," through which visitors float in small boats and view varied panoramas. At the extreme western end of this row of amusement pavilions is a "Scenic Railway" or "Roller Coaster," and nearby are two "Carrousels."

East Side Trolley Outings.

The 1905 edition of "East Side Trolley Outings," a publication of the East St. Louis & Suburban Railway Co. which is being gotten out each year by Mr. F. H. Thomas, general passenger agent, contains additional interesting information regarding the different outings and places of interest along its lines, in addition to the usual data concerning private car parties, schedules of rates, time cards, etc. An electric hay ride is the latest fad introduced by the company to develop traffic and arrangements may be made for chartering the "commodious, well-ventilated and heaven-canopied gondola"—the "Darrach"—which has been placed in service for hay rides. Interesting views along the line, together with a map of the system, complete the attractive and serviceable publication.

A Brief History of Philadelphia Street Railways.

The Philadelphia Rapid Transit Co. Its Officers and Heads of Departments.

In Philadelphia, as in the other larger American cities, the development of the local transportation system began with the omnibus; then came the horse car era with its multitude of small lines, many of them direct competitors, followed by electric surface railways. Incidental to the growth of the present system there has been a consolidation of local transportation interests furnishing a most striking illustration of the law that such business is in its nature a monopoly. At this time the Philadelphia Rapid Transit Co. is building a subway through the center of the city with elevated structures connecting the subway with both river fronts; this improvement when completed will make Philadelphia the fourth American city to install the elevated railroad and the third to have a subway.

The credit for introducing the omnibus in Philadelphia is given to James Boxall, who in December, 1831, announced an hourly stage coach from Schuylkill—seventh and Chestnut streets to the Merchant's Coffee House in Second street and return, from 8:30 a. m. to 5 p. m. each week day. The fare was 10 cents each way, 12 tickets for $1.00. In 1833 the second omnibus line from the Navy Yard to Kensington, via Second St., was started with hourly trips, fare 12½ cents.

City records show that in 1857 there were 322 omnibuses in service; in 1858 street car competition had reduced the number to 222; in 1859 there were only 56 buses in use and in 1864 but one. The fares on the omnibus lines varied from 3 cents to 12½ cents per ride, but some lines sold annual tickets at prices reducing the rate to 1 cent per ride for patrons riding regularly four times per day.

The first street car line was opened to the public Jan. 20, 1858, by the Philadelphia & Delaware Railroad Co. (a steam line) which June 9, 1857, had secured a supplemental charter authorizing it to operate a horse railroad in Fifth and Sixth streets. The company met with bitter opposition, and 1,200 residents along the proposed route filed a remonstrance alleging:

"1. The enterprise was a mischievous speculation aiming at monopoly.

"2. The rapidly moving cars could not be stopped and would be exceedingly dangerous to life and limb.

"3. The cars would disturb the repose of the streets and make city life intolerable because of noise.

"4. The danger and noise would depreciate property.

"5. The overcrowded streets would be further congested.

"6. The rails would ruin the streets for other traffic."

It is perhaps needless to remark that this indictment has failed on all counts except No. 5, and as regards this the streets have managed to stand even greater congestion than was contemplated in 1857.

The Second and Third Streets Passenger Railway Co. organized in 1858 had to fight for its life in the courts which finally decided that while a railway may "occasion loss or inconvenience, it may depreciate the value of property and render its enjoyment incom- [illegible] Despite continued opposition [illegible] the grant of the first street railway charter 18 companies had been chartered. The street railways displaced the omnibus and created new business [illegible] passengers per day. In 1858 the Philadelphia & Darby Company found "five cars insufficient to accommodate the permanent travel originally performed by one omnibus."

JOHN B. PARSONS,
President Philadelphia Rapid Transit Co.

As early as January, 1859, it was shown that the danger incident to the horse car had been exaggerated, the then mayor saying in his annual message: "Perhaps no public improvement ever occasioned more contrariety of opinion than the occupation by the passenger railway system of the streets of this city, and perhaps none has ever promised more general benefit to the community."

[illegible] was another improvement bitterly fought for eight years, and not until Nov. 9, 1867, were Sunday cars regularly operated.

The original policy of the legislature was to encourage competition, and [illegible] 1859, there was organized the Board of Presidents of City Passenger Railway Companies, with 10 companies represented, which by "gentlemen's agreements" eliminated ill effects of competition. The Board of Presidents was active until the formation of the Union Traction Co. in 1895.

In 1858 the street railways of Philadelphia began with a 5-cent fare, the prevailing omnibus rate then being 6 cents. At first exchange tickets were sold for 6 cents; in 1860 the Board of Presidents made the exchange rate 7 cents. In 1864 the single fare was raised to 6 cents because of the "high price of horse feed." Soon after the single fare rate was raised to 7 cents, 16 tickets for $1.00, and exchange tickets 9 cents each. In January, 1877, the rate for single fares was reduced to 6 cents, exchange tickets remaining at 9 cents. A reduction to 5 cents for single fares was made in 1887, though the new companies chartered between 1881 and that date were limited to 5 cents. Free transfers had been in vogue up to 1895 when the Union Traction Co. was organized; on the consolidation by this company free transfers were abolished, but the routes were rearranged so that the business center of the city could be reached from every section for a single 5-cent fare and Fairmount Park reached from most sections for a single fare. The rates today are 5 cents for a single fare and 8 cents for an exchange. The "exchange" is a ticket purporting to be good for the day of issue only, but which in practice is an unlimited ticket, given to the passenger upon paying 3 cents in addition to his 5-cent fare. The effect of the exchange system is to make the minimum rate 4 cents without transfer privilege as it is understood in other cities. The importance of the exchange system is discussed elsewhere.

On certain short lines not parts of through routes what are known as "passes" are issued to passengers paying 5-cent fares; these passes correspond to free transfers.

The Philadelphia Rapid Transit Co. was chartered May 1, 1902, to succeed the Union Traction Co. and charter holding companies. The property and franchises of the Union Traction Co. were leased for 999 years from July 1, 1902, and the charters of various rapid transit companies granted franchises in 1901 and 1902 have been acquired so that the Philadelphia Rapid Transit Co. controls all of the street railways of Philadelphia (excepting only the Fairmount Park Transportation Co. which has a 10-mile line in Fairmount Park) and has the right to operate cars on all the streets not already occupied by the Union Traction Co. The rapid transit franchises included those for the subway and elevated railroad on Market St.

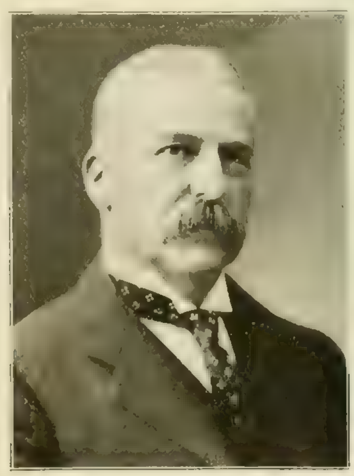
CHARLES O. KRUGER,
Second Vice-President and General Manager.

ALEX. RENNICK,
Third Vice-President.

The underlying companies of the Philadelphia Rapid Transit Co. are given in the accompanying table, arranged to show the path by which each one entered the consolidation. The date in parenthesis, unless otherwise stated, is the date of charter or incorporation. The first consolidation was in 1864 when the Fairmount & Arch Street company was merged with the Hestonville, Mantua & Fairmount Passenger Ry. In 1876 there were 17 separate companies operating under the co-operative control of the Board of Presidents. These companies carried about 117 million passengers per annum, of which the five companies carried 63 million; West Philadelphia, 15,000,000; Philadelphia City, 13,737,000; Germantown, 13,339,000; Union, 11,392,000; Hestonville, 9,635,000.

WALTER ELLIS,
General Superintendent.

F. H. LINCOLN,
Assistant General Manager.



JAMES BRICKER,
Superintendent Transportation.

The leasing of railways by other companies which led to final consolidation began about 1880, and in 1883 Messrs. P. A. B. Widener and W. L. Elkins organized the Philadelphia Traction Co., to acquire existing roads by lease or purchase. In 1895 there were only four operating companies which had track as follows: Philadelphia, 203 miles; Electric, 130 miles; People's, 73 miles; Hestonville, 24 miles.

In 1895 the Union Traction Co. was organized and bought stock control of the Electric and People's systems, and leased the Philadelphia system; the properties of the first two were also leased as a matter of convenience. The Hestonville line was leased in 1898.

The organization in 1902 of the Philadelphia Rapid Transit Co. to succeed the Union Traction Co. and acquire rapid transit franchises consolidated the local rapid transit system into a single unit, embracing underground and elevated as well as surface lines.

The physical property of the Rapid Transit company comprises 545 miles of electric track, 1,911 closed motor cars, 1,236 open motor cars, 27 freight cars, 14 mail cars, 18 work cars, 105 snow plows, 79 sweepers, and 92 miscellaneous motor cars.

The capital stock of the Philadelphia Rapid Transit Co. is $30,000,000, on which 40 per cent has been paid in, and a further payment of 10 per cent will probably be called this year.

The capital stock and funded debt liabilities of the underlying companies and the interest and rental charges imposed upon the Philadelphia Rapid Transit Co. are as follows:

H. B. NICHOLS,
Engineer of Way.

CHARLES HEWITT,
Superintendent Motive Power.

[illegible]
Electrical Engineer.

W. S. TWINING,
Chief Engineer.

[illegible]
Secretary and Treasurer.

R. G. OLIVER,
Master Mechanic.

FRANK WAMPLER,
Master Mechanic.

[illegible]
Purchasing Agent.

	Stock	Funded Debt	Interest and Sinking Funds	Rentals.
	$	$	$	$
New Companies,	(Owned)	1,500,000	65,000	. . .
Union Traction Company,	10,500,000	1,480,000	70,000	1,200,000
Electric Traction System,	2,838,576	282,100	595,935	1,069,448
Hestonville System, ...	1,132,281	1,250,000	59,507	128,678
People's Traction System,	6,531,830	750,000	900,357	217,500
Phila. Traction System, .	23,010,236	4,041,000	246,500	2,782,552
Total,	44,021,023	9,303,100	1,937,359	5,398,178
Less rentals on stocks owned by the Company in its own right or as lessee for 999 years, ...				223,790
Net rentals, ...				5,174,388

The gross earnings (including miscellaneous receipts), operating expenses, net earnings and operating ratio for the lines which now compose the Rapid Transit system for the fiscal years ending June 30, 1890, to 1904:

	Gross Earnings.	Operating Expenses.	Net Earnings.	Ratio of Op. Exp. to Gross Earnings.
	$	$	$	
1890.......	6,701,557	4,236,363	2,465,194	.63+
1891.......	7,023,915	4,565,868	2,458,047	.65+
1892.......	7,544,834	4,885,800	2,659,034	.64+
1893.......	8,691,923	5,556,991	3,134,932	.64
1894.......	8,431,105	5,431,515	2,989,590	.64+
1895.......	9,848,270	5,916,477	3,931,793	.60+
1896.......	10,759,705	5,707,435	5,052,270	.53+
1897.......	10,907,451	5,260,583	5,646,868	.49+
1898.......	11,236,437	4,619,375	6,617,062	.41+
1899.......	12,036,266	4,793,366	7,242,900	.39+
1900.......	13,249,819	5,624,898	7,624,921	.42+
1901.......	13,431,680	5,836,185	7,595,495	.43+
1902.......	14,118,158	6,402,338	7,715,820	.45+
1903.......	15,436,573	7,234,893	8,201,680	.47
1904.......	16,096,363	7,993,315	8,103,048	.49+

For the fiscal year 1903-4, the deductions from income were: Licenses and taxes, $1,060,879; interest, rentals and miscellaneous, $6,821,302; total, $7,882,181; leaving a surplus of $220,849.

The officers of the Philadelphia Rapid Transit Co. are: President, John B. Parsons; vice-presidents, George D. Widener, Charles O. Kruger, Alexander Rennick; secretary and treasurer, R. B. Selfridge; assistant treasurer, John B. Peddle.

The manager and heads of departments are:

Charles O. Kruger, general manager.

F. H. Lincoln, assistant general manager.

Walter Ellis, general superintendent.

William S. Twining, chief engineer.

Arthur B. Stitzer, electrical engineer.

H. B. Nichols, engineer of way.

C. B. Voynow, assistant engineer of way.

W. L. Maize, purchasing agent.

Charles Hewitt, superintendent of motive power.

James Bricker, superintendent of transportation.

Frank Wampler, master mechanic.

R. G. Oliver, master mechanic.

Mr. John B. Parsons, by whom, as manager or president, the Philadelphia consolidated properties have been administered for nine years, entered the street railway field in Philadelphia in 1870 as a clerk in the office of the Philadelphia City Passenger Railway Co., and was soon made division superintendent. In 1881 Mr. Parsons was elected president of the Lombard & South Streets Passenger Railway Co., and in 1886 president of the People's Passenger Railway Co. The next year he resigned and removed to Chicago to become vice-president and manager of the West Chicago Street Railroad Co., which property he managed for ten years, returning to Philadelphia in 1897 as vice-president and general manager of the Union Traction Co. He was elected president of the Union Traction Co. in 1898, and of its successor, the Philadelphia Rapid Transit Co., in 1902.

PHILADELPHIA RAPID TRANSIT CO.:

A. Market Street Elevated Passenger Ry. Co. (1901.)
B. Glenwood Rapid Transit St. Ry. Co.
C. Moyamensing & Southwark Rapid Transit St. Ry. Co.
D. Parkside Rapid Transit Co.
E. Bustleton & Byberry Rapid Transit St. Ry. Co.
F. Broad Street & Boulevard St. Ry. Co.
G. Doylestown & Willow Grove Traction Co. (1891.)
(Formerly Bucks County Ry. Co.)
H. Union Traction Co. (1895.)
I. Peoples Traction Co. (1893.)
1. Peoples Passenger Ry. Co. (1873.)
a. Germantown Passenger Ry. Co. (1866.)
i. Fairmount Park & Delaware River Pass. Ry. Co. (Formerly Richmond & Schuylkill River P. Ry. Co.)
ii. Germantown Passenger Ry. Co.
b. Green & Coates Streets Philadelphia Pass. Ry. Co. (1858.)
c. Northern Passenger Ry. Co. (1890.)
d. Centennial Passenger Ry. Co. (1889.)
e. Girard Avenue Ry. Co. (1894.)
f. Chelten Avenue Ry. Co.
g. Philadelphia, Cheltenham & Jenkintown Pass. Ry. Co. (1892.)
h. Hillcrest Avenue Pass. Ry. Co. (1896.)
II. Electric Traction Co. (1893.)
1. Frankford & Southwark Pass. Ry. Co. (1854.) (Chartered as Philadelphia & Delaware River R. R.; name changed, 1858.)
a. Citizens Pass. Ry. Co. (1858.)
b. Second & Third Streets Pass. Ry. Co. (1858.)
c. Lombard & South Streets Pass. Ry. Co. (Dissolved.)
2. Citizens East End St. Ry. Co. (1894.)
3. Citizens, Clearfield & Cambria St. Ry. Co. (1894.)
4. Citizens North End St. Ry. Co.
5. Brown & Parrish Street Ry. Co.
6. Lehigh Avenue Ry. Co. (1873.)
7. West End Passenger Ry. Co.
8. Omnibus Company, General, (1889, dissolved.)
III. Philadelphia Traction Co. (1883.)
1. Catharine & Bainbridge Streets Ry. Co. (1889.)
2. Union Passenger Ry. Co. (1864.)
a. Kessler St. Connecting Pass. Ry. Co. (1892.)
b. Continental Pass. Ry. Co. (1873.)
i. 17th & 19th Streets Pass. Ry. Co. (1859.)
3. 13th & 15th Streets Pass. Ry. Co. (1859.)
4. 23rd St. & Allegheny Ave. Pass. Ry. Co. (1890.)
5. Empire Passenger Ry. Co. (1868.)
6. West Philadelphia Pass. Ry. Co. (1857.)
a. Philadelphia City Pass. Ry. Co. (1859.)
i. Philadelphia & Darby Ry. Co. (Reorganized 1881.)
7. Philadelphia & Gray's Ferry Pass. Ry. Co. (1858.)
a. Schuylkill River Pass. Ry. Co.
8. Ridge Avenue Passenger Ry. Co. (1858.)
9. Walnut St. Connecting Pass. Ry. Co. (1890.)
10. Ridge Avenue Connecting Ry. Co. (1892.)
11. Huntington St. Connecting Pass. Ry. Co. (1894.)
IV. Hestonville, Mantua & Fairmount Pass. Ry. Co. (1859.)
1. Fairmount & Arch Street Pass. Ry. Co. (Consolidated 1864.)
2. Fairmount Passenger Ry. Co. (Consolidated 1865.)
3. Fairmount Park & Haddington Pass. Ry. Co. (1892.)
I. Darby & Yeadon St. Ry. Co. (Leased by P. R. T., 1904.)

Annual Picnic Montreal Street Railway Benefit Association.

The annual picnic of the Montreal Street Railway Mutual Benefit Association was held at Riverside Park, Montreal, August 14th to 20th, and proved to be a great success, financially as well as otherwise. A feature of the opening night was an electric street car parade, consisting of some thirty cars, brightly illuminated with lights and bunting and bearing the members of the association from the city to Riverside Park. The entertainments during the picnic included band concerts, vaudeville performances, athletic contests of various sorts, tugs-of-war, etc. A feature of the occasion was the publication of a souvenir program of the second annual picnic, which included a list of the officers and directors of the association, together with their portraits; special committees for the picnic; a short history of the organization and work of the association, and program of the picnic. The history of the association and the program of the picnic were printed in both French and English.

The Oklahoma City Railway Co., on August 1st, voluntarily raised the wages of the employes in its train service one cent per hour, this being the second increase of this nature granted by the company within a short time.

"Light and Power," the publication of the Electric Department of the Public Service Corporation of New Jersey, contains some interesting descriptive matter of recent contracts for lighting and power, especially the current furnished for lighting purposes in Electric Park, Newark, N. J.

Philadelphia & West Chester Traction Co.

The Philadelphia & West Chester Traction Co. lines extend from the Philadelphia city limits at 63rd and Market Sts. west a distance of 20 miles through Philadelphia, Delaware and Chester Counties to West Chester, the county seat of Chester County. The company also operates a branch from Llanerch to Ardmore, Pa., which

A. MERRITT TAYLOR.
President.

covers a distance of four miles. This latter branch is owned by the Ardmore & Llanerch Street Railway Co., but the road is leased to and operated by the Philadelphia & West Chester Traction Co. The road is double track from Philadelphia to Llanerch, one of the many beautiful suburbs of Philadelphia. A connecting line owned by the same interests is also being constructed through Garretford to Clifton Heights, [illegible] about four miles.

The eastern terminal of the [illegible] Sts., but the new terminal will be at Upper Darby in conjunction with the Market St. elevated railway terminal.

A new terminal station has been completed at Ardmore, which comprises train shed, waiting room and all conveniences.

The operating offices, main power station and car barns are located at Llanerch on the company's property.

Power Station.

The main power station at Llanerch is equipped with two 400-kw. Westinghouse double current generators, direct connected to Hamilton-Corliss cross-compound engines. The boilers are three 500-h. p. Edgemoor units. Water is obtained from a creek, and coal is delivered by the Pennsylvania R. R. to the company's trestle bins.

Sub-Station.

The sub-station is located on the main line about 10 miles west of Llanerch at Ridley Creek. This station, which has just been completed, is equipped with one 500-kw., 600-volt Curtis turbine unit with a battery of two 500-h. p. Edgemoor boilers. On the gallery floor are located two General Electric 250-kw., 25 cycle rotary converters and six oil-cooled transformers with switchboard apparatus. The steam plant is only used at present as an auxiliary, the converters being driven from the Llanerch station when traffic requirements are not heavy.

On the completion of the line to Clifton Heights all lines east of Newtown Sq. will be operated from the Llanerch station, and the steam plant at Ridley Creek will operate the main line west of Newtown Sq.—a point about at the center of the road. The rotaries are operated at a line tension of 15,000 volts through step-down transformers. The boiler room here is equipped with large concrete storage bins for coal, which is hauled from the main bins at Llanerch by the company's specially designed coal cars.

The building is on a solid rock foundation and is fireproof throughout. It was designed by and erected under the supervision of Messrs. Franklin & Clarke, civil engineers, of Philadelphia. All

THOMAS SIDING.

[illegible]

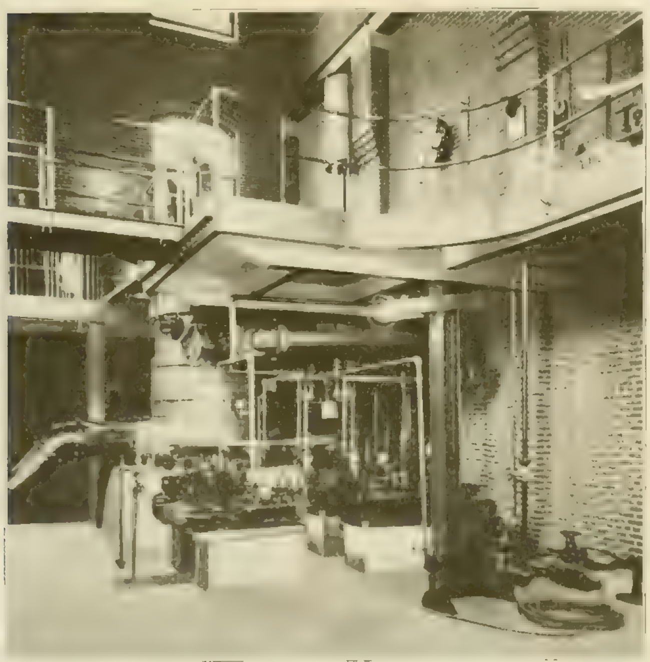
the [illegible] supervision of the company's superintendent and chief engineer.

Track.

The entire roadway and track is being reconstructed, and as far as the physical condition of the roadway will permit, is being constructed along steam railroad standards. The double track is being built by Messrs. Millard & McGraw, contractors, and the new track will be laid with 70-lb. A. S. C. E. standard T-rail; the old rail is 58-lb. and 60-lb. T with "Continuous" joints. The old track is being rebuilt by the company's force.

OFFICE AND MAIN POWER STATION, PHILADELPHIA & WEST CHESTER TRACTION CO.

A new steel viaduct 200 ft. long with masonry piers has just been completed at Ridley Creek. This viaduct will decrease the grade and place a portion of the road on private right of way. This viaduct was also designed by Franklin & Clarke, and erected by Chas. A. Sims Co., contractors. No pains are being spared to make the roadway and track high grade throughout, as it has been the company's policy to give the public a high-speed, close-schedule service



CURTIS TURBINE RIDLEY CREEK STATION.

The Ardmore division is being double-tracked about one-third of its length, and many heavy curves and grades are being eliminated.

The Philadelphia and Garrettford extension to Clifton will, except for the gage, 5 ft. $2\frac{1}{4}$in., be built according to steam railroad standards throughout. The extension will cross the Pennsylvania R. R. at Garrettford Road on a steel viaduct; it will also cross the Darby Creek near Clifton on a steel girder bridge.

Train Service.

The company operates a normal headway of 30 minutes from Philadelphia to West Chester and a similar schedule to Ardmore; when the traffic conditions require it, a 15-minute service is operated. This service will be greatly increased upon the completion of the Market St. elevated railway. The line is protected by electric signals with telephones at each siding, and a dispatcher is on duty day and night. The double track will be protected by semaphore spacing signals.

POWER STATION AT RIDLEY CREEK.

Every effort is being taken by the management to insure the safety of the traveling public; great care is also taken that the trains ar-

VIADUCT AT RIDLEY CREEK, PHILADELPHIA & WEST CHESTER

rive and leave terminals and sidings on regular schedule time. All construction and extra trains are dispatched by written train orders and are properly protected by flagmen and the system of marker lanterns. The dispatcher's office is located at Llanerch, as are also the trainmen's reading and dining rooms.

All cars, both open and closed, have Westinghouse No. 68 4-motor equipments. A new standard car is soon to be adopted by the company and two and three car trains will be operated.

The trainmen are governed by the standard road rules, and are required to wear the company's standard uniform, which is very similar to that used by the steam railroads. An excellent esprit de corps obtains among the employes of the company, who for the most part have their residences at Llanerch, within easy call in case of emergency. The trainmen are paid at the rate of 18, 19, 20 and 21 cents per hour, and no pains are spared by the management to get high-grade, efficient men.

The connection with the Philadelphia Rapid Transit Co's. elevated line and subway will enable the company to operate an express service between West Chester and Philadelphia. This connection will be a benefit to the Rapid Transit Co. and to the Philadelphia & West Chester Traction Co., giving the latter a reliable entrance into the city.

The present officers of the Philadelphia & West Chester Traction Co. are: President, A. M. Taylor; vice-president, W. S. Taylor; secretary, H. H. Aikens; treasurer, C. L. Rihl; superintendent, W. G. Woolfolk; assistant superintendent, C. B. Fulton.

Fairmount Park Transportation Co.

The Fairmount Park Transportation Co., which was chartered in 1894 to construct an electric railway within the confines of Fairmount Park, completed and opened its novel line Nov. 10, 1896. The park, which is one of the largest in the world, comprises some 2,740 [illegible]

In the [illegible] apart, at which passengers are received and discharged [illegible] line is inclosed by a wire fence and viaducts, stone arches or steel bridges were constructed over drives and pathways. To assist in preserving the beauty of the park, grass was planted between the tracks, so that only the heads of the rails show, as well as on the slopes of all embankments and cuts. The gage of the track, which is laid with 90-lb. T rail on yellow pine ties 6 x 8 in. x 8 ft. spaced 2 ft. apart, is 5 ft. 2¼ in. The overhead construction is neat and not conspicuous.

The power station for this system is situated in a ravine, the stack

CONSTRUCTION CAR, PHILADELPHIA & WEST CHESTER

being only as high as the building, so that from a short distance the building is almost hidden by the trees. The generating equipment of this station comprises General Electric apparatus. The building is served by a spur from an adjacent railroad, and coal is dumped into vaults by means of chutes, the station having capacity for one month's supply of coal. Fans and economizers furnished by the American Economizer Co. serve the station. The feeders are carried in 2½-in. Williamsport creosoted wooden ducts underground and the trolley wire, which is a No. 0000, is supported by span wires 7-16 in. in diameter. Mayer & Englund overhead material was used in this construction. The engineers for the work were Pepper & Register.

The equipment of the road, which originally consisted of 60 cars furnished by the J. G. Brill Co., now comprises 70 cars, 30 of which are motor cars and 40 trail cars. General Electric four-motor equipments are used. The car barn and repair shop is located in West Fairmount Park, a short distance from the power house, and is likewise hidden among the trees and banks of the ravine. The building, which is 110 x 425 ft., contains the local offices and shops of the company.

TRAIN SHED AND STATION AT ARDMORE

Considerable difficulty was experienced in securing the franchise for the construction of this line and it was several years after plans were first suggested that the Park Commissioners granted a franchise to the Fairmount Park Transportation Co. From the beginning of its operation the traffic has been very good and the operation of the line has been financially successful as well as satisfactory to the Park Commissioners and a great convenience to park visitors.

The officers of the company are: President, Charles A. Porter; vice-president, C. E. Platt; secretary and treasurer, W. C. Martin; superintendent, William Boetler; chief engineer, F. B. Falk.

Philadelphia & Western R. R.

Good progress is being made in the construction of the roadbed of the Philadelphia & Western R. R., which will extend from the terminus of the Market Street Elevated Passenger Ry. westward into a promising suburban district. The roadbed will be double tracked and laid with 85-lb. T-rails. It is said that a specially high class sub-structure will be built, extending from the Philadelphia terminus in a westerly direction to Bryn Mawr, thence to Parkersburg, thus making a line 44 miles long. If the operation of this portion of the line warrants, it is expected that the track will be extended to York, Pa.

The location of the right of way has been carried on with a view to reducing the curvature and grades to the lowest possible amount. In the section of the roadbed between the Philadelphia terminus and Wayne there will be about 30 highway crossings, none of which will be at grade. At the western limits of Philadelphia the line will cross the terminal property of the Philadelphia Rapid Transit Co's. Market Street Elevated Passenger Ry. Here will be erected a joint transfer station to be used by the Philadelphia & Western R. R., the Philadelphia Rapid Transit Co. and the Philadelphia & West Chester Traction Co. The plans for this terminal are given elsewhere in this issue in the description of the Market Street Elevated Passenger Ry.

The offices of the Philadelphia & Western Railroad Co., of which Mr. J. M. Bramlette is general manager, are in the West End Trust Bldg., Philadelphia.

No announcement has as yet been made regarding the type of equipment to be used but it is said that high speed cars will be operated at frequent intervals, and undoubtedly some traffic arrangement will be made so that passengers or perhaps cars of the Philadelphia & Western R. R. will be taken to the center of the city by way of the Philadelphia Rapid Transit Co's. new elevated structure and subway.

The American Railways Co.

The American Railways Co., which has its general offices at 1321 Walnut St., Philadelphia, was incorporated under the laws of New Jersey in April, 1899, to construct, lease, purchase and operate street railways and electric lighting systems. Immediately after its organization the company began the purchase of railway and lighting property. The company purchased the Bridgeton & Millville Traction Co. and the Bridgeton Electric Co., Bridgeton, N. J.; it owns all the stock of the Springfield Railway Co. and the Springfield Light & Power Co., of Springfield, O., of the People's Railway Co., Dayton, O., of the Altoona & Logan Valley Electric Railway Co., Altoona, Pa., which already controlled the City Passenger Railway Co.

The properties of the Joliet Railroad Co. and the Chicago & Joliet Rapid Transit Co. were later purchased and consolidated under the name of the Chicago & Joliet Electric Railway Co. The stocks and franchises of the Chicago & Desplaines Valley Electric Railway Co. and the Desplaines Valley Electric Railway Co. were secured and consolidated under the name of the former company, and arrangements made for through service from points on the Chicago & Joliet Electric Ry. to the Chicago city limits over the Chicago & Desplaines Valley Electric Ry., where connections are made with cars of the city system.

In March, 1903, the properties of the Tyrone Electric Railway Co. and the Home Electric Light & Steam Heating Co., both of Tyrone, Pa., were purchased. Some few months later the Home Electric Light & Steam Heating Co. was leased to the Tyrone Electric Railway Co. for 99 years, and this property and that of the Altoona & Logan Valley Electric Railway Co. and the City Passenger Railway Co. were merged into one company, known as the Altoona & Logan Valley Electric Railway Co.

The company now controls over 217 miles of track upon which are operated 348 cars. The aggregate capacity of its station plants is 9,450 h. p., in addition to which it owns three electric lighting plants. The company has recently purchased 40 acres of land near Chicago, on the line of the Chicago & Joliet Electric Railway Co., to be used as a park. This, added to the land already used for similar purposes, makes a total of 182 acres owned by the company and devoted to park purposes.

The officers of the company are: President, J. J. Sullivan; first vice-president, W. F. Harrity; second vice-president, C. L. S. Tingley; secretary and treasurer, W. W. Perkins; assistant secretary, assistant treasurer and comptroller, Frank J. Pryor, jr.; general counsel, Silas W. Pettit; general manager, H. J. Crowley; chief engineer, A. S. Kibbee; purchasing agent, W. J. Mulholland.

Interstate Railways Co.

The Interstate Railways Co. was chartered under the laws of New Jersey in December, 1902, for the purpose of taking over the property of the United Power & Transportation Co., which had been incorporated April 20, 1899, to construct, purchase and operate street railways, electric lighting and power plants, and had already secured control of considerable property. Those companies in which it had secured a controlling interest are the Citizens' Electric Light & Power Co., the Delaware County & Philadelphia Electric Railway Co.; Edison Electric Illuminating Co. of Lebanon, Pa.; Holmesburg, Tacony & Frankfort Electric Railway Co.; Lebanon Valley Street Railway Co.; Media, Glen Riddle & Rockdale Electric Street Ry.; Roxboro, Chestnut Hill & Norristown Railway Co.; Schuylkill Valley Traction Co.; Trenton Street Railway Co. of Trenton, N. J.; Trenton Traction Co.; Wilkesbarre & Wyoming Valley Traction Co.; Wilmington & Chester Traction Co.; Wilmington City Electric Railway Co.; Wilmington & Great Valley Turnpike Co.; Wilmington & Philadelphia Turnpike Co.; Wilmington & Christiana Turnpike Co.; Reading & Southwestern Street Railway Co.; Reading Power Co.; Philadelphia & Chester Ry.; the Southwestern Street Railway Co., and United Traction Co. of eRading, Pa.

The Interstate Railway Co., through ownership of stock of the United Power & Transportation Co., receives practically the entire earnings, which for the year 1904 were as follows:

Gross income	$708,512
Interest, expense, etc.	364,057
Net income	$344,455
Dividends paid	343,563
Surplus	$ 892
Total Surplus	$267,078

The officers of the Interstate Railways Co. are: President, John A. Rigg; vice-president, Joseph L. Craven; secretary and treasurer, Remi Remont; auditor, William S. Bell; general counsel, R. L. Jones. The general offices of the company are in the Mariner & Merchant Building, Philadelphia, Pa.

The annual statement of the Fryeburg Horse Railroad Co., which is now the only horse railroad in Maine, contains some interesting statistics. The company has three miles of track and operates three open cars and three closed cars, the average number of drivers and conductors employed being two. The gross earnings of the company for the year were $730; operating expenses, $659.15; net earnings from operation, $70.85; surplus for the year, $1.56. The salaries of the general officers and clerks amounted to $10, provender for horses cost $25, and the maintenance of harness, horse shoeing, etc., amounted to $10.50. The line only operates two weeks during August at the time of the Chautauqua meetings, and three days in October during the Oxford County Agricultural Fair.

American Railway Mechanical and Electrical Association Program.

MONDAY, SEPT. 25, 1905.

Registration at Convention Hall (South Building, Philadelphia Commercial Museum) 8:45 a. m.
Meeting called to order at 10 a. m.
Address of welcome, Hon. John Weaver, Mayor of Philadelphia.
Address by Hon. W. Caryl Ely, President A. S. R. A.
President's Address, C. F. Baker.
Report of Executive Committee.
Report of Secretary and Treasurer.

MONDAY AFTERNOON—1:30 O'CLOCK.

"Power Distribution." By C. H. Hile, superintendent of wire, Boston Elevated Ry.
"The Power Station Load Factor as a Factor in the Cost of Operation." By L. P. Crecelius, chief electrician, United Railways Co., St. Louis.
"Controlling Apparatus." Report by J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Co., New York.

TUESDAY, SEPT. 26, 1905.

Meeting called to order at 9:00 a. m.
"Way Matters." Report by F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway & Light Co.
"Maintenance and Inspection of Electrical Equipment." Report by William Pestell, New York.
"The Power House." By Fred H. Bushnell, chief engineer Rhode Island Co., Providence.

TUESDAY AFTERNOON—1:30 O'CLOCK.

"An Emergency Track Brake." By F. F. Bodler, master mechanic, United Railroads of San Francisco.
Discussion of the Question Box.
Reports of special committees.
Election of officers.

American Street Railway Association.

The papers to be read before the association include:
"The Application of Gas Power to Electric Railway Service." By J. R. Bibbins.
"Notes on the Design of Large Engines with Special Reference to Railway Work." By Arthur West.
"Single-Phase Railway Systems." By C. F. Scott.
"Electric Railway Equipment." By W. B. Potter.
"Organization." By H. L. Doherty.
"Deisel Engines." By Col. E. D. Meier.

Program Accountants' Association.

THURSDAY, SEPT. 28, 1905.

Convention called to order at 2 p. m.
President's Annual Address. By W. G. Ross, managing director Montreal Street Ry.
Report of the Executive Committee.
Report of the Secretary-Treasurer.
Appointment of Committees.
Report on Proposed Reorganization of the A. S. R. A.

FRIDAY, SEPT. 29, 1905.

Meeting called to order at 10 a. m.
Report on "Standard Classification of Accounts." By C. N. Duffy, secretary and auditor Chicago City Ry.
Report on "Standard Form of Report." By W. F. Ham, comptroller Washington Railway & Electric Co.
Report on "International Form of Report." By C. N. Duffy.
Report on "National Association of Railway Commissioners, Birmingham, Ala., Nov. 15-17, 1904." By C. N. Duffy.
Report on "National Association of Railway Commissioners, Deadwood, S. D., Aug. 15-17, 1905." By W. F. Ham.
Discussion of the Question Box.

FRIDAY AFTERNOON, 2 O'CLOCK.

"The Cost of Carrying a Passenger [illegible] vice-president American [illegible]
"Interurban Fare Collection." By [illegible] troit United Ry.
"Interurban Ticket Accounting." [illegible] Rochester & [illegible]
"Accounting with Loan Departments." [illegible] tary and treasurer Elmira Water, Light & Railroad Co., Elmira, N. Y.

SATURDAY, SEPT. [illegible]

Meeting called to order at [illegible]
Unfinished business.
Report of committee on resolutions.
Report of committee on nominations.
Election and installation of officers.

Rules Regarding Reduced Rates to the Convention.

The American Street Railway Association, through its secretary, has announced that the railroads have granted rates of fare and one-third on the certificate plan; that is, full fare going, and on the presentation of 100 certificates, one-third fare returning. It is necessary that a certificate be secured from the ticket agent when the ticket is purchased, the certificate is then deposited with the clerk at the registration booth immediately on arrival at Philadelphia, where it is signed by the secretary and validated by the special agents of the railroads. A fee of 25 cents is charged on each certificate, which must be paid when the certificate is deposited. Unless the certificate is validated by the special agent not later than September 29th the benefit of one-third fare on the return journey cannot be had. One hundred certificates must be presented to secure the reduction in fare. Tickets to Philadelphia may be secured on September 21st, but not later than September 27th. Certificates for the return trip will be ready September 29th, although delegates may remain until October 4th before returning home. No stop-over is allowed on the return journey.

Convention Preparations.

Mr. William Wharton, jr., as chairman of the local committee of the American Street Railway Manufacturers' Association, has arranged with Andrew F. Stevens, a Philadelphia caterer, who will fit up a lunch room in the exhibition hall. Mr. Wharton has also contracted with Frank A. Kerr to provide three 4-horse coaches on September 25th, 26th, 27th and 28th, from 9 a. m. to 10 p. m. to convey delegates between the convention hall and the street cars

The Manufacturers' Association will furnish all the badges, which for delegates to the various associations will be distributed by their respective secretaries.

The American Street Railway Association will provide a banquet, which will be entirely separate from the entertainments provided by the Manufacturers' Association.

Each member of the Manufacturers' Association is entitled to four badges for representatives, by reason of such membership; extra badges will be charged for at the rate of $5 each.

The Local Committee has designated Henderson & Bro., Inc., 25th St. below Spruce, Philadelphia, to haul, deliver and erect in place, shipments of exhibitors. The company has the best of facilities for this work and undertakes to furnish teams, rigging, experienced riggers and other labor at prevailing Philadelphia rates. The directions to exhibitors regarding shipments are as follows:

"Consign everything to yourselves at Philadelphia, Pa., and send bills of lading to Henderson & Bro., Inc., properly endorsed by you. State approximate weight and general description of goods, and any special directions as to the manner of handling and placing them in the building. Also mark the number and letter of your space upon each article or piece. Large or heavy exhibits can be shipped by car direct to the exhibition buildings, in which case consign the car to the Pennsylvania R. R. Siding of Philadelphia Museums, 34th and South Sts., Philadelphia, Pa."

THE STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE

KENFIELD PUBLISHING CO.,

45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address, "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:

New York—39 Cortlandt Street. Cleveland 302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV SEPTEMBER 15, 1905 No. 9

CONTENTS OF THIS NUMBER.

ANNOUNCEMENT.

We announce the resignation of Mr. Daniel Royse as editor of the "Street Railway Review," to take effect October 14th. Mr. Royse joined the "Review" staff in December, 1896, and since February, 1901, when he succeeded Mr. H. H. Windsor, has served as managing editor of the journals owned by the Kenfield Publishing Co., including for a time "Steam Engineering," as well as the "Street Railway Review" and "Brick."

Mr. Lawrence E. Gould, who for some time has been associate editor, will succeed Mr. Royse as editor of the "Review." Mr. Gould is especially well qualified for this position, having since his graduation from Cornell University been engaged for several years in practical electric railway work, with experience in both operation and construction departments.

THE "DAILY REVIEW" FOR 1905.

The "Daily Street Railway Review" will be issued at Philadelphia September 26th to 29th inclusive, this being the seventh successive year of this publication, and will contain full reports of the papers and discussions at the meetings of the four electric railway associations and descriptions of the exhibits. The "Daily Review," although a separate publication, should for convenient reference be bound with the monthly "Street Railway Review," and accordingly the page numbers of the "Daily" will be made consecutive with those of this issue. Attention is again called to this because in sending the "Review" to the binder the "Daily" is frequently not included, and when the binder finds 150 pages or so missing we are called upon to supply duplicates, which unfortunately we cannot always do.

"EXCHANGE" TICKETS.

One of the striking points in the reports of the Philadelphia Rapid Transit Co. is the small number of free transfers issued on that system, the figures for the fiscal year last reported showing that only 7 per cent of the total number of passengers rode on free transfers, as compared with 20 per cent in Minneapolis, 30 per cent in New York City, and nearly 40 per cent in Boston and Chicago. In Philadelphia the single ride fare is 5 cents but the "exchange" system provides what is practically two rides for 8 cents, and as the number of passengers not taking advantage of the reduced or "exchange" rate is greater than the number of free transfers, the receipts of the company are slightly in excess of 4 cents per passenger riding, although the receipts per revenue passenger are cut to 4.38 cents because of the exchange tickets.

In the other cities mentioned, where there is only a 5-cent fare, the use and abuse of free transfers reduce the revenue per passenger to only 3 or 3½ cents; for the Chicago Union Traction Co. the figure is 3.06 cents, and for the New York City Ry., 3.49 cents per passenger. This difference in receipts per passenger explains the low ratio of operating cost to receipts, only .45 to .49, which the Philadelphia road shows.

HELPING THE POWER HOUSE BY TELEPHONE.

Every operating man now appreciates the usefulness of the telephone in his own branch of street railway work, but the same sense of its value in the co-operation of different departments is sometimes lacking. In most of the large city systems the operating problem is so intensely exacting that the telephone service is of necessity excellent, and the private branch exchange idea has been applied to give the quickest possible communication between departments. On some of the systems, however, whose tracks cover many miles of rural and urban territory characterized by low or moderate population density the telephone lines are not worked to secure the fullest possible co-operation between widely scattered points.

It is important, for instance, that the power houses and sub-stations should be notified in advance whenever the transportation department is aware that unusually heavy riding is about to occur. Otherwise the stations are likely to be unprepared with the possibility of dangerous overloads that may even result in a shutdown of power, complicated with injury to the equipment. In a recent case six large special cars, each equipped with four 50-h. p. motors, were simultaneously put upon the system at a carhouse located some 20 miles from the power station, without the slightest notice from the transportation department. At the time the power house load was being carried by a 2,000-kw. generator, and the peak which

resulted as the six cars loaded with excursionists began to accelerate came near shutting down the machine. In another instance a [illegible] holiday was advertised throughout a whole county many miles from the power house, and no notice was given to the chief engineer of the plant. Fortunately the day before the deluge the engineer chanced to pick up a newspaper containing an item in regard to the proposed celebration, involving scores of extra cars, and when the demand came extra boilers and generating units were ready for it.

It is difficult for the outside man, in constant touch with the traffic stream, to realize how little the power house force can know of the prevailing external conditions unless he takes the trouble to inform them. The station attendants might watch the switchboard instruments all day without the slightest idea of the emergency demand caused by bunching extras. Something better than guesswork is needed to properly fit half-a-million dollars' worth of generating machinery to the unusual demands of two hundred square miles of country. The telephone offers an easy way out of the difficulty, and a little foresight on the part of the division superintendents and car house foremen in keeping in close touch with the power house department will pay high interest on the time and trouble involved.

REORGANIZATION PLANS.

The most important matter coming before the American Street Railway Association at the Philadelphia meeting is the question of reorganization. On pages 576 and 577 will be found the proposed constitution and by-laws as approved by the committee on reorganization, and this plan should receive the careful attention of the management of every railway compnay that is to have representatives at the convention. Whatever the action on reorganization, to be effective and insure satisfaction in the future, it must be, in fact as well as in name, in accord with the views of the majority. There is danger in accepting the recommendations of committees, when the acceptance is merely acquiescence and not positive approval. Such action lacks force, as has been illustrated by the sundry reports on standards which the records of the association show were unanimously approved—and never followed. The point we would make is that the active interest of the whole association must be aroused if the reorganization is to be effective.

There seems to be unanimity of opinion as to the need of a reorganization for the A. S. R. A. We believe the unsatisfactory work of this body is not due to the lack of ability on the part of the men active in its affairs but to the misdirection of effort. Men who direct the general policy of their respective companies cannot be expected to enter into the discussion of the smaller technicalities with enthusiasm. Yet year after year in choosing subjects old precedents have been followed.

With reorganization of the A. S. R. A. itself it is also proposed to reorganize the two departmental associations, incorporating them as branches or subordinate bodies. The manner in which this shall be done is important, and is more deserving of serious consideration and full discussion on the floor of the convention than any other one feature of the plan, with the possible exception of the matter of dues. The question should be viewed from every side and it has several. There is the general principle that the industry should have only one official representative body, through which its co-operative work is to be done. There is the consideration that the success of the departmental associations depends upon the activity of individuals who cannot but have more incentive to work for an independent body, than for a committee. All the associations have for their object the benefit of the companies which they represent, this benefit being secured principally through interchange of ideas and notes on practice. The individuals who represent the companies might secure fully as much personal benefit and more glory for themselves were their efforts given to an association of individuals, but such a body would suffer loss of prestige because it could not represent the industry.

In our opinion the merits of the plan submitted for accomplishing the proposed amalgamation depend upon the interpretation which is given to section C, article XII, of the by-laws: "By granting financial assistance to such [affiliated] associations for specific purposes." If the purse-strings are to be drawn too tightly, it were better for all to make the departmental associations mere committees in name and [illegible]. A happy compromise [illegible] for the year 1905-6 [illegible] the departmental associations [illegible] a secretary, the [illegible] experience [illegible] machinery [illegible].

WORK OF THE MEMBERSHIP COMMITTEE.

In February last the president of the [illegible] committee on membership, of which Mr. H. H. Vreeland is chairman, charged with the duty of presenting to electric railway companies not now members of the [illegible] advantageous for them to [illegible] cooperative work. This committee refrained from engaging in an active campaign until the plan for the reorganization of the association had been so far matured that [illegible] members the committee could show clearly what advantages membership would offer, but as soon as that plan was known it was promptly presented to all whom it is desirable to interest.

Those features of the reorganization plan which it is believed will be most appreciated by railway companies not now members of the A. S. R. A. are the bureau of information to be incorporated with the secretary's office, and the sliding scale for association dues, whereby the burden of membership is tempered to the strength of the company. The bureau of information, it is intended, shall collect valuable data relating to various phases of the industry and provide for its circulation among the members of the association. The larger companies have in years past accumulated information along specific lines, and through the association's bureau a general interchange of such data will become more practicable, with benefit to all. The effect of such a clearing house will also be to relieve companies of the burden of replying to inquiries. The work of the bureau, it is contemplated, will include that of investigating subjects affecting all engaged in the electric railway field—such as questions of taxation, franchise rights, municipal ownership and railroad laws.

Companies with but small mileage should consider that while they may have less interest in such questions than do the roads with larger mileage, yet on the other hand they can even less afford to make mistakes in such matters.

THE TIME ELEMENT IN THE REPAIR SHOP.

Although repair shop economy has been much discussed during the last few years, there is still need of emphasizing the importance of an efficient maintenance organization in street railway shops. In some cases a narrow policy is still pursued by the management as to the purchase of improved appliances and the payment of attractive wages in the mechanical department; in others the failure to turn published experience to the best account is the result of the inability of the operating department to spare rolling stock for service long enough for the thorough inspections and light repairs, which, when properly carried out save the equipments from much more serious breakdowns and delays. Under such conditions the time required for the execution of repairs is doubly worth reducing, and every comprehensive plan to secure more efficient work in the shops must have this end in view to insure success.

The key to the whole problem is good organization of labor and machinery. Motor-driven tools and high speed steels are important factors in the repair process carried on under "forced draft" conditions, but unless the saving of time at the machine tool is to be lost elsewhere, it is necessary to investigate the repair shop problem in the same manner as do factory managers contemplating the installation of the most modern processes—processes which require one to use a stop watch and note book from the time the raw material enters the establishment until the finished product leaves the works to fully appreciate what is being done.

For example, the vertical hoist is a most useful piece of machinery, but if the shop is deficient in facilities for horizontal translation, the time saved amounts to very little. Runways along which motors, axles or other loads supported by power hoists can be freely moved should be liberally provided in the repair shop, and the track layout in new designs ought to require the shortest possible distances of handling between departments.

The new shops of the Portland (Me.) R. R. illustrate some desirable features. The cars are run into an equipping shop for general dismantling, the shop being centrally located with respect to the storeroom, woodworking and painting departments; the trucks may be rolled directly into the blacksmith shop for heavy repairs, and the general machine and electrical repair shops are equally convenient to the dismantling shop. Well lighted pits are provided to expedite light repairs and compactness may be said to characterize the entire design.

Local conditions of course frequently prohibit the symmetrical arrangement of shop departments, but even in old plants a great deal can often be done to shorten the time of repairs by bringing the tool to its work, replacing group drives to some extent at least by direct connected motors, installing prisms to secure a larger amount of daylight, putting in ventilating fans for operation during summer weather, and laying tracks for inter-department communication. The replacing of trucks is a process which can be much expedited by the use of a hydraulic jack in the pit beneath the car; the location of toilet and washrooms in a central part of each shop division saves time otherwise lost in walking to and from work; the use of tools shaped to cut away material on the center and sides of trolley wheels simultaneously and the turning or grinding of both wheels at once in tire repairs are other examples of how the output of the shop can be increased, and the time for the repairing process shortened. For each day that a car is held in the shops the company may easily have to make up $20 or $30 in lost earnings by the use of an extra car, which means an additional investment in rolling stock, and anything which lowers the percentage of cars in the shop is therefore well worth striving to attain.

CONCRETE IN RAILWAY WORK.

Among the materials used in railway and power house construction, concrete now plays a very important part. The Philadelphia Rapid Transit Co. emphasizes this statement by the numerous uses to which it puts this material. In its new subway construction the floor, walls and roof are formed of a 1-3-6 mixture, reinforced except in the floor. No steel beams are placed in the wall structure, the reinforcing being done by vertical rods which with the vitrified ducts and the mass of the concrete make a wall heavy and strong enough to resist the thrust from the sub-soil without and to carry a portion of the load of the roof system supporting an average of six feet of back fill and the street substructure with its tracks and other loads above. The floor under the subway tracks has a thickness of 11 in. Between the tracks, the floor mass of concrete is brought up to form a longitudinal foundation and anchor for the roof supporting columns. This arrangement makes a bed for the trackwork. As a precaution against a serious weakening of the roof supports in event of a car being derailed, a longitudinal strut of reinforced concrete is placed horizontally between the columns at about their mid point. This design takes the place of one using concrete bulkheads enclosing the bases of alternate pairs of columns to a height of about four feet above the rails.

Along the sides of the subway run sewers which, in the rearrangement of the substructures of the street, it was found necessary to build. To insure the usefulness of these new sewers against chance breakage from settlement of the sub-soil, steel rods, both horizontal and encircling the bore, are used in reinforcing the concrete walls. These sewers pass through a tangled mass of pipes, conduits and underground structures, many of which it was necessary to deflect around the sewer bore. By the use of concrete this task was lightened since the intersecting pipes and conduits could be bedded in the wall of the sewer and the amount of deflection necessary thus reduced. At the subway stations the flexibility of concrete as a structural material is illustrated by its use for platforms, walls, stairs, ventilation chambers and other like details.

In the construction of the four-track bridge over the Schuylkill River another use is made of concrete. The east abutment of this structure is of concrete alone. The shore piers and the two river piers are of masonry work, but the foundations of these piers which must withstand the deteriorating effects of continued contact with water are built of concrete. In the masonry piers a core of concrete ties the stone work together.

Still a different use for concrete is exemplified in the elevated roadbed. Upon a floor of steel plates is placed a bed of concrete extending from side to side of the structure and being anchored to the vertical surfaces of the longitudinal girders. The upper surface of this concrete bed is formed to receive the trackwork and to provide proper drainage for the ballast and roadway. Special care was here taken to cover all possible steel surface with concrete as a protection from water.

In the power and sub-station buildings concrete is also put to its customary uses for wall foundations, floors, ash and coal hoppers, intakes and stairways. In addition to these the rotaries in the substations and the turbine-driven units in the power house are supported on reinforced concrete columns. In the Wyoming Ave. and Second St. alternating current station the 1,500-kw. horizontal turbine units are each supported by eight such vertical columns about 20 ft. long. The reinforcing in these columns consists of four steel rods tied together by punched iron plates. Setting a turbine in this way has an advantage other than that of low cost in that space is made for the accommodation of the condensing machinery directly under the unit. This method of supporting heavy machinery will probably be looked upon with doubtful eyes by engineers accustomed to the use of a monolith of concrete as a foundation for a reciprocating engine.

In the sub-stations the rotaries are mounted directly upon the reinforced concrete floor and have for their support single reinforced concrete columns, 9 ft. high. These columns are hexagonal in section and about 18 in. thick. Each supports an intersection of two reinforced concrete floor girders, the line of columns being 6 ft. 5 in. from the nearest foundation wall with a floor span on the opposite side of 20 ft. 2 in. Such columns support rotaries weighing 77,000 lb. placed directly on the floor and centered above the posts. Various other uses are made of concrete, such as in surface track construction, elevated structure piers and setting poles. This material adapts itself to many uses and has an especial value in railway work where although the general design of a structure is standard there are yet many slight changes that must be made to conform to local conditions.

ON QUESTIONS AND ANSWERS.

Quite a number of technical societies have found that there are many points on which their members desire information, either instruction in theory or data on practice, but which are not suitable for the subjects of formal papers or reports. Hence the Question Box has become a feature of the programs of several associations, including the Accountants' and the Mechanical and Electrical, in the electric railway field.

In handling the Question Box there are two important points—the Question and the Answer. Language always has two meanings—that intended by the writer and that understood by the reader—and often there are more than these two. In the question boxes we have seen most of the questions are stated in too general terms, with the result of omitting all reference to the particular circumstances prompting the question and having important bearing on its correct answer, and often making the question ambiguous. In other words, one can seldom tell from the question exactly what the questioner wishes to know. Such questions are provocative of discussions on the meaning of terms which are interesting enough, but fail to throw the desired light. A good example of the simple question, one that is shorn of all illuminating explanations, is: What is the correct pronunciation of "b-o-w"?

As to the answer, it is usually necessary to further define the question by assigning sundry hypothetical conditions, and then frame the reply accordingly. The answers in the Question Box are often statements of a practice without explanation of the theory on which it is based, such answers being possibly of most value in suggesting subjects for further discussion. Thus the Accountants' Question Box has 16 answers to a question on the distribution of expenses between operating and lighting departments, when of such a nature as not to be directly chargeable to either; 7 favor proportioning such expenses according to the division of energy output at the power house, and 8 according to gross earnings, 1 suggests an equal division. Were it not that there are but few items to be so distributed, this question is worthy of a paper, as on the two theories indicated much could be said. The basis of gross earnings is affected by the matter of proportion of profits, and the basis of power house output by the difference in load factor, which modifies the cost of manufacture.

Summer Parks.

BY C. L. S. TINGLEY, SECOND VICE PRESIDENT, THE AMERICAN RAILWAYS CO., PHILADELPHIA

Do summer parks pay? This is a question often asked of street railway managers, and one to which two answers can be given, both of them true and both misleading. For very few railway parks take in more money in the park itself than a progressive management

C. L. S. TINGLEY

will spend on the upkeep and operation of the park, and in that sense they do not pay; but, on the other hand, very few street railways have all the traffic they can profitably handle, and a well managed summer park is a great traffic breeder, and every up-to-date electric railway should have one. Having decided to have a park, do not trust its location and equipment to chance or to incompetent hands; the park is worthy of the best thought the management can give it.

INTERIOR SUMMER THEATER, LAKEMONT PARK, ALTOONA, PA.

First, as to the location, study the situation well, and see if there is any one particular line that it is desirable to build up, for the frequent service to the park in summer time and the crowds of people carried will surely build up a permanent resident population along the line if there is [illegible] be, then it is desirable to avoid [illegible] traffic on a line which is already crowded.

Second, the site should contain at least ten acres, and may be as large as the population served demands, but should not be larger than the company can properly keep in order, police and light. It should contain a grove or wood for picnics, and some water; this latter is very important, and if a tract of land cannot be found in a proper location with a stream on it, wells should be sunk and water pumped. Good water and plenty of it is needed for drinking, sanitary uses, fire protection about the various concessions, and for watering the flowers and lawns. A lake, even a small one, is a great addition to the landscape, and if it can be had large enough, the renting of boats can be made a good source of income. A few water fowl are a great addition.

The writer is connected with the management of a park of about eighteen acres in which there was no natural water supply. A well was drilled and an electric pump installed, run from the trolley feeder, and a 20,000-gallon tank placed on a steel structure on the highest point in the park. The tank affords ample water for all purposes around the park, including fire protection, and is so connected with the pump that when the tank is full the turning of a valve causes the water to flow directly from the pump into a lake which has been made by building an embankment across a natural depression or gulley.

Having secured the land, employ a competent landscape gardener to lay out the improvements, advise as to trees, shrubbery and flowers. Secure the water supply, lay out an ample system of pipes, so that water may be had in all buildings for sanitary purposes and fire protection, with a goodly supply of hydrants for watering flowers and lawns.

The tracks should enter the park so that, if possible, it will not be necessary for people to cross them in going from one part of the park to another (a loop is desirable), and should if possible be fenced; a loading and unloading platform with a shed for shelter in case of storm is desirable.

The buildings will vary with the size of the park and the population to be served. Next after the terminal shelter there should

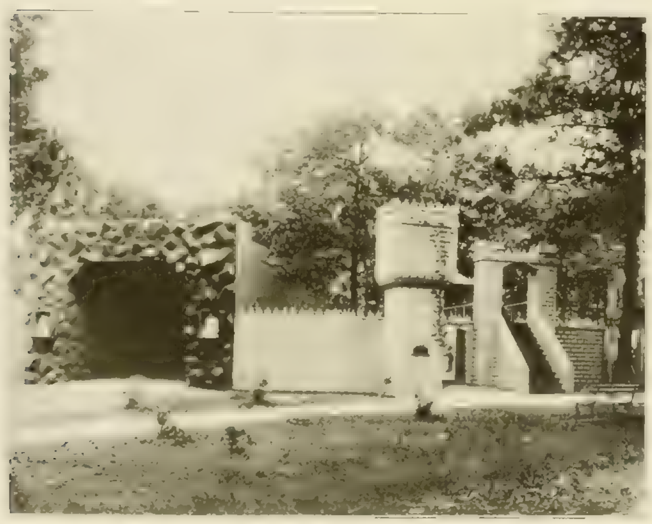
be a club house or restaurant. This will range from a fully equipped club house with a restaurant where regular meals are served, a bowling alley, billiard room, public comfort room, etc., to an open pavilion where light lunch, candy, fruit, cigars, etc., are to be had. Other buildings will include a casino or open pavilion where dances

OPEN AIR THEATER, TUMBLING DAM PARK, BRIDGETON, N. J.

can be held under proper restrictions and, according to the size of the park, one or more small pavilions where soft drinks, soda water, ice-cream, etc., can be sold. There should be an ample supply of buildings for public comfort. If picnics are to be catered to, a pavilion with tables and benches for lunch should be located in the picnic grove. There should be a generous supply of benches and lawn swings scattered all over the park. There should be a band stand for free band concerts and the benches should be distributed with the idea of seating people so they can see as well as hear the band. In some parks, notably Willow Grove, near Philadelphia, where the free concerts have been made a feature, benches are provided for the seating of large audiences, and a large part of the park is wholly given over to this feature. This, of course, can be done only in a large park.

A cottage should be built for the gardener or superitnendent of the park. It will also be found economical in some cases to build greenhouses for the propagation and care of flowers.

An open-air theater, where vaudeville, comedy, minstrel shows,



CAVE OF THE WINDS AND HOUSE OF TROUBLE, SPRING GROVE PARK, SPRINGFIELD, O.

or even light opera, can be given is usually a money-maker. This building will vary from merely a covered stage with the seats ranged around under the trees, to a fully equipped theater with opera chairs all under cover. This theater should be operated by the park management, as they are more interested in the number of people hauled to the park than in the receipts of the box office; in fact, is may be good policy to give only a short performance in the theater to which every one entering the park on the cars should be admitted free, and in most cases it is good policy to sell only reserved seats and permit those who will stand outside of the reserved seat enclosure to see the show free. There should be buildings free to the public of sufficient capacity to shelter the normal attendance in case of storm.

There are a number of people who make a business of devising and furnishing amusement features for summer parks and who will usually install and operate them on a percentage basis. The best known and one of the most popular of these devices is the carrousel or merry-go-round, and one or more of these old but ever popular devices should be found in every park and should be located as near to the picnic grounds as is consistent with the general layout of the park, for the children are its most consistent patrons.

As a money maker, the scenic railway or figure-eight toboggan slide in some of its various forms is near the head of the list. The circle swing or captive air ship is a novelty and a good money earner; the laughing gallery, especially if it has a Cooper-Hewitt mercury light installed in it, is a mirth provoker and very popular. A miniature railway can be made a very attractive feature, especially if it can be laid out on the shores of a lake with a trestle bridge over the outlet and a small tunnel on the line. There are almost countless numbers of minor attractions which can be in-

REFRESHMENT PAVILION TUMBLING DAM PARK, BRIDGETON, N. J.

stalled at small expense, and will attract patrons for a few years, among the best of which are the House of Trouble or Mysterious Castle, the Cave of the Winds, the Down and Out or Bamboo Slide, the House Upside Down, the Shooting Gallery, the Ball Throwing Gallery, Knife and Cane Rack, Penny-in-the-slot Machines, and the Biograph or Moving Pictures (this last either in a building by itself or as a part of the evening performances in the theater).

A competent man should be engaged as park manager. He should start out about the first of January, and make a canvass of the city and all the surrounding towns for excursions, picnics, etc., getting in touch with churches, schools, both Sunday and day, lodges, societies, and trade organizations. In so doing, printer's ink should not be spared, but good attractive circulars or booklets should be well distributed, and placed in hotels, railroad stations and other public places. After the park opens, the manager should see that the picnics which he has booked are properly taken care of; that the transportation department is advised each day of what excursion business must be taken care of the next day; when and where the cars are to meet the passengers; the probable number of persons, etc. The park manager must have a general oversight of all the amusement features, look after the theatrical bookings and

must always be present at the first rehearsal so that any objectionable act or part of act may be eliminated. He must look after the advertising, both in the daily papers and on billboards, and also see to the newspaper write-ups. This is a very important position and should be filled by a good man, and one with some previous experience in the same line, or in newspaper work, is preferable.

THREE-WAY TOBOGGAN SLIDE, FAIRVIEW PARK, DAYTON, O.

Under no circumstances should liquor be tolerated in the park, and absolute order should be preserved; for this purpose park police, who should be peace officers, should be provided and all objectionable persons removed from the grounds and all cases of disorder prosecuted. As an aid to this, the grounds should be well lighted.

A close supervision should be had over all the concessions to see that nothing is done to offend the patrons of the park and that all the buildings are kept clean and neat and that nothing is stored in them which might cause fire or otherwise endanger the buildings or the park patrons.

The public likes to get something for nothing, so give some free shows, of which the best is good band music, especially on Sunday; a tight-rope act, a balloon ascension, or diving horses or elk, if free, will draw good crowds, provided they are not offered so frequently as to cease to be novelties.

CASINO, LAKEMONT PARK, ALTOONA, PA.

Make Children's Day a feature. Choose some day not too late in the season and make all the amusements free to the children during certain hours of the day, or give each child going to the park on the cars a certain number of tickets good during that day at the various amusements.

As to the Sunday question, respect the religious sentiment of the community, and if the best element of the city will not patronize the park when the amusements are open on Sunday, close the amusement features.

Keep the park sweet and clean, physically and morally; keep your attractions fresh and bright; advertise and work up the excursion business to keep the park busy during the day; and you will undoubtedly find that [illegible]

The accompanying [illegible] may be done elsewhere under similar conditions.

The New Tariff of the Municipal Street Railway in Cologne, Germany.[1]

The adjusting of the rates of fare on street railways or short distance railways always arouses the greatest interest in railway circles, especially in cases where new methods are being applied such as are based upon the experience collected during more or less protracted and practical experience along these lines. This adjustment of the rates of fare may be of great interest to parties interested in the running of street railways and I wish therefore to report to you upon our new schedule of rates such as it was submitted to our city council and accepted by it without any further change.

There was an urgent need for a reform in our schedule of rates, owing to the great extension of our entire system of street railway lines, of the higher speeds established, of the increase in opportunities for travel and the extraordinary increase of the transportation business, due to these increased facilities, creating as they did entirely new and strange conditions.

During the period of four years, from the first of April, 1900, to the first of April, 1904, the miles of street railway track increased from 81 to 137, the car trips over these lines from 1,171,558 to 2,045,804 and the car-kilometers from 5,941,642 to 13,223,521, while the number of persons carried increased from 29,189,639 to 48,549,079. During the current year there is a considerable increase over these figures.

The present very limited schedule of rates which is yet in operation, awaiting the introduction of the new schedule, does not adapt itself sufficiently to present conditions, the result being that some passengers pay too much and others too little for the distance traveled. This condition does not correspond with the principle of "same service, same pay," and in a way hampers the development of traffic.

The first duty of a street-car system is to facilitate traffic, and as our city owns the lines, the question of profit is a second consideration only.

A reform from the present system of single trip and punch tickets had been under consideration for a long time. Our system uses electric power throughout and our experience of the past year has shown that we are on a good successful footing and that the city of Cologne can proceed to adjust its schedule of rates to suit its own conditions.

We do not mean to establish new principles, as conditions are subject to rapid changes, but for the purpose of reaching satisfactory results we used the following fundamental arguments:

1. A moderate charge should be made by the city for services rendered to its citizens. In this case the pay should correspond with the length of the ride. The schedule should not be established on so low a basis as to create a loss.

2. A reduction of the established rates should be granted only to those purchasing weekly or monthly tickets or for social reasons to the financially weaker ones (children, laborers, etc.).

3. The receipts must be so adjusted as to provide, not only for the payment of the interest on the indebtedness, the keeping of the property in good condition, the expansion of the system, etc., but also for the payment of the principal of the indebtedness.

4. After duly adjusting the matter between the wishes of the people and the practical and satisfactory running of the roads, any surplus revenue resulting from the ownership of the street railways should be considered a public revenue, the same as with the railways owned by the state, and should be used towards paying the public debt.

[1] Translated from [illegible] 1905.

These fundamental principles led to the following changes:

The introduction of a graded schedule of prices with a corresponding price-difference for single-trip tickets.

Transfer privilege on tickets costing 15 pfennig (3.75 cents) and up.

Introduction of weekly or monthly tickets over stated routes.

Introduction of early morning tickets and the application of this class of tickets to the working class.

As a basis for the schedule of prices the whole network of roads is divided into units of one kilometer or thereabouts.

We now give you the rates of fare for single tickets which are as follows:

For a distance up to

3 kilometers	10 pfennig
6 kilometers	15 pfennig
9 kilometers	20 pfennig
Over 9 kilometers	25 pfennig

Differences in distance and price-calculations up to 300 meters are allowed. The maximum price for a single ride is 25 pfennig.

This does away with our present maximum rate of 15 pfennig which could not possibly be kept up any longer; under present conditions the city of Cologne would have to carry some of its passengers as far as 10 and even 11 kilometers for 15 pfennigs, which rate is untenable, unjust and unbusinesslike.

These long distances find their origin in the fact that after the introduction of the electric power the lines reaching out into the suburbs were connected in the center of the city, giving passengers the opportunity to travel from one suburb to another, through the center of the city, without any increase in the ticket-rate, as for instance between these points: Rodenkirchen to the Zoologischer Garten, 8.8 kilometers; Lindenthal to Muehlheim, 9.2 kilometers, and up to the center of Muehlheim, 11 kilometers.

The distance allowed for the 10-pfennig (2½-cent) rate is also regulated and made more uniform. Under the present system which is still in operation the 10-pfennig distance varied from 1.8 kilometers to 4.2 kilometers, while it averaged only 2.5 kilometers. Under the new system, 3 kilometers is the distance allowed.

The underlying idea of our schedule of prices is this, that 10 pfennig should carry a passenger at least from the farthest point of a suburb to the belt-line and for 15 pfennig he should be carried to the center of the city, either to the cathedral or to the Union Railway Depot.

This graded schedule of prices facilitates the introduction of the transfer privileges with a minimum fare of 15 pfennig. As there are a great many points where the different lines of our city railway system cross each other this privilege of transferring from one line to another is but fair and it greatly facilitates interurban travel.

An extension of this privilege to include the 10-pfennig rate of fare could not be made, owing to financial reasons. This privilege cannot very well be demanded, as the 10-pfennig distance was increased by 500 meters on an average, so as to make it three kilometers.

The uniform rate of 10 pfennig which so many people called for could not be adopted. Other cities, such has Dusseldorf, Munchen, Elberfeld, Barmen, etc., having much shorter lines than our city had tried this uniform rate and had to give it up again for very good reasons. Such a uniform rate of 10 pfennig applied to our city of Cologne would mean a loss of at least 425,000 marks, taking as a basis of calculation the 8½ millions of 15-pfennig tickets issued in 1903.

Entirely new are the monthly route tickets and as a consequence we have two forms of monthly tickets, a general ticket covering all lines and a route-card covering a specified route only.

There is an increase in the price of general tickets, covering all the lines, from 10 marks to 13 marks for a monthly ticket good on Sundays also. This increase seems to be justified by the fact that when the original schedule of prices was made the tracks were increased from 81 miles to 137 miles and the car-kilometers from 5 to 13 millions without any raise of prices in the meantime. It is also to be considered that there is not another city in Germany with over 100,000 inhabitants that issues general monthly tickets below 15 marks.

The price of a general monthly ticket of 13 marks would cover 130 single trips at 10 pfennig each; this would mean 4.3 daily single trips at 10 pfennig each, while our statistics show us that in reality 4.66 single trips are used on an average by the purchasers of general tickets. This average promises to become higher still after the practical introduction of the monthly route tickets.

Our future purchaser of a general monthly ticket will have all those rides free which he uses in excess of an average of 4.3 10-pfennig rides daily.

Monthly route-tickets which are now to be introduced can be used over combination-routes. We have already mentioned that the entire system of street railways is to be subdivided into short unit-lines which will be numbered. The purchaser of a monthly route-ticket arranges the desired numbers of his route and the monthly ticket will be made out accordingly. These route-cards are good only during week-days but on all the cars running over the specified route and are made out for the calendar month.

The schedule of prices for these route-tickets is as follows: Up to 3 kilometers, 5 marks; up to 5 kilometers, 7 marks; up to 7 kilometers, 8 marks.

No monthly route-tickets will be issued over longer routes than 7 kilometers. It is expected that these route-cards will be largely used over routes up to 5 kilometers more so than over 5 kilometers and we saw fit to reduce the price of tickets on routes over 5 kilometers by one mark making it 7 marks, while a 7-kilometer route-ticket would apparently cover the demand for such tickets, so far as the distance is concerned. A run of 7 kilometers requires about 40 minutes' time and this same run, four times a day, would mean 2½ hours daily ride on the cars. For longer distances we have the general monthly ticket.

This new plan is a great benefit for a large number of passengers who run only over certain routes daily. Heretofore such people were compelled either to buy single tickets (punch-tickets) or to buy a general monthly ticket of which they had only a partial benefit. A great improvemnt will also be brought about in the dwelling-facilities.

For social and economic reasons the poorer class (laborers), or the weaker class (school children, etc.), are granted special privileges, the laboring class receiving their privileges in the shape of early morning commutation tickets. These are weekly tickets good for 6 rides for 30 pfennig. These tickets are transferable and can be used as freely by other members of the family or by anybody else. These tickets are unlimited as to the length of each single trip, but they are good only on the week-days marked on the ticket with no transfer privilege. The start must be made before 7:30 in the morning, which is the most suitable time for the laboring class. The trips that are not taken on the days marked on the ticket are void.

It looks as if these early morning tickets would correspond with the needs of the laboring class. Should it be shown, however, that a further reduction in this direction is advisable, we have in view the issuing of weekly commutation tickets for laborers. These laborers' commutation tickets which we may issue would be good for the entire week, at two trips for each week-day, going and returning, starting before 7:30 in the morning,—the same summer and winter. These tickets will also be made transferable and cover an unlimited length of ride without transfer. They will be issued only to parties whose income tax falls below 31 marks. Unused rides are void. The price of these tickets will be 80 pfennig per week, with an additional tax of 20 pfennig weekly as a bridge tax should the route lead across the Rhine.

This price does not seem high, considering the fact that the length of the route is unlimited.

The whole question of granting the workingman special privileges is so closely allied with the actual use of these early morning commutation tickets that the success of this experiment remains to be seen.

The present system of single trip tickets for 5 pfennig and 30-trip punch tickets for 1.50 marks remains in force. This system, however, is now to be extended so as to grant full-grown students attending the colleges the same privileges, provided they show a certificate issued to them by their respective colleges. All students above the age of 14 years will have to show such a certificate when they purchase either a single trip or a 30-ride ticket, while children below the age of 14 are free from this restriction. These student tickets are good for an unlimited ride without transfer and

are only good for the express purpose of attending school or for divine services in the school and return from there. Heretofore where students had to cross the Rhine to attend college, the same fee for single trip tickets was charged to them as to grown persons. Under the new system the reduced scholar tickets, either single trip or 30 ride tickets are good to cross the Rhine without any additional tax.

Children below the age of ten receive the same rate as scholars do for single trips at 5 pfennig each for an unlimited length of a ride without transfer.

Small children held in the lap are free.

We have an arrangement with the railroad administration whereby the city is to pay 2 pfennig for every street car passenger crossing its bridge across the Rhine, or rather we pay them a round sum of 100,000 marks yearly toll. Owing to this tax which we have to pay, we are compelled to make an additional charge on route tickets and early morning cards, these two forms of tickets being issued at the lowest rate. This additional tax amounts to 1.50 marks on monthly route tickets and 10 pfennig additional on weekly early-morning cards. In both instances, however, the additional tax charged by us is lower than what we are actually paying out for the same privilege.

Single trip tickets [illegible]

After the [illegible] morning tickets will very advantageously replace the punch-tickets.

We [illegible] made without any change in the schedule of rates. We have been able to give to the people of Cologne what they were after, "same service, same pay," cheapening of rates in general, better facilities for transportation, with the desired transfer privileges, an improvement in the dwelling facilities and reductions to the poorer or weaker classes.

To what extent the new schedule will prove a success remains to be seen. It is quite possible and even likely that a reduction in the income will be the direct result but the city believes itself to be in a good position for trying the experiment.

Even where the demands made were not fully complied with, this much is to be seen that quite a number of just wishes have been granted. H. Z.

The Treatment of the Ground Return in Railroad Systems.

BY ALBERT B. HERRICK.

The conducting of the return current back to the power station on the railway system is one of the problems that the railway management has to solve and the questions that arise are how to best improve this portion of the system with the least possible cost, and on what portions of the system it would be most profitable to improve this return. The broad question that first has to be solved by the tests is: "What is the aggregate drop back to the power station?"

It will be found on any system of rails that certain sets of rails will carry the greater portion of current back to the power station, either due to their location or due to the fact that they form the lowest resistance return circuit.

There are several methods of determining the aggregate drop from the negative bus to different portions of the railway system. In any case where the railway owns its own telephone system, the telephones wires can be used as pressure wires, or if the temporary use of the telephone exchange wires can be had, connection can be made to the telephone wires and by plugging this wire around at the cable switchboard to a pair of wires leading to the station, which in turn are connected to the negative bus. It is best to insert the voltmeter to measure this pressure in the station, between the end of the telephone wire and the negative bus, so that a comparison can be made between the drop on the rail tested and the load on the overhead feeders which feed this section of rail at the time of taking pressure readings.

By using a high resistance voltmeter corrections for the resistance of telephone pressure wires are hardly necessary, except where the distance is considerable. A pair of telephone wires run about 11.3; a single wire 22.5 ohms per mile.

In order to see graphically the results of these tests, a plan of the city including the railway lines can be used and potential contour lines laid out, using the points of tests for determining the location of these contour lines. Four or five tests along the road are generally sufficient to give fairly reliable results, but where there is a change in the size of the rail or in the character of bonding, the point where the change takes place should be selected as a test point.

The expansion and contraction of these contour lines when being drawn out for each volt fall, will show immediately the electrical condition of the railroad system, and where the ground return circuit needs improvement.

When a railroad company secures these records it will be in a position to say with surety on what lines the rebonding can be done with the greatest profit, and the saving of energy delivered to the cars. When it has been decided to re-bond a road, the bonding foreman should be instructed thoroughly in the use of the millivolt meter and should determine for himself the condition of every bond and renew those which show resistance equivalent to a rail length greater than that which would be determined in applying the following method.

In testing a rail bond, several considerations are necessary in order that the work of repair may render the return circuit the most effective for the least expenditure of money, and consequently the resistance of a bond in terms of the length of the rail, which would be called good, bad, or indifferent, will depend on what portion of the rail return system this bond occurs. The current density on the rail being the important factor in determining what will be the permissible drop, on this basis should the effectiveness of the individual bond be judged. Assuming the maximum return drop which we wish to allow for a given stretch of road from the power station serving that road, we would first determine the current flow that the rails have to carry back to the power station, the voltage being taken by drop tests or computed for the maximum load at half the track distance. Assuming that the rail (60-lb. rail) measures .0052 ohms per thousand feet as a fair condition for rails weighing over 40 lb. and that their resistance is in inverse proportion to their sectional area, this gives us the drop that will occur with the given current flowing through the rails, considering it a continuous rail system. Assuming the maximum drop permissible to be 20 volts, subtract the drop thus found for a continuous rail from 20 volts and divide this difference by the number of joints occurring to the points on the rails corresponding to the assumed drop; this will give the potential difference on the average joint and from this may be computed the length of rail equivalent to the average bond, or the condition required to be maintained in order to give the drop on the rail joint, which will come within the desired potential loss on the return system.

There are other considerations that cannot be neglected in this proposition; that is, where the equipment is large the acceleration of this equipment becomes an important factor in determining the copper overhead and the bonding of the rail return in order that the equipment may accelerate without undue heating and the schedule be maintained without over-speeding the equipment on high pressure portions of the system.

The foregoing treatment of the bond question leads to varying section of bond as the power station is approached, and this is the correct method of placing bonds for a given amount of money expended in bonding to give the least possible drop and consequently it is impossible to arbitrarily fix any length of rail in terms of bond resistance without knowing the condition under which the bond be used.

In a paved street [illegible]

pavement are both in good shape, the question is which would be the more economical, the ground return feeder or the opening of the joint and placing the bond. The objection, of course, to opening a joint is that it can never be restored with the same permanency as it had originally and after removing a fish plate it can never be replaced so as to secure as good a bearing as it had before its removal. In asphalt paving it is nearly impossible to repair the pavement and make as good a job as originally existed.

Again, on a poor track, where this is a main artery of conduction back to the power station, and where it is eventually proposed to replace a track, the ground return cable is often the most economical expedient.

Often roads having poor power place feeders overhead to improve the condition. But this can only be intelligently done when the overhead losses are known and separated from the ground return losses. I have found roads loaded overhead with copper, whereas the important drops were on the ground return part of the system and by turning this copper down to the negative side the copper was utilized at a greater economy and produced better pressure conditions for the equipment. Also where a current is congested (in proximity of the power station) on the rails, this brings to a focus the current that has been diverted to the water pipe system and may produce local trouble by electrolysis to the piping system. Here the value of a ground return feeder system, embracing this system and extending beyond it, should not be lost sight of in treating broadly this special problem as to how to produce best results from all points of view.

In selecting the bond that would be best suited to the special conditions, the consideration of the condition of the track, the dimensions of the rail, the fish plate and paving, have all to be considered. It is required of any bond to make a good electrical connection between the flexible portion of the bond and the rail, and this connection should present ample surface and as a rule estimating on current density of 200 amperes per square inch of contact for the mean current flowing through the bond will be found good practice and the terminal of the bond should be of such metal that when it is exposed to moisture that local corrosive action will not take place between the rail and the bond terminal. It has been found in the type of bond that is inserted in the hole in the rail that pressure in making this connection has more to do with the continued conductivity of the bond than the area of contact. The pressure on the head of a bond should be great enough to force the metal at the head of the bond to completely fill the hole in which it is inserted (twenty-five tons per sq. in. for a ⅞-in. terminal is found to be about the correct pressure to produce the best results; a 6 ft. lever on a 4 pitch screw will produce this pressure.) If this is not accomplished, moisture will creep in and gradually corrode the surface of the contact.

The riveting of a bond in a hole does not produce satisfactory results. The head may be held mechanically rigid, but the shank of the bond has not been expanded to fill the hole. This method leaves the area of contact small and moisture will soon produce a poor connection.

A bond can be expanded or riveted in a rusty hole, just as tight as in a clean one. In the first case it is worthless and in the second case it should form a good contact.

For drilling holes for rail bonds, soap water, or oil (heavy mineral oil), is being generally used, and I find that with either of these lubricants being used that if the hole is carefully cleaned immediately after drilling, that it does not affect the resistance or the life of the bond, but the bond should be inserted and fixed in its position as soon after the hole is drilled as possible. No drill holes should be left over night and this work should not be carried out in damp or foggy weather, as a film of oxide forms on the freshly drilled surface of iron, almost immediately, and seriously affects the resistance of contact between the bond surface and the rail.

In holes that have been bored or old holes to be re-bonded a reamer is the best tool for cleaning this hole and a reamer which has on it a miller which cleans the surface of the rail against which the head portion of the bond will be compressed, decreases the resistance of the contact between the bond and the rail about forty per cent. The resistance between the shank of the bond and the rail due to the different character of metals employed in this contact and the gathering of the current at this point, in the case of a 6-in. cast concealed bond newly inserted (the resistance at the contact of the two terminals of the bond), averages about 75 per cent of the total resistance of the bond in a No. 0000 ⅞-in. shank, bond. The application of white lead to the bond before inserting is not advisable and has been abandoned by the railroad companies who instituted it. Plastic alloy can be used in the case of a rough bond being the only intermediary used between the shank and the hole that assists in the conductivity of the bond. The alloy should never be used with a bond having anything but a pure copper head, as it will rot out any compound of copper with zinc or tin, as mercury in this case permeates into the body of the bond and destroys its mechanical structure.

Welding bond terminals to the rail is the ideal method, especially in the case of the electric weld, yet this method has been so surrounded by patents and litigation that the railroad companies are deprived of utilizing the method which gives the ideal connection between rails and bonds. The soldered bond can be applied to some rails and not others. The bond underneath the foot of the rail requires suspended joints and a number of the rail splices used are not adaptable to the use of this type of bond without a special joint being made for the purpose. The type of soldered bond, that soldered to the ball of the rail, gives the ideal result; but an objection to this type of bond is that it is exposed and easily stolen, I would suggest that such bonds be painted with a paint containing arsenic, so that it would be of very little value when the copper is melted for reduction.

Welded joints cast since 1896 do not require any bond around them, as they average lower than the rail resistance itself. That is the case on the railways at Minneapolis, Milwaukee, Indianapolis, Rochester, N. Y.; Grand Rapids, and in other towns where I have investigated this matter and the same is true of the electric weld made since 1898. Bonding and cross bonding should both be employed where expansion joints are used, but with a concrete grouting rich in lime between the rail and its adjacent pavement, assuming there is a concrete base upon which the rail is laid, either beam or tie construction, no movement of the rail takes place with the temperature changes and expansion joints are unnecessary, but particular care should be taken to maintain the effectiveness of the cast weld rail return at special work by supplementary bonds at steam road crossings, and special work, for frequently I find more drop in a steam road crossing, in a cast weld track, than I have found in 6,000 ft. of track adjacent to this crossing.

In interurban work, cross bonding should be done on single tracks a great deal more than it is, and for a four motor 200-h. p. equipment at least five times a mile, especially where sub-stations and rotary transformers are used, for if the bonding is defective near the sub-stations, it throws the load unequally on sub-stations. I have recently found two sub-stations adjacent to each other; one operating normally at one-half load and the other at 40 per cent overload; the whole cause of this unequal distribution between sub-stations was due to defective bonding and no cross bonding.

The critical portions of an interurban road, where the bonding becomes defective, are at switches and turnouts, railway crossings and derailing switches, and the only satisfactory solution for bonding around this portion of the tracks, is to bond in supplementaries having a section of copper, of an aggregate section equal to the section of the bonds employed and completely surrounding the special work by the supplementary, tying the four tracks of the turnout together and the two tracks of the main line with this jumper; and at steam road crossings to thus connect the rails of electric road. It is well to assume that the bonding between electric rail and steam rail cannot be maintained. Crossing bridges is another critical point and a supplementary wire should be used at bridges or double bonding across bridges; a concealed and an exposed bond in this location give better results with time than two bonds of the same kind.

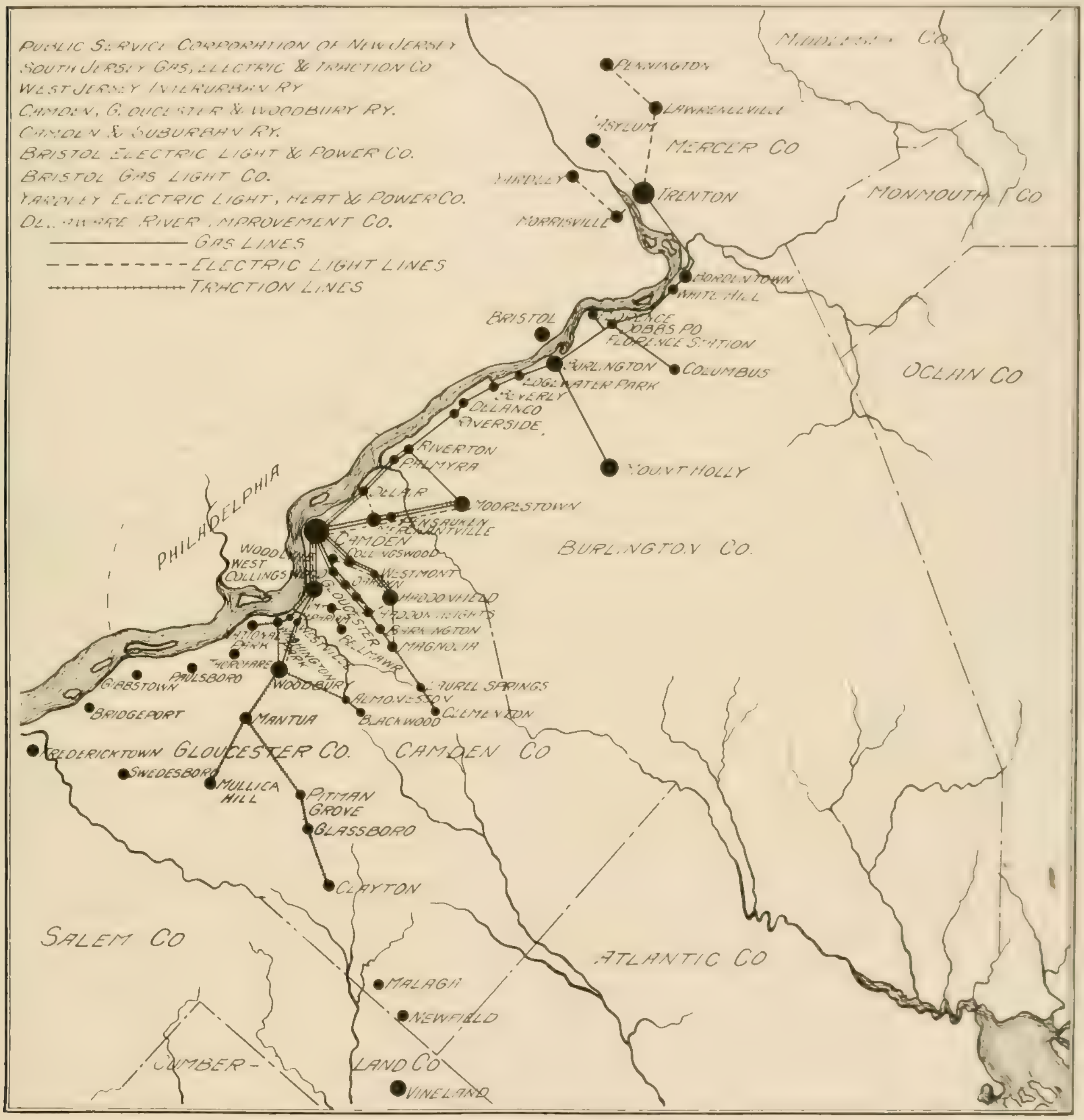
It has been found that where the bonding has become defective and yet the track has stability to hold the bond, the cause has been that the men who have put the bond in have not been fully instructed. Trackmen who are competent to drive a spike, and tighten a bolt, fail in putting in the bond, for the reason that they do not fully appreciate the importance of the proper method of preparing the hole to receive the bond, and produce a mechanical, rather than an electrical job, in making of the connection between the rail and the bond; this has been the point where a large number of trackmen have failed to produce a good return circuit.

Forms for Purchasing, Delivering and Paying for Materials.

BY JAMES R. [illegible]CHURZ, AUDITOR PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The subject here taken up is one which every corporation has to meet in some way, each and every business requiring its own peculiar forms and methods, due to its operating conditions. In showing the forms, it is not attempted to suggest their adoption, but merely for the purpose of bringing out the plan which is operated by the South Jersey Division of the Public Service Corporation of New Jersey in carrying out its work in a division which covers a large amount of territory and varied operations, with 105 miles of railway, 272 miles of pole line, and 360 miles of gas main (including 36 miles of 12-in. high pressure pipe line), a coke oven plant (consuming 150,000 gross tons of coal per year, producing coke [illegible] are lighting stations.

The map [illegible] the distribution of [illegible] of the operations and the points covered—from the Borough of Pennington, which is the most northern end of the system, where municapl and commercial lights are furnished, to Clayton, the most southern end of our proposed railway extension, a distance of 70 miles.



MAP OF DISTRICT COVERED BY THE [illegible]

The main office of the division is situated at No. 418 Federal St., Camden, N. J., from which point all materials are ordered, and where accounts are kept, audited and paid.

5-16 05 Requisition No. 4800

For Shipment To NEWTON AVE CAR BARN

For CAMDEN N.J.

To Be Used For STORES

Place Order With JOHN DOE

WILMINGTON DEL

QUANTITY	MATERIAL
1000	TROLLEY WHEELS

Signed J.R.WILSON

Approved { J.R.GILKYSON

Order No. 14478

FIG. 1. REQUISITION. (ORIGINAL 5¾ X 8½ IN.)

Form 420

PUBLIC SERVICE CORPORATION OF NEW JERSEY

South Jersey Division, 418 Federal Street

CAMDEN, N. J. 5-16-05

To JOHN DOE. WILMINGTON, DEL

Please deliver to NEWTON AVE CAR BARN

Ship via CAMDEN N J

Mark on your bill Order No. 14478

1000 TROLLEY WHEELS @ .58

FOB DESTINATION

THESE INSTRUCTIONS MUST BE FOLLOWED

Send Notice of Shipment and Bill to 418 Federal Street, Camden, N. J.
All correspondence, notices and bills must refer to our number printed above. Make bill on form supplied and charge account of

4800
J.R.W.

PUBLIC SERVICE CORPORATION OF N. J.
SOUTH JERSEY DIVISION.
J. R. GILKYSON Gen. Agent
Per F

FIG. 2. ORDER. (ORIGINAL 5¾ X 8½ IN.)

Form 408

PUBLIC SERVICE CORPORATION OF NEW JERSEY

South Jersey Division, 418 Federal Street

We Have To-day Ordered the Following:

JOHN DOE WILMINGTON DEL
NEWTON AVE CAR BARN
CAMDEN N.J.

Local Order No. 14478

TROLLEY WHEELS

STOREKEEPER'S COPY

S. J. Order No.

LOCAL REQUISITION
4800

J.R.W.

FIG. 3. NOTICE TO STOREKEEPER. (ORIGINAL 5¾ X 8 IN.)

DELIVERY RECORD

Date Goods Received	5-20
Date of Bill	5-18
Date Bill Received	5-20
Date Bill Returned Approved	5-24

4800
J.R.W.

FIG. 4. DELIVERY RECORD.

ORDER DEPARTMENT RECORD

Date of Bill	5-18
Date Bill Received and Forwarded	5-20
Date Bill Returned and Passed	5-24
Remarks	

4800
J.R.W.

FIG. 5. ORDER DEPARTMENT RECORD.

FORM 413

ORDER NO. 14478 5-18 1905 1-12

PUBLIC SERVICE CORPORATION OF NEW JERSEY
"SOUTH JERSEY DIVISION"

P. S. C. 27951

PLEASE NOTE TERMS OF CASH DISCOUNT

TO JOHN DOE DR.

ADDRESS WILMINGTON

TERMS: NET 30 DAYS DEL.

WHERE AND HOW SHIPPED BUSH LINE

PLEASE USE THIS IN PLACE OF YOUR BILL HEAD

1000 TROLLEY WHEELS @ .58 $ 580.00

F. O. B. DESTINATION

AUDITING RECORD		RECEIVING RECORD RAILWAY		CLASSIFICATION			Price Correct
Pur. Agents Order				Charge	District	Amount	F. P. H.
P. S. Order	14478	Date Received	5-20-05	NO. 502 MATERIAL AND SUPPLIES	RAILWAY	$ 580.00	
Local Order	4800	Received by	G. C.				General Approval
Date Recd.	5-20	Freight or Express	$ 13.72				
Date Retd.	5-24	Cartage	$				
Extensions	H	Total	$ 13.72				
Acct. Pay	M. C.	General Stores	801 ^ 5-31'05	J. R. W.			H. T. CORLISS H.
Class Record	5	Record	129				

FIG. 6. BILL (ORIGINAL 8½ X 11 IN.)

The forms herewith describe an operation covering the purchase of 1,000 trolley wheels, and these forms have covered the operation from the time the requisition was made until some of the wheels have been transferred to another department, and others used in the railway operation.

Fig. 1 is the form of requisition issued by the different departments for their requirements and forwarded to the general agent and general office for approval. This form (417) is 5¾ x 8⅝ in. and is made up in books with pages of white (for originals) and yellow (for carbon copy duplicate) sheets, the white sheets being perforated near the top; the sheets are consecutively numbered in pairs. If the materials are of such nature that they are purchasable in the local market, there is placed on the requisition the name of the party from whom the material is to be purchased. In the case of a large quantity of material, or materials that can be purchased to advantage by the purchasing agent, notification is sent to our Philadelphia office of our requirements. An order is then written by the purchasing department (Fig. 2), with three copies; this form (420) is 5¾ x 8½ in. Fig. 3 is a form of the same size, stating from whom the material has been purchased, leaving off information as to the quantity ordered, and is forwarded to the receiving clerk at the storeroom as notification for him to look out for the delivery of the material.

RECEIPT NO. 501

DELIVERED BY

Express

P. R. R. Freight

$13.72 PD.

Local Express

Co's Team

Car

Pur. Agt. Order No.

P. S. Order No. 14151

PUBLIC SERVICE CORPORATION OF NEW JERSEY

Railway Department **South Jersey Division**

Received from JOHN DOE

1000 TROLLEY WHEELS

Date 5-20-06 Received by G CHRISTIAN

FIG. 7. REPORT OF RECEIPT. (ORIGINAL 8¾ X 4 IN.)

One copy of Form 420 (Fig. 2) is used by the clerks in checking the bills, as to receipt of material. This blank differs from Fig. 2 only in a "Delivery Record" blank, as shown in Fig. 4, is printed at the bottom of the form instead of the "Instructions" shown on Fig. 2. This copy is on blue paper, 8½ x 8½ in. in size, with the left margin pierced for filing in a sectional post binder.

The other copy of Form 420 (Fig. 2) is held by the purchasing department for the purpose of checking the bill as to price and quantity ordered, and this blank has at the bottom the "Order Department Record" shown in Fig. 5, instead of the "Instructions" of Fig. 2. The size of this blank is also 8½ x 8½ in. and is similarly pierced for filing in a sectional post binder. After the order is checked and filled, it is filed in a post binder for future reference; records of unfilled orders are filed in a separate binder which is used for checking purposes.

With each order that is mailed is sent a copy of Fig. 6 (Form 413), or if the order is of such volume that it will require several shipments, enough bill heads are sent to meet the requirement of the shipment. When the bills are received in the office, they are passed in the following manner:

The purchasing agent's order number is entered thereon, if it happens to be material purchased from that source, or the Public Service Corporation's order number, if purchased locally; the local requisition number is then entered. The date bill was received is entered next for the purpose of future reference, as in the case of bills being discounted, quite often it is necessary to know the date the bill was received, as a number of houses are very late in sending their bills, and then claim exemption from their trade discounts.

Every bill is recorded in numerical order (as on Fig. 6, which is

Article	Article No.	Description	Page No.
WHEELS		TROLLEY	801 A

FIG. 8. INDEX SHEET. (LOOSE LEAF LEDGER 10 X 10 IN.)

Sheet No. 1 **PUBLIC SERVICE CORPORATION OF N. J.** 801 A

TROLLEY WHEELS

Date		Received	Issued	Balance	Order Number	Price	Per	Purchased From
5-20	05	1000			14478	5702	EACH	JOHN DOE
5-31	05		10	990				

FIG. 9. GENERAL STORES RECORD. (LOOSE LEAF LEDGER 11 X 11 IN.)

Auditor 5-24 1905 No. 28041

SOUTH JERSEY DIVISION.

Charge To JOHN DOE

From Railway

	13 72

Amount

Approved S. T. C.

FIG. 10. AUDITOR'S CHARGE. (ORIGINAL 8½ X 7 IN.)

No. 27,951, and charged against the railway department, each department being allowed five days for the purpose of recording the receipt of goods and classifications. After that time the bill must be returned, with such notations as to the non-receipt of goods or as to material being unsatisfactory. When this bill is received by the railway department storekeeper, and if the materials have been received by the receiving clerk, and his report (Fig. 7) agrees with the amount of material on the bill (Fig. 6), it is filled out, showing date of the receipt of materials at the storeroom, initial of receiving clerk, records of freight and cartage paid, or claims for unsatisfactory material. The class of material is then indexed in the "General Stores Record." Reference to the index sheet (Fig. 8) gives the ledger page, 801-A, and the amount of material is entered as in Fig. 9, giving the date received, order number, price and from whom purchased. The bill is then classified as, Account No. 502, Material and Supplies, Railway Department, and approved for payment. If the material on order No. 14478 (Fig. 2) was purchased f. o. b. destination, and amount of freight paid on this shipment was $13.72, an "Auditor's Charge" (Fig. 10) is made out by the railway storekeeper, attached to Form 413 (Fig. 6) and returned to the main office, where the date returned is entered opposite the bill number, 27,951, in the bill record book (Fig. 11) extensions checked, and credit memorandum (Fig. 12) made out for the amount of freight charges paid, and attached to Form 413 (Fig. 6), the auditor's charge being filed for future reference.

The bill, with credit memorandum, is then passed to the bookkeeper, who records bill and credit. The bill and credit upon being received by him is entered on index sheet of the Voucher Journal (Fig. 13) and given a number, which is entered opposite file number on the bill and credit, which denotes that it has been entered in column 1, line 12, and column 1, line 13. It is then distributed into the various accounts on sheets containing the various classifications,

1-13

5-24 1905

JOHN DOE 28041

WILMINGTON DEL

To PUBLIC SERVICE CORPORATION OF NEW JERSEY, DR.

SOUTH JERSEY DIVISION

TROLLEY WHEELS 13 72

Receiving Record: RAILWAY — 5-24 — 5-24 — H — MC — S

Bill No. 27951 — 2nd charge — 801A JRW — 5-31-05

Classification: Railway 13 72

F. P. H.

FIG. 12. CREDIT MEMORANDUM. (ORIGINAL 8½ X 11 IN.)

No.	Date	NAME	DEPARTMENT SENT TO	Date	Ret. App.	Order No.	Amount
27951	5-18	JOHN DOE	RAILWAY	5-20	5 24	14478	580 00

FIG. 11. BILL RECORD BOOK. (ORIGINAL 9½ X 14¾ IN.)

Public Service Corporation of New Jersey.—South Jersey Division

May 1905

Fig. 13. Voucher Journal. (Loose Leaf Ledger 28 x 15 In.)

May 1905

GLOUCESTER ELECTRIC

Fig. 14. Account Sheet. (Loose Leaf Ledger 28 x 15 In.)

NAME John Doe Do

SHEET No.

	Voucher			Invoice			
5	5 24 05	2804	13 72	5	2795	5 18 05	580 00
	5 25 05	9792	566 28				

Fig. 15. Accounts Payable Book. (Original 14 x 10½ In.)

Camden, N. J. May 25th 1905 No. 9792

This voucher, when properly endorsed by payee, becomes a check on

THE CENTRAL TRUST COMPANY

CAMDEN, NEW JERSEY

Payable in Current Funds Through Fourth Street National Bank Philadelphia

For Five Hundred-Sixty Six-28/100 DOLLARS $566.28/100

To the order of

FOR ACCOUNT OF

Public Service Corporation of New Jersey

SOUTH JERSEY DIVISION

John Doe

Wilmington

Del.

Approved

Approved and Payment Authorized Auditor

Vice-President

May 18th 1905 To bill rendered $580.00

By credit 13.72

$566.28

Fig. 17. Voucher. (Original 9½ x 7¼ In.)

Public Service Corporation of New Jersey
South Jersey Division
418 Federal Street
Camden, N. J.

Camden N. J. May 25th 1905 No. 9795

CENTRAL TRUST COMPANY, CAMDEN, N. J.

Fourth Street National Bank Philadelphia

Pay to the order of John Doe

Wilmington, Del.

Five Hundred Sixty Six 28/100 DOLLARS

Public Service Corporation of New Jersey

May 18th 1905 To bill rendered $580.00

May 24th By credit 13.72

$566.28

Auditor

Vice-President

Fig. 16. Voucher. (Original 9¼ x 3¾ In.)

CASH PAYMENTS May 1905 **PUBLIC SERVICE CORPORATION**

DATE 1905		NAME			AMOUNT			SUNDRIES
May	25	JOHN DOE			566 28			

MISSING BILLS DIVISION.

Material Received

John Doe

SOUTH JERSEY DIVISION

Charge To

From

Shipping Record | Credit Account | Amount

Order No.

How Shipped

Charges

General Stores Record

Approved

FIG. 19. MISSING BILL REPORT (ORIGINAL 6¼ X 8 IN.)

FIG. 20. DEPARTMENT ORDER (ORIGINAL 8 X 7½ IN.)

which are numbered consecutively (Fig. 14), using 1-12 as month number, and black ink for bills and red ink for credits. The bill with credit is then marked with the number denoting the month and the date it has been posted; that is, month of May being the classification record, or "5," and then passed to individual bookkeeper, to be entered in the Accounts Payable Book (Fig. 15). After being entered there, it is handed to typewriters to make out vouchers, either in the style shown in Fig. 16, which is the voucher used for small number of bills, or in Fig. 17, which is the voucher used for larger number of bills in one payment. A heavy manilla paper is used for duplicate copy of voucher, and pasted to the back of the bill and credit. After signature by the auditor and the vice-president the voucher is entered in the Cash Payment Book (Fig. 18) and given a number, the same number being put on the back of bill which is to denote that voucher No. 0762 has paid bill or bills of corresponding voucher number. Bill and credit, with copy of voucher, are then filed in numerical order in a cabinet for future reference. In all forms for this work a uniformity of size is carried out—for bills, credits, etc.—and confined to one width; that is, 8½ in.

All materials received by the receiving clerk are reported to the office on a receipt blank (Fig. 7), and if no bill is received by the fifth of the following month by the storekeeper, Form 59 (Fig. 19)

Form 27

SHOP REPORT

Public Service Corp. of N. J.

South Jersey Division — Railway Department

From 7 A. M. P. M. *To* 5 A. M. P. M. — *Charge Acc't* No. 406

Est. No. — *Workman's No.* 16 RICHARDS — *Job Finished*

Order / Job No. 198 — *Part* — *Car No.*

Operation REPAIRS TO ELECTRIC EQUIPMENT CARS

Date 5-31-05 — *Dept.* REP — *Foreman* CRAWFORD

X	HRS RATE	¼	⅓	½	¾	1	2	3	4	5	6	7	8	9	10	11	12
	.08⅓	.02	.03	.04	.06	.08	.17	.25	.33	.42	.50	.58	.67	.75	.83	.92	1.00
X	.10	.02	.03	.05	.08	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20
	.12½	.03	.04	.06	.09	.13	.25	.38	.50	.63	.75	.88	1.00	1.13	1.25	1.38	1.50
	.15	.04	.05	.08	.11	.15	.30	.45	.60	.75	.90	1.05	1.20	1.35	1.50	1.65	1.80
	.16	.04	.05	.08	.12	.16	.32	.48	.64	.80	.96	1.12	1.28	1.44	1.60	1.76	1.92
	.16⅔	.04	.06	.08	.13	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00
	.17½	.05	.06	.09	.13	.18	.35	.53	.70	.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10
	.18	.05	.06	.09	.14	.18	.36	.51	.72	.90	1.08	1.26	1.44	1.62	1.80	1.98	2.16
	.20	.05	.07	.10	.15	.20	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40
	.22½	.06	.08	.11	.17	.23	.45	.68	.90	1.13	1.35	1.58	1.80	2.03	2.25	2.48	2.70
	.25	.06	.08	.13	.19	.25	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
	.27½	.07	.09	.14	.21	.28	.55	.82	1.10	1.38	1.65	1.92	2.20	2.48	2.75	3.02	3.30
	.30	.08	.10	.15	.23	.30	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60

SUMMARY $1.00

Contract Price

Paid on Account

Bonus

Proportional

Paid 190

ENTER ON EACH SHEET ITEMS CHARGEABLE TO ONE OPERATION ONLY.

FIG. 22. WORKMAN'S DISTRIBUTION (ORIGINAL 8 X 5 IN.)

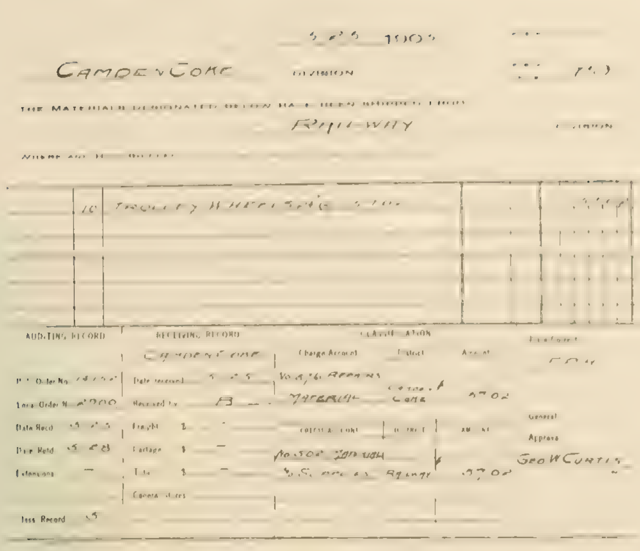


Fig. 21. Department Bill (Original 8 x 11 in.)

is made out for the purpose of requesting bills not in hand. This precaution is used in order to follow up the prompt receipt of bills as far as practicable.

Materials transferred from one department to another are only shipped after orders are issued on the regular form, the same as material ordered from outside parties. When these materials are shipped, Form 399 (Fig. 20) is made out and forwarded to the main office, where a form (Fig. 21) is made out, which acts as the bill against that department; this form follows the same course as any bill, and Form 399 (Fig. 20) is held as a record until return to office of Fig. 21. At the end of the month Fig. 21 is summarized with the other transfers and accounts charged and credited that are effected, by entries on the form shown in Fig. 13, in red and black.

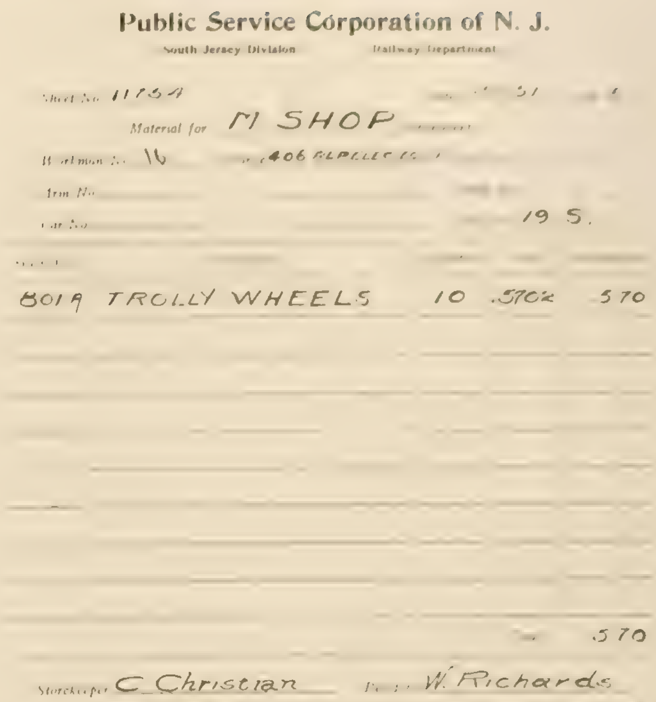


Fig. 23. Storekeeper's [illegible]

with the other issues for the day [illegible] out, similar to that in Fig. 23, for every article delivered from the storeroom and for materials outside of the storeroom which are accounted for by the storekeeper, whether return of material, transfer of material from one department to another, or material used in that department. The clerks charging out these materials record the article number [illegible]

801 A

SUMMARY.

Form 20.

May 1905											
Sheet No.	Date	Quantity	Rate	Sheet No.	Date	Quantity	Rate	Sheet No.	Date	Quantity	Rate
11754	31	10	5 702								

Fig. 24. Summary Sheet (Original 11 x 11 in.)

In the issuing of material from stores for work in its own department there are used:

Form 27 (Fig. 22) is used by the workmen for material needed to cover operations. Material required is entered on the back of this form and approved by foreman. On the front is recorded the time spent on the operation, which is noted by the foreman, and at the end of the day all of this form are turned in for the total of the workman's time.

The storekeeper, on issuing material, makes up Form 62 (Fig. 23).

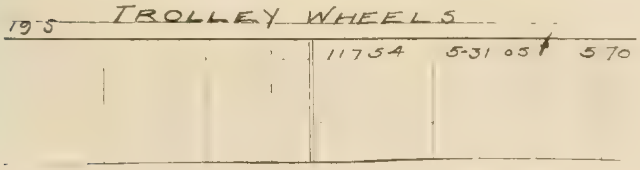


Fig. 25. Index Card (Original 5 x 3 in.)

entering account to be charged to (No. 406); workman's number, (No. 16); and operation number (19-S). This number, as well as the number of cars or armature, is used as sub-classification for the purpose of keeping a detail of the daily cost of any particular operation, and on this is entered the quantity and description of articles delivered. This form is forwarded to the railway office which the material appears in the Storeroom Ledger. The material is then entered on the Summary Sheet (Fig. 24), which is the credit side of the Storeroom Ledger, placing on Fig. 23 the cost per unit and the total extension. These daily deliveries are summarized by accounts at the end of each day, and the total amount charged to the accounts affected, and at the end of the month the Stores Account is credited with the total amount of issues.

Fig. 25 is a card used for the purpose of assembling the records of individual operations, such as the repairs to the different kinds of equipment; repairs to trolley wheels, registers, or any other subdivision of the regular classifications. By the use of this form we are enabled at any time to tell the total cost of any particular operation which might be required. Similar forms are used for summarizing the cost of labor each day on individual operations.

The New Hampshire Traction Co. has been publishing this summer under the direction of its advertising manager, Mr. Edward P. Hulse, a weekly paper called "The Street Railway Bulletin." The publication includes information regarding the attractions along the lines of the company, the programs of the Canobie Lake Opera Co. at Canobie Lake Park, trolley excursions and other data in the interest of its summer traffic.

A speed of over 70 miles an hour was attained recently on the Detroit, Monroe & Toledo Short Line Ry.

Proposed Constitution and By-Laws of the American Street and Interurban Railway Association.

CONSTITUTION.

Name and Location.

I. a. The name of the association shall be the "American Street and Interurban Railway Association."

b. The headquarters of the association shall be located in the city of New York.

Objects.

II. The objects of the association shall be as follows:

a. The discussion and recommendation of methods of construction, management and operation of street and interurban railways, and of safeguarding the interests of the same.

b. The establishment and maintenance of a spirit of co-operation among the members, and the encouragement of friendly relations between the companies and the public.

c. The acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street and interurban railways and the diffusion of this knowledge among the members.

Members.

III. The membership of this association shall consist of two classes, as follows:

a. Active members, consisting of American street and interurban railway companies, or lessees, or individual owners of street and interurban railways. Each member shall be entitled to one vote, which shall be cast by the properly accredited delegate.

b. Associate members, consisting of individuals who are or have been at some time actively identified with street and interurban railway interests, and other persons who in the opinion of the executive committee have had experience of such a nature as to render desirable their connection with the association. The privileges of the associate members shall be similar to those of the active members excepting that they shall not be entitled to vote or hold office nor shall they have the privileges of the floor unless permitted by the association.

Amendment.

IV. This constitution may be amended by a two-thirds vote of the members present at a regular meeting, provided the proposed amendment shall have the approval of the executive committee, and provided that a copy shall have been sent to each of the active members at least thirty days prior to the date of the meeting at which the proposed amendment is to be acted upon.

BY-LAWS.

Election of Members.

I. Every applicant shall signify his desire to the secretary, enclosing the requisite fee. All applications for membership shall be referred to the executive committee, a two-thirds vote of the members of the executive committee by ballot being necessary to election. In case of rejection the membership fee shall be returned. The executive committee shall report at each meeting the names of new members elected.

Officers.

II. a. The officers shall consist of a president, vice-presidents equal in number to the number of affiliated associations, a treasurer and a secretary. The officers shall assume their duties immediately after the meeting at which they are elected.

b. The president, the vice-president and treasurer of the association shall be elected at the annual meeting of the association. All such elections shall be by ballot, and a majority of the votes of all members present shall be necessary to an election. The secretary shall be appointed by the executive committee.

President and Vice-Presidents.

III. The president shall be the chief executive officer of the association. He shall preside at the meetings of the association and of the executive committee. In the absence of the president any duties devolving upon him may be performed by one of the vice-presidents.

Treasurer.

IV. The duties of the treasurer shall be to receive, safely keep and account for all moneys of the association; to keep correct accounts of the same, and to pay all bills approved by the president. He shall make an annual report to be submitted to the association. He shall give a bond to the president in such sum, and with such sureties as shall be approved by the executive committee. He shall be paid a salary fixed by the executive committee.

Secretary.

V. The duties of the secretary shall be as follows:

a. To take minutes of all proceedings of the association and of the executive committee and to enter them in books proper for the purpose.

b. To conduct the correspondence of the association.

c. To read minutes and notices at all meetings and to present papers and communications if the authors wish it.

d. To collect and file for the benefit of the members information and statistics regarding matters relating to the purposes of the association.

e. To receive applications for membership and to lay such before the executive committee.

f. To attend to the publication of the proceedings of this association; and, in conjunction with the secretaries of the affiliated associations, to the publications of the proceedings of such affiliated associations.

g. To send notices to all members of the association at least 30 days before each meeting, mentioning papers to be read and any special business to be brought before the meeting.

h. To perform such other duties as may be required of him by the constitution and by-laws, and such duties as may be assigned him by the executive committee.

The office of the secretary shall be maintained at the headquarters of the association. He shall be paid a salary fixed by the executive committee. He may or may not be in the employ of an active member of the association.

The Executive Committee.

VI. a. The entire charge and management of the affairs of the association shall be in the hands of an executive committee, which shall consist of the president, the vice-presidents, and one member appointed by each of the affiliated associations. The executive committee shall make arrangements for carrying out the objects of the association.

b. The executive committee shall hold a regular meeting before each regular annual meeting of the association, and shall hold such special meetings as may be necessary. Such special meetings may be called by the president and five members of the executive committee. Five members of the executive committee shall constitute a quorum at all meetings.

The secretary shall give such reasonable notice of all meetings as the committee shall by vote prescribe, and all such notices shall specify the business to be brought to the attention of the committee at such meetings.

c. The executive committee may assign to its allied association, the American Street Railway Manufacturers' Association, the management of the exhibit features of the annual conventions, and it may arrange with the said Manufacturers' Association the details of such entertainments as may be given in connection with the annual conventions of this association.

d. The executive committee shall present a report to each regular annual meeting of the association, and shall include in such report the names of members elected during the year, and its recommendations for the future work of the association.

Meetings.

VII. a. Regular annual meetings of the association shall be held at such time between the 15th day of September and the 15th day of December, in each year, as the executive committee may decide to be best suited to the locality in which the meeting is to be held; the time to be decided upon and each member notified of the selection by the first day of May in the year in which the meeting is to be held. Special meetings may be held upon the order of the executive committee. Notice of every meeting shall be given by the secretary, in a circular addressed to each member, at least 30 days before the time of the meeting. Fifteen members shall constitute a quorum at any meeting.

b. At all meetings of the association discussion shall be limited to active members, provided, however, that special privileges may be accorded others at the will of the meeting.

e. At any regular or special meeting, executive session may be held. Such sessions shall be open to active members only.

Order of Business.

VIII. The regular order of business shall be:

1. Reading of minutes of last meeting.
2. Report of the executive committee.
3. Address of the president.
4. Report of the treasurer.
5. Reports of standing committees.
6. Reports of special committees.
7. Reports from affiliated associations.
8. Reading and discussion of papers.
9. General business.
10. Election of officers.

Committee on Subjects.

IX. In order to secure continuity of work and uniformity of general purpose, a committee on subjects shall be appointed each year by the executive committee. The function of this committee shall be to suggest topics for the work of the American Street and Interurban Railway Association and its affiliated associations for each year in advance.

The committee shall consist of one member from each of the affiliated associations and a number from the American Street and Interurban Railway Association equal to the total number from the affiliated associations. The committee, at each annual meeting, shall present its plans for the coming year.

Voting.

X. All votes except as herein otherwise provided shall be viva voce; and in case of a tie, the presiding officer may vote.

Reading of Papers.

XI. All papers read at the meetings of the association must relate to matters connected with the objects of the association and must have been previously approved by the executive committee.

Affiliated Associations.

XII. This association shall do all in its power to promote the welfare of other associations organized with its approval to investigate technical matters connected with street and interurban railway construction and operation. To this end it will, in the following way, and in others which may be determined by the executive committee, assist in the work of such affiliated associations:

a. By granting charters to and approving the constitutions of such associations.

b. By admitting to the executive committee a member from each of such associations.

c. By granting financial assistance to such associations for specific purposes.

d. By editing, printing and binding the reports of the proceedings of such associations.

e. Through its secretary and committee it will assist in arranging for conventions, suggesting suitable subjects for investigation; it will file information for reference and distribution and in every way endeavor to stimulate interest in all of the affiliated associations.

Papers, Drawings, Etc.

XIII. All papers, drawings and models submitted to the meetings of the association shall remain the property of the owners; subject, however, to retention by the executive committee for examination and use, but at the owner's risk.

Fees.

XIV. Active members shall pay an admission fee of ten dollars and annual dues payable in advance based on gross earnings from railway operation during the preceding fiscal year (ending June 30th) as follows:

Gross receipts under..........	$ 100,000			$ 25.00
Gross receipts between..........	100,000	and	$ 250,000	50.00
Gross receipts between..........	250,000	and	500,000	100.00
Gross receipts between..........	500,000	and	1,000,000	150.00
Gross receipts between..........	1,000,000	and	2,500,000	250.00
Gross receipts between..........	2,500,000	and	5,000,000	350.00
Gross receipts between..........	5,000,000	and	10,000,000	500.00
Gross receipts over..........	10,000,000			600.00

Associate members shall pay in advance an annual fee of five dollars.

Arrears.

XV. No member [illegible] be entitled to vote.

Withdrawal.

XVI. Any member may retire from membership by giving written notice to that effect to the [illegible] annual dues to that date, but [illegible] the payment of annual dues [illegible] as hereinafter provided.

Expulsion.

XVII. A member may be expelled [illegible] vote of two-thirds of the members [illegible] of the association, upon the written [illegible] tive committee.

Rules of Order.

XVIII. All rules not provided for in these [illegible] those found in Roberts' Rules of Order.

Amendment.

XIX. All propositions for adding to or [illegible] of these by-laws shall be laid before the executive committee, which shall bring them before the next regular meeting of the association, if it shall consider such course desirable; and it shall be the duty of the committee to do so, on the request, in writing, of any five members of the association.

FORM OF CHARTER TO BE GRANTED BY THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

The American Street and Interurban Railway Association, in order to promote the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street and interurban railways, and the diffusion of this knowledge among those persons interested in the improvements of street and interurban railways, and the diffusion of this knowledge among those persons interested in the improvements of street and interurban railway service and the reduction of its cost, hereby agrees to co-operate in the work of the Street and Interurban Railway ——— Association in the following ways:

1. By admitting to its executive committee a member of the said affiliated association.

2. By granting financial assistance for specific purposes to the said affiliated association.

3. By editing, printing and binding the reports of the proceedings of the said affiliated association.

4. By suggesting subjects for investigations and in every way encouraging such investigation on the part of the said affiliated association.

5. By managing the details of conventions and other meetings for the said affiliated association.

6. By collecting, filing for reference and distributing such information as may be desired by members of the said affiliated association.

In consideration of this assistance, the .... Association by the acceptance of this charter agrees that the constitution and by-laws of the said affiliated association shall be subject to the approval of the American Street and Interurban Railway Association and all amendments to and changes in the same shall be subject to such approval; and that the American Street and Interurban Railway Association shall have the right to withdraw its support and assistance whenever, in the judgment of its executive committee, the said ——— Association is not satisfactorily accomplishing its objects as stated in Article II of the constitution of the said affiliated association.

In witness of this agreement, we, the presidents and secretaries of the American Street and Interurban Railway Association and of the .... Association have affixed our signatures hereto, this day of ...., 19 .

....

Secretary of A. S. I. R. A.

....

President of A. S. I. R. A.

....

Secretary of

....

President of

Trio of Fraudulent Accident Workers.

By courtesy of the United Railways & Electric Co. of Baltimore we have been furnished a detailed account of the [illegible] and capture of three fraudulent accident workers who planned an extensive campaign against street railway companies, including most of the larger cities. The facts are briefly as follows:

On June 5, 1905, a collision occurred between two cars on the Edmondson Ave. line of the United Railways & Electric Co., of Baltimore, at Bloomingdale Road and Harlem Ave., Calverton, in the suburbs. Both cars were bound west. One car was standing waiting for an east bound car to come through a short stretch of

EDWARD E. REILLY, alias F. B. Moran, age, 30; height, 5 ft. 7¼ in.; weight, [illegible] lb.; build, medium; hair, light chestnut; eyes, azure blue; complexion, medium dark; moustache, light chestnut; born in Brooklyn, N. Y.; occupation, motorman; arrested, Aug. 1, 1905. Bertillon measurements: Height, [illegible]-7; outs, 82; trunk, 89-6; head length, 18-6; head width, 15-1; cheek, 13-9; right ear length, 6-7; left foot, 25-7; middle finger, 12-1; little finger, 9-1; forearm, 48-5. Scar on left forearm and scar at right elbow.

single track, and while so standing, was run into from the rear by another car on which Edward E. Riley was motorman. The collision was very slight, and did not injure, jar or excite any of the passengers except one Martha Wiens. As soon as the collision occurred the Wiens woman, who was sitting in a front seat near the entrance, immediately fell out. The car was a side-step open car. The moment she struck the ground, she began groaning and pretended to be in great agony. Her escort, who passed as her husband, Frank Wiens, did not go to his wife's assistance, but immediately got out a book and pencil and endeavored to get witnesses on the car. He was unsuccessful here, and he then went to the street corner and tried to secure the names of persons standing there. The woman was helped to her feet by the conductor and others, and pretended to be badly injured about the knee.

After some little while they took an east bound car and started for their home, 2004 Fairmont Ave. Before doing so, however, and after the car from which she had fallen had left, the first thing she did was to ask her husband how many witnesses he had gotten. This remark was overheard by a conductor in citizen's clothes, who lives in the vicinity of the scene of the accident. The case was suspected from this time on. Wiens called at the office of the claim department a few days after the accident and made his claim, and requested that his wife be examined by the company's surgeon. This was done and it was found that the woman was suffering from a hernia, which she and her husband claimed was the result of the accident. They claimed $2,500, but as the case was looked upon as fraudulent, their demand was promptly refused. The motorman of the car was dismissed for the accident. Suit was immediately filed in the Baltimore City Court through William Colton, attorney, for $50,000.

Riley was then sent to Pittsburg by Mr. and Mrs. Wiens, and he secured employment with the Pittsburg Railways Co. as motorman, under the name of Edward Moran. Mr. and Mrs. Wiens followed him shortly afterward. He stayed there only a short time, however, as the Baltimore City Detective Department and the United Railways Secret Service Department were pretty hot on their trail. While in Pittsburg, Wiens made a proposition to a Pittsburg conductor that if he (the conductor) would deliberately [illegible] Mrs. Wiens while she was getting on or off his car, he (Wiens) would pay a substantial sum. The conductor declined this proposition. Then Riley was sent to Cleveland to secure employment and Wiens followed him later. When Wiens arrived, however, he was not impressed with Cleveland, as he said the double footboard cars were too dangerous; his wife might be seriously injured by falling from a car of this construction; also that cars with transverse seats and center aisle construction were not good for their business. They then decided to go to Buffalo.

Reaching Buffalo, Riley secured employment as a motorman with the International Street Railway Co. under the name of F. B. Moran. A rapid correspondence was then begun with Mrs. Wiens

FRANK BOBSON, alias Wiens, alias Davis, age, 35; height, 5 ft. 6 in.; weight, 133 lb.; build, medium; hair, chestnut; eyes, light chestnut; complexion, dark; born at Chicago, Ill.; occupation, laborer; arrested Aug. 1, 1905. Bertillon measurements: Height, 67-5; outs, [illegible]; trunk, 88-5; head length, 18-4; head width, 15-5; cheek, 14-3; right ear length, 6-4; left foot, 25-8; middle finger, 11-2; little finger, 8-7; forearm, 45-5. Two scars from burns on left forearm and scar on right forearm.

and the woman who posed as her sister, then in Pittsburg. He requested them to come to Buffalo promptly as he had secured the "job" and the plan was now ready to be carried out. Mrs. Wiens and the woman posing as her sister left Pittsburg and started to Buffalo. While on the Pennsylvania R. R. train they both claimed to have been injured while in the toilet room, caused by the sudden and unusual jerk of the train. The woman claimed to have been thrown down and Mrs. Wiens claimed to have been thrown

MARTHA WEINS, alias Martha Bobson, age, 40; height, 5 ft. 3⅛ in.; weight, 166 lb.; build, medium stout; hair, light chestnut; eyes, azure blue; complexion, fair; born in Germany; occupation, housewife; arrested Aug. 1, 1905. Bertillon measurements: Height, 60-2; outs, 60; trunk, 88-9; head length, 18-2; head width, 14-6; cheek, 12-9; right ear length, 5-9; left foot, 24-9, D-1; middle finger, 10-1; little finger, 8-2; forearm, [illegible]. Two narrow scars on right forearm.

violently against the washstand and severely injured, which accident resulted in a hernia. She made claim against the Pennsylvania R. R. Co., representing that the injury was produced by the accident. While the company was investigating the case, Wiens and his wife and Riley were arrested by W. M. Atkinson, of the Baltimore City Detective Department.

Shortly after his arrest, Riley made a sworn confession. Wiens' correct name is Frank Bobzin and his wife, Martha Bobzin. He also passed as Frank Wiens, Frank Davis, Martin Wiens and —— Richard. Riley also passed as Edward Moran, E. B. Moran and —— Clark. In Riley's confession he admits that the claim was planned in Brooklyn, and the arrangement was that they come to Baltimore and have Riley secure a position as motorman. When he secured this position, he was to keep in close communication with Wiens and his wife and post them as to where and when to board his car. He was then to wait until an opportunity presented itself, and deliberately run his car into another car, and, to quote his own words, he was to "tap the other car with sufficient force to enable Mrs. Wiens to tumble off, which arrangement I carried out to the letter. The plan worked successfully, all but getting the money."

An investigation showed that Riley frequently visited the home of the Wiens' before the accident occurred, always going in and out by the back entrance.

Mrs. Wiens claims to have been injured in 1903 by falling from a car of the Brooklyn Rapid Transit Co., in Brooklyn. She claimed that a hernia developed as a result of that accident. The case was tried in Brooklyn and a verdict of $2,500 rendered in her favor. They got the money in April, 1905, and then began a systematic trip throughout the United States, planning to work the following cities: New Orleans, Baltimore, Philadelphia, Atlantic City, Newport, Buffalo, St. Louis, Kansas City, San Francisco, Los Angeles, Pittsburg and Cleveland. New Orleans was eliminated on account of the yellow fever.

They were arrested in Buffalo on Sunday, July 30th, and indicted by the Baltimore City grand jury, July 31st, charged with conspiracy to defraud the United Railways & Electric Co. out of $2,500, and Capt. A. J. Pumphrey, chief of the Baltimore City Detective Department and Capt. J. J. Gilbert of the United Railways Secret Service, started for Buffalo with the requisition papers. The party reached Baltimore Friday, August 4th, and Wiens, his wife and Riley are now confined in the Baltimore City jail in default of $5,000 bail each, awaiting trial, which will take place during the fall term of the Criminal Court. During the investigation the Secret Service of the United Railways and the Baltimore City Detective Department co-operated, and in this connection Capt. Joseph J. Gilbert, Capt. A. J. Pumphrey and W. M. Atkinson each did very effective work.

In explanation of the natural query as to how Riley was able to secure positions so easily with so many companies it may be said that his preparations were very carefully made. In the case of the Baltimore road Riley was employed May 9th, was "learning" ten days, and between the 19th and the date of the accident had actually served less than a week. Every applicant is required to furnish at least two letters of recommendation, one of which must be from his last employer. The Employment Bureau of the company also sends out "tracers," and, besides, the motormen and conductors are bonded in the sum of $500. Riley's letters were not only satisfactory, but also the replies to the "tracers."

Fraudulent Claims at Cleveland.

On August 15th, about 7 p. m. as a south-bound car on the Euclid and Jennings Ave. of the Cleveland Electric Ry., was leaving the square a man fell from the running board, and was dragged some distance. It was assumed that he was injured seriously, and he was taken to Charity Hospital in an ambulance. There was nothing particularly suspicious about the formal report of the accident to suggest anything crooked, but upon receiving report of the company's surgeon, who saw the man within one hour after the accident occurred, Mr. G. A. Boone, assistant claim agent, became suspicious, as it was stated that the patient feigned to have convulsions in the ambulance on the way to hospital and after the first hour or two in hospital had numerous spasms, the character of which the company's surgeon was unable to determine. The patient's temperature and pulse were normal, the only objective signs of injury being slight skin scrape and contusion that would necessarily follow from the character of the fall. The railway company immediately sent one of its assistants to the hospital and after some talk with the man who gave the name John Edwards, i[illegible]

[illegible] Edwards [illegible] Benson, [illegible] Cleveland [illegible]

Mr. Boone [illegible] suspicions that they were fakers. Immediately after the accident the [illegible] superintendent, who saw the accident, stated that as Edwards fell from the running board he hooked his arm between the two steps of the running board and held onto the car and was dragged some ten or fifteen feet; that he lay perfectly still until they ran to his assistance when he immediately began to throw his legs and arms around and moan and complain of his leg and back. On Saturday, August 19th, a telegram from Mr. J. W. Crawford, assistant claim agent of the International Railway Co. of Buffalo, was received; he stated that he thought they knew these men, and that two men would be sent to Cleveland to identify these men.

On Saturday Edwards left the hospital, coming to the office in company with Benson, making written statements of the accident and stated that they were with Thompson & Dunkin, a vaudeville company which jumped from Buffalo to Elkhart and from Elkhart to Denver. They were requested to call again at two o'clock, Aug. 21st, when some settlement of their claim would be made if possible. On Sunday W. C. Smith, special agent of the International Railway Co., in company with C. E. Reid of 180 Franklin St., Buffalo, with whom the two young men roomed under the names of E. Forbes and John Wilmott, came to Cleveland. Mr. Smith brought with him the report of the accident to John Wilmott, 180 Franklin St., Buffalo, occurring on August 5th, about 8:30 p. m. in which Wilmott fell from the car as it was starting up in front of Athletic Park, being taken to the Sister's Hospital, remaining there three or four days. E. Forbes was a witness to the accident and went with him to the hospital in the ambulance. Mr. Boone was then satisfied that Edwards at Cleveland was Wilmott at Buffalo, and Benson, was Forbes at Buffalo.

They came to the office as per appointment at two o'clock August 21st. It had been arranged with the chief of city detectives and another detective to be present, and they were introduced to Edwards and Benson as the company's claim committee. After securing their statements which conflicted with their previous statement, in that they stated on Monday that they came to Cleveland directly from Philadelphia, and on questioning them further they were advised that the claim committee consisted of the detective and his assistant. The chief immediately requested Benson to remove the wig he wore and it was found that he had a heavy head of hair under the wig. After separating the men they were questioned very carefully, and Benson admitted that he was at Buffalo and stopped at 180 Franklin Ave.; that his name in Buffalo was Forbes; that there was an accident on August 5th, and that Edwards, under the name of John Wilmott, was injured, not admitting, of course, that the accident was a fake. He claimed that they came to Buffalo from Philadelphia; that his home was in New York and that his business was that of a photographer instead of a tumbler.

Wilmott, however, refused to talk much, reiterating that he never was in Buffalo and that he came directly from Philadelphia, and that his name was Edwards and not Wilmott.

They were then confronted by Mr. Reid with whom they roomed in Buffalo, who he immediately recognized as E. Forbes, alias Edward Benson, and John Wilmott, alias John Edwards. They were arrested on suspicion August 22nd, and with the exception of Edwards admitting on the witness stand that he was in Buffalo under the name of Wilmott he refused to talk. They were sentenced to 30 days in the workhouse and fined $50 and costs, which, under the rule of being allowed only 20 cents per day in working out a fine, will keep them in the workhouse about 300 days.

These men left Buffalo without making a claim other than through an attorney with whom they left it with the understanding that

[illegible] settlement was made the matter would be [illegible]. It was thought in Buffalo that there were [illegible] the superintendent of the Cleveland company also stated that there [illegible] at the time [illegible] August [illegible] Wednesday night, August [illegible] giving his name as Joseph Burns was arrested on suspicion and on being placed in the sweatbox made full confession to the chief of police and Mr. Boone in the form of an affidavit covering eight typewritten pages. Burns stated that he first met Wilmott in New York in May at Bristol's restaurant, 120 East 14th St., and a short time later met Benson under the name of Edward Forbes; that Forbes was the man who did the scheming and induced Wilmott and himself to go with him around the country having fake accidents; that they went to Philadelphia from New York where Forbes fell from a car on Market St. on the 22nd or 23rd of last July, and was taken to a hospital where settlement was made with him a few days later for $300; that two days after the settlement was made they went to Buffalo where Wilmott did the falling as described; that he, Burns, and Benson, alias Forbes, came to Cleveland ahead of Wilmott, and that it was his, Burns, turn to fall in Cleveland, but that he was afraid to do so and after two days Wilmott came on from Buffalo and had accident above referred to. Burns admits that when about 18 years of age he spent nearly a year in the reformatory in New York, but says other than that he has never been arrested. Benson, alias Forbes, admits being arrested in New York some years ago on suspicion, but claims to have been acquitted. Burns very frankly tells his entire connection with the scheme. His case was continued in order that the company might hear from the Philadelphia Rapid Transit Co., and if his story is true it is probable that the Philadelphia company will have them extradited.

White City Advertising.

The White City, Chicago, which since its opening in May last has done much towards the development of summer traffic on the lines of the Chicago street and elevated railway companies, has been very progressive in advertising its attractions. Some months before the opening of this park the management began the publication of a monthly magazine in which were described and illustrated the many amusement devices that would be installed in the park. After the opening, the publication of the magazine was continued, it being used for placing before its readers programs of the band concerts that are given in the park daily, programs of the performances of the various theatres, fire show, educated horse show, etc. In addition to the publication and wide distribution of the White City magazine, which also contained several short stories of general interest, the company has freely used printer's ink in and about Chicago. Extensive use has been made of bill boards, street car banners and the newspaper columns. Placards 21 x 11 in. in size have been placed in almost every car on both elevated and street surface lines in the city, as well as the suburban lines. On the left half of these placards is a cartoon showing the "White City Kids" availing themselves of the various attractions offered by the park. On the right half of the card is the location of the White City, directions for reaching the park and appropriate verses.

Both steam and electric railways, as well as steamship companies operating on Lake Michigan, have co-operated with the advertising department of the White City, of which Mr. Frank R. E. Woodward is manager, in developing traffic to and from the park. Certain days have been set aside as Michigan Day, Milwaukee Day, Elk's Day, etc., on which occasion excursions were run from towns in Michigan within a radius of 150 or 200 miles at reduced rates. One of the recent excursions that has been run to the White City was over the line of the Aurora, Elgin & Chicago Railway Co. On this occasion the cars of the interurban line were run over the tracks of the Metropolitan and South Side elevated lines to the White City, special excursion tickets being issued. These consisted of five coupons 2¾ x 2 in. The bottom coupon was for the ride from Elgin to Chicago; the second coupon for the South Side Elevated Co. for the ride to the White City; the middle coupon was the admission to the White City, while the two remaining coupons were for the return trip to Elgin. Tickets were also issued from other points on the line.

Trans-Ohio Trolley Line.

An important addition to Ohio interurban railways has been made by the opening of the 17-mile extension of the Toledo, Fostoria & Findlay Railway. The new division connects Fostoria and Pemberville, and its completion marks a record for quick construction. Grading was started on April 29th, and although 27 working days were lost on account of the extraordinarily wet season, the entire line was in operation on a regular passenger schedule in less than four months from the date of starting. The entire work was done by the company, in charge of Mr. F. W. Adams, its general manager, and he is receiving congratulations upon his practical demonstration of how to build a railroad. This property, always one of the best in the state, now takes on added importance because of its location as the connecting link between two great systems, the Lake Shore Electric and the Western Ohio. With the completion of the Western Ohio branch from Lima to Findlay, now about completed, the cross-state

Cleveland-Cincinnati route will be a reality. While the route may appear to be rather indirect, it is not so in practice as compared with steam routes between the same cities. All the present steam routes have been made up by the joining of various small railroads, and no very short line has resulted. The interurban combination, as contemplated, gives a through mileage of 294 miles from Cleveland to Cincinnati. There are four steam lines between these cities whose mileage is as follows: Pennsylvania, 291; Big Four, 263; Erie, 372; Baltimore & Ohio, 349. It can thus be seen that a through traffic arrangement between the roads forming the trans-Ohio route would start under more favorable circumstances than did some of the small steam roads which have since been combined into famous railroad systems.

Taking for granted that the limited cars now operating from Dayton to Lima via the Dayton & Toledo and the Western Ohio will run into Findlay, and that the Toledo, Fostoria & Findlay cars will run the five miles from Pemberville to Woodville over the Lake Erie, Bowling Green & Napoleon Ry. to reach the Lake Shore Electric, only three changes of cars would be necessary in the 294 miles, without further traffic arrangements, which is an unusual combination of traction lines, and one which will probably be in evidence as long-distance traffic is further developed.

An Electric Railway Passenger Department.

What Has Been Accomplished on the Boston & Northern and Old Colony Systems.

BY ROBERT H. DERRAH, PASSENGER AGENT, BOSTON & NORTHERN [illegible],

Consideration of the millions of dollars spent by the steam railroad companies of America to induce people to travel on their lines, and to take outings which require much time and a considerable expenditure of money, has brought many street railway officials to a realization that a little missionary work on their own part might result in substantial profit. They had the advantage that no large outlays of money were involved, and that the pleasure seekers might find varied and delightful outings nearer home.

Particularly did this appear with force to the Boston & Northern and the Old Colony Street Railway companies. These roads operate over 850 miles in 22 cities and 66 towns and through a territory which combines more of scenic and historic interest accessible by trolley than any other equal area in the United States. In all parts of this territory there are manifold attractions for the tourist and lover of nature—a variety of seashore resorts, interesting and historical cities and towns, rivers, lakes, and a diversity of delightful suburban scenery. There is not a single line in this whole system which has not some special features and advantages to offer to the tourist.

It is everywhere recognized among street railway men that one of the greatest sources of revenue to the suburban street railway is that which comes from pleasure travel. Furthermore, if a company can induce people to use its cars for pleasure it not only adds to its revenue but it makes the whole community happier and healthier. From the standpoint of the passenger, in order to induce this pleasure travel, it is only to be shown that he will receive his money's worth, and it is easily demonstrated that there is nothing in the world which offers one more for his money than street railway transportation.

So long as the street railways of Massachusetts were operated only in the congested sections, and the large centers of population, there was little opportunity to develop pleasure travel. With the development of suburban lines in recent years, which has been such that practically every city, town, village and hamlet, park and seashore resort, can be reached by trolley, the street railways have more attractions to offer the tourist than the steam roads.

So many places may be reached from any given point that the difficulty of the tourist is in deciding what place to visit.

Instead of seeking to develop pleasure travel in the line of traffic to the nearest park or beach, the Boston & Northern and Old Colony [illegible] develop the long distance pleasure travel on the trolleys. With carefully planned excursions from various points on their systems to other points, the [illegible] excursions in one pleasant week. Some of these excursions have taken the passengers over what some years ago would have been four or five different lines, with as many changes of cars.

Under the present system of conducting excursions, the passenger goes through to his destination without change of cars, and everybody has a seat. The importance of these two points cannot be too strongly emphasized to street railway men, who have been in the habit of regarding the [illegible] company's dividends. The excursion business which has been built up by these two companies is the result of the recognition of what the traveling public wants, and determination to meet that end. These excursions have created a special class of traffic, and brought people to travel, who, under other circumstances would not use the trolley lines. From the passengers' point of view, it is the very essence of pleasure travel, that they should be able to travel with comfort, and this point has too often been overlooked by street railway managers.

SUMMER EXCURSION ON BOSTON & NORTHERN STREET RY.

For fully eight years it had been the writer's conviction that in Boston there should be some centrally located office where the public might obtain any desired information pertaining to pleasure or other trips over the 2,000 or more miles of trolley lines. It was felt that the public was entitled to this information and that if such an office were established riding would be materially increased. The test has been made and the correctness of this view demonstrated. Last October the Boston & Northern and Old Colony Street Railway companies established a joint passenger department. A large pleasant office was taken on Washington St., in the heart of the district in Boston where the steam roads maintain their offices. The department has been operated entirely independent of the executive offices. The main offices are located in State St., away from the center of travel, whereas the passenger department was located in the busiest section of Boston's busiest street. Now that the first year of its existence has been practically completed its popularity and its value both to the companies, and to the riding public have been firmly established, and exceed even its originator's expectations. The street railways of eastern Massachusetts form

[illegible] because of natural or historic interest are numerous and by setting forth their various attractions, the office has been the means of inducing people to take longer trips than they might otherwise have taken, explaining how best to reach these attractions in such a way that patrons felt perfectly safe in taking long instead of short trips. In the early spring, six folders were published, each of which was devoted to a certain section of the system, namely, the South Shore, Southern Massachusetts, North Shore, Mystic Valley, Merrimac

VIEWS OF THE PASSENGER AGENT'S OFFICE.

Valley and The Parks. In this printed matter there were given the mileage, rates of fare, running time, and a concise and interesting description of the sections. These folders were, from various places in the sixteen divisions, distributed from specially built cases. Instead of sending the folders by express to the widely separated places of distribution, a regular car was employed, which, while serving as a prompt and effective method of delivery also constituted an excellent advertisement for the companies, attracting as it did from its novelty much attention wherever it appeared. As the car passed through each city and town a story was delivered to the local papers setting forth its mission and informing the public where it might obtain desired information, free of charge. The idea seemed to appeal to the newspapers as a unique one, and invariably

A NEWSPAPER MEN'S PARTY.

A SPECIAL ADVERTISING CAR.

the appearance of the advertising car was in each city or town followed by generous publicity which must have had its influence on the riding public.

In the territory served by the two companies there are something like 140 daily and weekly newspapers, exclusive of those in metropolitan Boston. Although the writer had had a more or less direct acquaintance with all the newspapers for the past ten years, his first step was to make each a personal call, and in the spring the newspaper men were invited to trips over certain sections in the companies' parlor car, with a dinner at some hotel or a clam bake at the sea-shore. These trips were made informal, jolly affairs and [illegible] ship with the newspaper men, and bore fruit in liberal space in which the beauties of the trips were well and fully described. Six of these excursions were run. Never was a street railway company better treated, never were the news columns more open for the company's matter than in newspapers in the sections covered by the two systems.

Along the lines of the two systems there are to be found pieces of woodland that rival in beauty views in the Adirondacks; there are long stretches of sand and rocky shores; parks and groves and rivers and lakes well worthy of a photographer's attention. To start a search for picturesque places reached by the companies' lines a photographic contest was initiated, numerous desirable prizes were offered and the editor of the Photo Era and two others, as high in the profession, were selected as judges.

A condition of the contest was that all photographs submitted were to become the property of the companies. To say that the contest has proved popular is putting it very mildly indeed. Many very beautiful photographs have been received, and more are coming in every day, and there is no doubt but that the idea has been a profitable one.

"Inland to the Sea by Limited Trolleys."

One of the most important experiments and in which almost unlimited possibilities may be seen, was the inauguration of a regular schedule of through excursions with reserved seats guaranteed from various points over our two systems, and principally from the inland towns to the sea-shore resorts, historical towns and places of amusements. As many as 35 independent trips per week were run. The trips varied from 40 to 100 miles per round trip all trolley; in other trips a steamboat ride was used in combination with the trolley. The [illegible] running these trips varied from 50 cents to $1.20 per passenger. The round trip fare in most cases was placed at a lower figure than the passenger making the trip individually would have to pay. The limited feature of the excursions certainly made a

but. They became popular in many cases partly on account of the cheaper rate perhaps, but principally because of the [illegible] of a seat and the doing away with the necessity of changing cars. At the objective point of the trip passengers were either admitted free to some amusement place, arrangements made for their dinner, or places selected where they might each have lunch. In addition these specials were given attention and schedule time made. As previously stated, these "limited" trips were in the nature of an experiment. So they were, but so positive has been the success of the experiment and so well pleased are the companies with the scheme that they are already formulating plans whereby this class of travel will receive a great deal of attention in the coming year. There is not the slightest doubt that two-thirds of the people who have taken advantage of the trips would not have traveled in regular cars. The reception which has been given to the innovation has been carefully noted and it is believed to be one of the best moves made by the new department. As an advertisement the limited trolley trips are also a success. They bring in an unequalled manner the attention of the masses to the beauties of trolley riding, and what may thus be seen not only en route but at the terminus.

Hitherto it had been the general belief that a 75 or 100-mile trip by trolley was too long and tiresome for pleasure but to a great extent these excursions have changed this opinion. The writer is sure they will do more than anything else to encourage long distance traveling by trolley, heretofore almost unthought-of in New England.

Regular excursion tickets were printed for these trips. Folders giving all information were distributed about hotels, railway ticket offices, and other places. Dasher signs on the cars, flyers and the columns of the newspapers have been used to aid in giving publicity to these excursions.

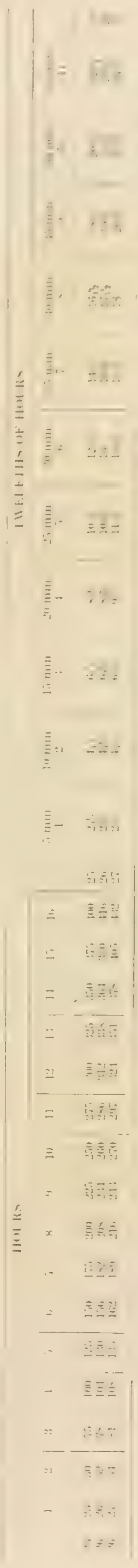
No one corporation in the country maintains a larger or more popular group of pleasure resorts than do the Boston & Northern and Old Colony street railways. The two systems have seven parks where entertainments are given every afternoon and evening for ten weeks, during the summer months. Five of these are directly under the companies' control and management. The other two are sublet. In past years performances given in the rustic theaters at these parks have been of a vaudeville nature, but this year a radical departure was made and first class light operas, operettas and musical comedies were produced, and much appreciated by the public as demonstrated by increased riding in cars running to these places. And so satisfactory to the companies has been the results that the policy of giving high class plays only will be continued next year.

All the advertising of the various amusements, advance notices and reviews of the plays are handled entirely in the passenger department. Advertising matter for the five parks was inserted in 26 daily papers; advance notices or write-ups in some 55 weekly papers, each week, and reviews in 30. Five cars were fitted up and sent on regular trips through the different places of each division advertising the attraction at the local park.

The two companies have under consideration several novel schemes to stimulate travel the coming fall and winter. The first of these is the running of special through cars on certain days from various cities over their systems to Boston. This will give an opportunity for people of the outlying districts to do their shopping in Boston knowing that on the return they will be able to get a seat all the way and thus avoid the rush, especially during the Christmas shopping days, when this innovation will surely become popular and appreciated.

During the winter the companies are planning to inaugurate several outdoor recreations such as toboggan slides and artificial skating rinks at various points on their systems.

Although this year's work has been purely of an experimental nature, it is felt that the missionary work in bringing to the attention of the public, in a manner never before attempted, the variety of delightful trips offered by the two systems; the placing of the parks on a higher plane of excellence than ever before; maintaining an office where the public might obtain all sorts of information; the special excursions run for the comfort and convenience of the passengers, and last, but by no means least, the friendly relations with the newspapers, have, taken as a whole, placed the Boston & Northern and Old Colony street railways prominently and favorably before the public. The companies are satisfied with the results of the experiment and aided by the experience gained are now looking forward to another year's work with great hope.



Pay Roll Hour Extending Table.

[illegible] zontal lines in addition to the hour headings, [illegible] more convenient reference. Twenty-seven verti- [illegible] the totals of the whole number of hours for any [illegible] ing the totals of the fractions of hours for any number of days. The time it is desired to find is the sum of the two totals.

[illegible] reproduced herewith, assume that it is desired [illegible] same line under the column 35 minutes or 7-12 hour, a total of 15 2-12; the sum of these is 301 2-12 hours, which is the total time.

A table of this character is convenient for use in an office where pay rolls have to be made or checked, and aside from that, if the men themselves had access to such tables it would obviate many disputes as to whether errors had been made in computing wages. It is Mr. Gaither's intention to publish the entire table covering 16 hours per day, with 5-minute divisions and 31 days per month. It can be made in the form of a folder for the pocket for distribution to trainmen and others employed by the hour. Inquiries from those interested may be addressed to him at 9328 Ewing Ave., Chicago, Ill., or care of the "Review."

British Notes.

Much acrimony has been engendered by the rejection of the London County Council Tramways bill by the House of Lords, by a vote of 64 to 33. The council will re-introduce the scheme in its entirety next session.

The Report of the Royal Commission on London Traffic lately issued is an overwhelming verdict in favor of the great services rendered to the metropolis by the tramways system. It recommends the creation of new lines, and the linking up of the, at present, disconnected system, through communication being established from east to west and from north to south. Steady progress is being made with the subway which is eventually to connect Southampton Row with the Embankment. It is devoutly to be hoped that this scheme will have an important result in relieving the terribly congested condition of some leading thoroughfares.

The next parliamentary session promises to be largely devoted to Tramway schemes. The London County Council will seek powers, among other things, for seven new routes, involving an outlay of nearly half a million sterling for electrical equipment, and a further £200,000 for improvements thereby required.

The annual report of the British Electric Traction Co. shows that during 1904 the number of passengers carried was increased 22,926,300, and

the traffic receipts increased £102,000 [illegible]. The gross profit, how-ever, was not in proportion, being £29,500 less than in 1901. The rate of dividend was maintained.

Whether tramcars should be permitted to run at higher speed is a question which from time to time is revived and as to which conflicting opinions prevail. Colonel Yorke, of the Board of Trade, has now been instructed by the Board to inspect various routes and draw up a report on the matter.

The report of the North Metropolitan Tramways Co. for half year ending June 30th, shows gross receipts amounting to £307,419, and expenditures of £295,524. The surplus enables the directors to distribute 3½ per cent to the holders of ordinary shares. The business of the company will be handed over to the London County Council as from Apr. 1, 1906.

The optimistic expectations of substantial profits from the conversion of southern tramway lines in London to the conduit system carried out two years ago have not been realized. The £1,000,000 promised as an annual contribution towards the reduction of rates is not in evidence, but the ratepayers must for the present rest content with the outlay of about that amount in the widening of roads through which the lines pass. A thoughtful article on this matter, and cognate subjects appeared in a recent issue of our contemporary "The Engineer."

The Dewsbury, Batley & Birstall Steam Tramway, the first of the kind established in Great Britain, is now in the hands of workmen who are preparing for a conversion to the trolley system.

Central Station Steam Heating Plants.

On April 22, 1905, Mr. W. H. Schott, engineer, Chicago, gave an illustrated talk before the Robert Fulton Society on the subject, "A Central Station Heating Plant." The able manner in which the subject was handled was the cause of much favorable comment and the demand for the data and information contained in the address has resulted in the publication of a limited number of copies of a synopsis of this lecture. The publication was prepared and arranged in Mr. Schott's office and consists of some 14 drawings and charts on heavy bond paper with descriptions and explanations typewritten on opposite pages. All drawings and manuscript are on pages 8 x 11 in., except Design No. 1, which is 11 x 21 in. and is the design of station piping and street and residence connections in a Schott balanced column hot water system.

The first five designs are those of the complete plant, the gage-board, type of condenser used in central station work, type of expansion joint and a system of regulation. Design No. 6 represents a test made on a plant operating with and without regulation and No. 7 is a table showing the amount of radiation that a given sized pipe line will take care of at a given velocity. Following these are tables showing radiation supplied by 100 h. p. boiler capacity at variable temperatures, coal consumption at various temperatures, steam consumption per i. h. p. at variable back pressures, mean temperature coefficients, and tables for arriving at the requirements for cubic contents. The data given are both interesting and valuable and while the publication is only a synopsis of Mr. Schott's talk before the Robert Fulton Society, the charts and tables, as well as the accompanying descriptions and explanations, are both clear and complete.

The Falk Co.

The Falk Co., Milwaukee, Wis., is contractor for and builder of complete electric railways. Besides manufacturing switches, frogs and crossings, motor gears and pinions, and steel castings it has developed and patented the cast welded rail joint. The company's hardened center cast steel track work which has stood the test of heavy service in many large systems in the country, is integral, with all principal wearing surfaces especially treated to combine toughness with hardness. Its steel-bound track work dispenses with bolts, angle plates or knees, and, being thoroughly welded together by heavy steel castings, is integral in its nature; it is offered as a compromise between the built-up and hardened-center work. The '04 frog (built-up) is made up with heavy open-hearth steel knees and corner filler blocks, provided with guards and riser protection for points.

The steel used in its gears and pinions is made in the company's own open-hearth steel foundry, which is one of the most modern and thoroughly equipped in the country. It is claimed the company is the only gear cutter having a steel foundry in connection with the plant, a great many advantages resulting therefrom.

The company's machine shops are new and thoroughly modern, equipped throughout with the latest types of labor saving machines. With such facilities the company is enabled to produce the most perfect motor gears with dispatch. About 5,000 standard type pinions are carried in stock, all of which are thoroughly tested for accuracy before shipping.

A great deal of attention has been given by the Falk Co. to the development of cast welding and one of the latest contracts entered into by it is with the United Railways & Electric Co. of Baltimore, to cast-weld 10,000 or more joints, on the tracks in that city. The work is now well under way on Linden Ave., where 2.5 miles of track will be made continuous by the Falk process. Certain parts of Charles St. and McCullough St. have already been finished, and the railway management is well pleased with the results so far obtained. Track on other streets to be cast-welded is as follows: Edmonson St., 8.8 miles; John St., 4.9 miles; Carey St., 2.8 miles; Preston St., 5.1 miles; Fremont St., 3.7 miles; Orlean St., 7.5 miles.

The Falk cast-welded rail joint has demonstrated that it makes a continuous track, saves current, rails and equipment, reduces track maintenance and makes a very smooth riding track. Tests show 20 per cent greater conductivity at the joint than in the rail itself. Cast-welding is no experiment, hundreds of thousands of joints being in use the world over, many of the leading systems, both in this country and abroad, having welded all of their track.

The officers of the company are: President, H. W. Falk; vice-president, O. H. Falk; secretary and treasurer, E. A. Wurster; second vice-president, Adolph Quentin; assistant secretary, C. L. Jones; chief engineer, W. F. Carr; superintendent, C. R. Falk.

L. E. Myers Co.

The L. E. Myers Co. is an Illinois corporation with principal offices in the Monadnock Building, Chicago. It conducts extensive operations in financing and building electric railways and maintains a complete organization and full equipment of modern machinery for this purpose. This company has built some of the largest and most modern interurban as well as street railways and has been successfully engaged in this line for many years. It now has the following roads under contract: From Lansing to Jackson, Mich., 43 miles; Lansing to Pine Lake, Mich., 5 miles; Springfield to Bloomington, Ill., 60 miles; Fort Wayne to Bluffton, Ind., 23 miles; Lima to Toledo, O., 76 miles; or a total of 207 miles. From this it will be seen that the company has a thorough organization and exceedingly complete equipment of modern railroad building machinery such as steam shovels, locomotives, flat cars, dump cars, track laying machines, etc.

Branch offices are maintained at Lansing, Mich.; Ossian, Ind.; Lima, O., and Lincoln, Ill., and the work on each of these roads is proceeding entirely independent of the other. The officers of the company are: L. E. Myers, president; Theodore P. Bailey, vice-president and general manager; W. H. P. Weston, secretary and treasurer; C. E. Collins, general superintendent.

It is announced that the Avon Beach & Southern Ry., the Lake Shore Electric Railway Co's. extension from Avon Beach to South Lorain, O., will be completed by November 1st.

At the request of the Indianapolis, Columbus & Southern Traction Co., the United States Fish Commission has made a consignment of black bass to be deposited in Blue River, Sugar Creek and Flatrock Creek, along the company's line.

Some 25 passengers were injured in a collision between an interurban car of the Public Service Corporation and a construction outfit of the Trenton & New Brunswick Railway Co. on the tracks of the latter company near Dayton, N. J., August 19th.

The Atlanta Northern Railway.

The First Single Phase Railway in the South.

The first installation in the South of the single phase railway system developed by the Westinghouse Electric & Manufacturing Co. is that made by the Atlanta Northern Railway Co., which on July 17th last opened its line between Atlanta and Marietta, Ga. Exceptionally large crowds have at times been transported and the successful operation of the line is assured. The company operates some 15 miles of track between the terminal cities of Marietta and Atlanta and enters the latter city over the track of the Georgia Railway & Electric Co. The interurban line, however, is operated entirely independently and makes no attempt to conduct a local service.

Marietta, the northern terminus of the line, is at the foot of the Kenesaw Mountain, the battlefield of which is now the site of a national cemetery. The intervening country is rolling and is devoted largely to the raising of cotton. The line crosses the Chattahoochee River at Iceville and passes through the villages of Smyrna, Gilmore and Butler. It is constructed over a private right of way which runs parallel to the track of the Western & Atlantic R. R.

PASSENGER CAR—ATLANTA NORTHERN RAILWAY CO.

The track construction is exceptionally good, consisting of 70-lb. T-rails laid on ties which are ballasted with slag shipped from the iron furnaces of the Birmingham district. The maximum grade is 3 per cent and the shortest curve has a radius of 574 ft. The gage is 4 ft. 8½ in. Within the limits of Atlanta, girder rails are used.

Except within the city limits of Atlanta, a single No. 000 trolley wire forms the entire low tension distributing system. This is fed with 25-cycle single-phase alternating current at a potential of 2,200 volts. The trolley wire is suspended from cross spans secured to wooden poles set 90 ft. apart on straight track and about 45 ft. apart on curves. The construction is similar in general to that ordinarily used in direct current practice except that specially heavy insulators suitable for the higher voltage are employed.

The current supply for the new railway is obtained from the water power station of the Atlanta Water & Electric Power Co., about 18 miles from [illegible] 22,000 volts. The [illegible] cludes Westinghouse three-phase 25-cycle alternators with an aggregate capacity of [illegible]. In [illegible] power station, current may be obtained from a thoroughly equipped steam power plant which the Georgia Railway & Electric Co., which also obtains power from the water power plant ordinarily, has in reserve for the operation of its lines in the city of Atlanta in emergencies. Few railways in any part of the country are so well provided with duplicate power apparatus for maintaining the operation of the road at all times.

The trolley line is divided into three sections, each fed from one leg of the three phase transmission system through oil insulated self-cooling transformers. There are two transformer stations in each section connected to the same phase, making a total of six stations located approximately 3½ miles apart. One of these is in Atlanta, one in the car barn near the limits of Atlanta, and the others at the towns of Bolton, Gilmore, Smyrna and Butler.

The transformer stations are well constructed of brick and each is equipped with one 150-kw. Westinghouse oil-insulated self-cooling transformer together with the necessary lightning arresters, choke coils, switches and fuses. The transformer in Atlanta and one of those in the car barns supply the 550-volt section of the trolley and in order that all transformers may be interchangeable, all are wound so the secondary voltage of either 2,200 or 550 may be used. Since these stations contain no moving machinery, no attendants are required. An occasional inspection of the stations is all that is necessary.

To insure regularity of service with a minimum of reserve capacity, each transformer is mounted on a low truck and is installed in the transformer station on a platform at the height of a standard flat car. A reserve transformer is held in the car barn mounted on a similar truck and loaded upon a flat car ready for instant transportation to any part of the line. This outfit serves as a reserve

[illegible] at any station, the crew of the first car discovering the difficulty [illegible] hauled to this point and on arriving would roll the damaged transformer and its platform on to the flat car and replace it by the reserve unit. This arrangement is an ingenious application of the portable sub-station idea. As each transformer station is capable of

VIEW ON MAIN LINE

carrying the entire load of its section, practically a duplicate installation has been made. With this arrangement and the reserve unit described above, there is little likelihood of cessation of service because of failure of the power supply.

The rolling stock comprises six passenger cars and one freight car, four cars being employed in regular service to maintain a half-hour schedule between terminal points. The running time is 45 minutes each way including some 20 stops. During the heavy rush hours, 189 passengers have been carried on a single car.

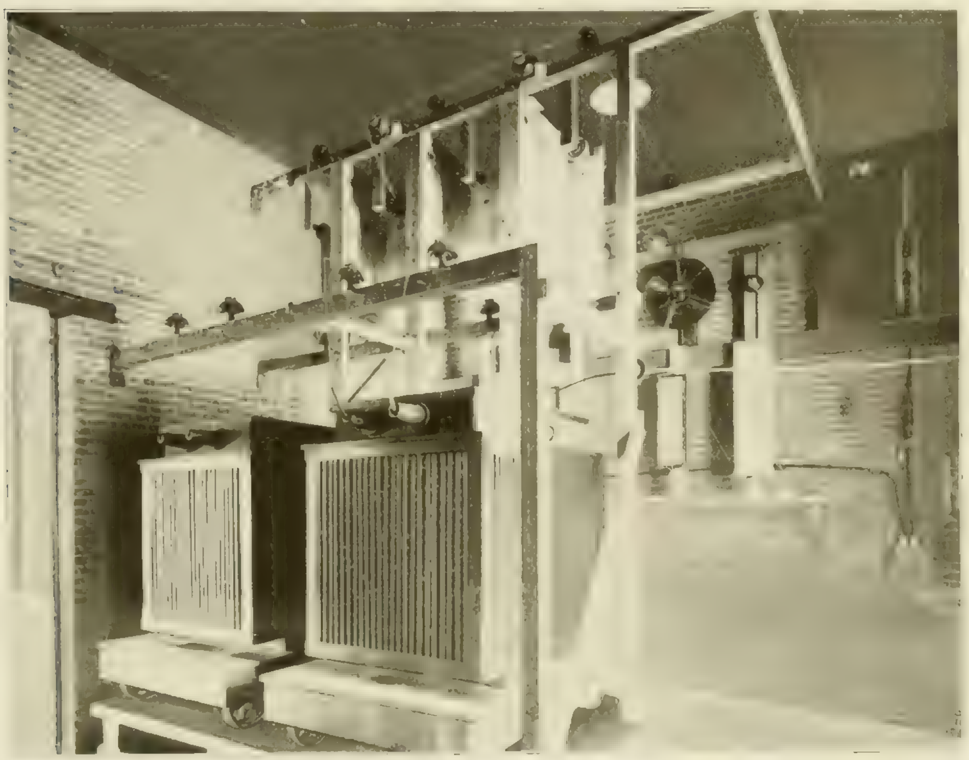
The passenger cars measure 50 ft. 6 in. over all, weigh about 30 tons each, and have a seating capacity of 56 persons. The cars were [illegible] and are mounted upon Brill 27 F trucks. The freight car was also constructed by the Cincinnati Car Co. and is mounted upon standard trucks of the manufacturer. All cars are of the double truck type with 28 ft. between truck centers.

The passenger cars are equipped with quadruple Westinghouse No. 108 (50 h. p.) motors. In the equipment of these cars simplicity was made a strong feature. The circuit from the trolley passes to an auto-transformer through a double-throw oil switch which connects it to either one of two taps on the high tension winding of the transformer according to whether 2,200 or 550 volts is used on the trolley. After leaving the auto-transformer, the circuit passes directly to the ground. The motors may be connected to various taps on the low tension winding of this transformer, giving five different running points.

The connections are made by a drum type controller mounted on each platform. The motors may be run continuously on any one of the five notches so a wide range of running speed may be secured.

The freight car is equipped with four No. 108 motors similar to those used on the four passenger cars with hand control, but in order that this car may be operated on any part of the city system as well as over the company's own tracks, the control is arranged for operation on either direct or alternating current. There are therefore, three operating conditions which can be met by this car. It can be run from a standard 550 volt direct current trolley, the 550 volt alternating current trolley in Atlanta and the 2,200 volt alternating current trolley between Atlanta and Marietta. To meet these widely different conditions, a combination of rheostatic and voltage control is used instead of pure voltage control as on the passenger cars. The motors are connected permanently, two in series, and the two groups thus formed may be connected to any one of three different taps on the transformer. In starting the car, the motors are connected first to the lowest tap, then to the middle tap through a resistance, next to the middle tap without the resistance, then to the highest tap with the resistance in circuit, and finally, to the highest tap with the resistance short circuited. With this equipment, three different running points are obtained.

When operating on direct current, the motors are connected all four in series and rheostatic control only is used. There are thus four resistance points in addition to the "full-on" position.



TRANSFORMER STATION AT CAR HOUSE.

NO. 431 CONTROLLER.

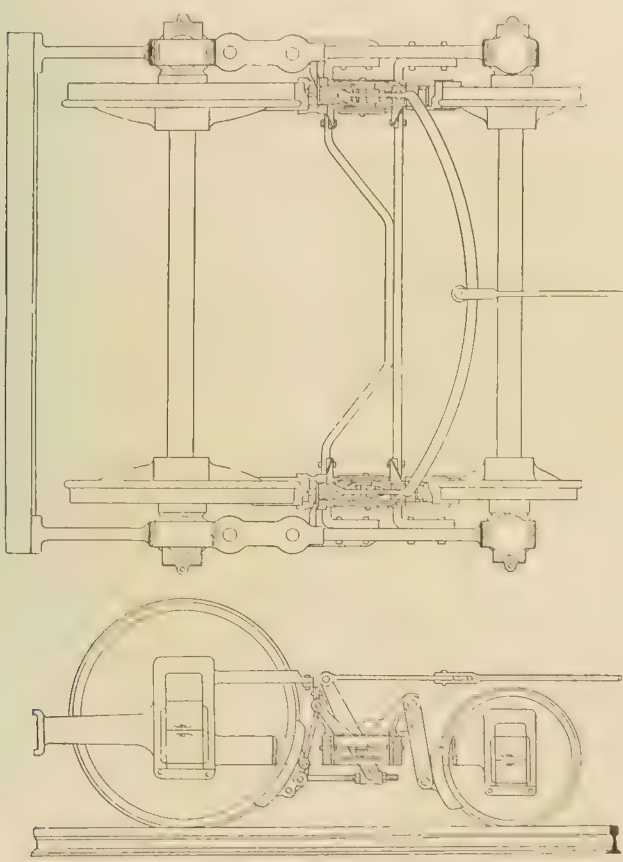
Current is collected from the trolley wire by [illegible] trolleys of the ordinary type except that these trolleys are mounted on porcelain insulators on account of the high voltage [illegible]. Each car carries two trolleys, one at each end, and is equipped with Westinghouse straight air brakes, the compressors for which are operated by series wound motors similar in general to the main car motors. Nothing necessary to an equipment of the highest grade and to enable the company to maintain a safe and reliable high speed service has been omitted.

The officers of the Atlanta Northern Ry. are: P. S. Arkwright, president; T. K. Glenn, vice-president; G. W. Brine, secretary and treasurer; and A. Balsley, chief engineer.

The work of installation and construction was done almost entirely by the company itself, including the track and overhead construction which was conducted under the management of William Glenn, engineer of maintenance of way.

Quick Acting Beamless Brake.

In brakes as usually constructed it is advantageous to hold the brake shoe close to the wheel, thus lessening the amount of movement required of the brake beam and associated parts to operate the shoe. Where the brake shoes are held away from the wheels, the extent which the motorman is obliged to move the mechanism is often at variance with the quickness of the stops required of the car. Thus it has been common practice to adjust the brake shoes to a release position quite close to the wheels. Frequent inaccuracy in adjusting permits the released shoes to remain in contact with the wheel and thus bring about a waste of energy and an increased wear of parts. The removal of car wheels is also hampered by the ordinary type of brake rigging.



PLAN AND ELEVATION OF TRUCK WITH BRAKE

The new type of inside hung brake rigging which has just been placed on the market by the Columbia Machine Works & Malleable Iron Co., of Brooklyn, is designed to perform its functions without the defects just mentioned. This brake was designed especially for the Brill "Eureka" maximum-traction truck by Mr. Charles E. Remelius, superintendent of rolling equipment of the Public Service Corporation of New Jersey.

A system of levers and links for transmitting the pressure to the brake shoes is mounted in a compact form between the forward and rear wheels [illegible] at the respective sides of the truck [illegible] levers are connected [illegible] operated by [illegible] between the [illegible] and links [illegible] rod J. When the motorman actuating the brake lever draws upon the rod J, the pull is divided, and transmitted through the pull bar to the levers A on either side of the truck. [illegible] A [illegible] on a pivot [illegible] lower end, thus moving in opposite directions the bent link D and the push bar K. [illegible] connection with the lever B from the bottom of which is hung the brake shoe against the idler wheel. The simultaneous movement of D and K in opposite directions forces the shoes I and H, which are hung by the links B and G, against the wheels at practically the same instant. The arrangement of these links and levers is such that the travel of the rod J is closely equaled by the travel of the shoes H and I. This allows an adjustment of the links, which will place the shoes when in a released position at a distance from the tread of the wheel sufficient to prohibit any constant rubbing, and due to the approximate equality of travel of the shoes and the rod J, it is found that with the levers proportioned as in the illustration the brakes can be applied from the released position to a full stop setting with but three-fourths of a turn of the brake handle. This relation of levers also assures a quick release when the pull is relieved from the brake rod. The pull bar connecting the brake mechanisms on either side of the truck with the brake rod is curved in shape and provides equalization of pull on the two sides. Owing to the proportions of the lever arms A and B, the braking effect is unevenly divided between the driving and idler wheels so as to prevent skidding of either pair of wheels. The connection between the lever A and push bar K is made by means of a sleeve pivoted to the lower end of A and adjusted along the axis of K by means of set nuts. In this way the adjustments can be made for any slight difference in the braking effect on the two sides of the track due to the wearing of the parts or differences in the proportions of the members.

The links and levers of the brake mechanism are designed in a generous manner and are carried by an auxiliary frame extending

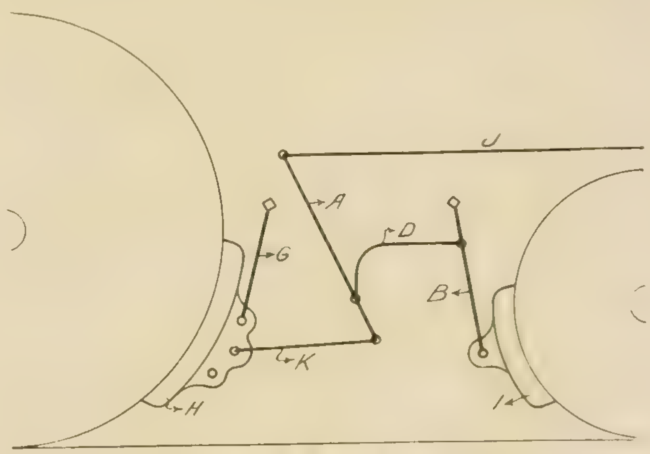


DIAGRAM OF BRAKE LEVERS

between the two wheels on either side of the track in the shape of a box. Into this box fits a rectangular shaped hollow frame provided with brackets for supporting the upper ends of the links B and G. In the sides of the frame are horizontal slots which guide the movement of the pin forming the pivotal connection between the lever A and the bent link D. Due to the arrangement of the parts this pin has a small travel in a horizontal direction.

On May 5, 1905, a car of the Brooklyn Rapid Transit Co. equipped with this brake was put into service. The new brake shoes used weighed 30 lb. each at this time, and after constant use up to July 17th these shoes, which were of cast iron, had lost but 20 lb. each. During the period mentioned the brake mechanism was adjusted but three times and no trouble from slack chains or defects in the mechanism was reported. Cars are now being equipped with this type of brake for the Public Service Corporation of New Jersey, and for the Philadelphia Rapid Transit Co.

The Mayer & Englund Co.

In 1893 Mr. Charles J. Mayer came to Philadelphia from Pittsburg, to represent the R. D. Nuttall Co. in the sale of gears, pinions and trolleys, and he continued alone as agent for the Nuttall company until late in 1895, when he invited Mr. A. H. Englund, of Chicago, to form a partnership, Mr. Englund bringing with him the

C. J. MAYER

A. H. ENGLUND

eastern sales agency for the International Register Co., of which company he was at the time secretary and manager.

The partnership of Mayer & Englund was formed in December, 1895, and the firm had two small offices in the Betz Building. Nuttall gears, pinions, and trolleys, International registers, and Macallen line insulation were about the only products handled at the time and until 1897, when a small store and basement was secured at No. 10 South Tenth St. A limited stock was carried in this store, with the result that the business commenced to increase very rapidly, so that it soon became necessary to add the second floor.

About this time the firm was incorporated in Pennsylvania as the Mayer & Englund Co. The business continued to grow in volume until it became necessary to take the entire building at No. 10 South Tenth St., embracing five floors and basement. By the end of 1901 the concern had entirely outgrown its quarters, and realizing the necessity of more room and of a more suitable space in the way of larger area on each floor, arranged to have built for it a large building at Nos. 1020-1024 Filbert St. The architect's plans for this building were partially completed when the negotiations for the lease were started; nevertheless numerous changes were arranged for to meet the particular requirements of the company's business, particularly in the addition of two stories to the structure. This building has a frontage of 60 ft. on Filbert St., with a depth of 80 ft. to Commerce St., affording commodious entrances for handling freight on both streets. It is nine stories high, including a 12-ft. basement, and is completely equipped with electric passenger and freight elevators. The second floor is used exclusively for the offices of the company, enclosed private offices for the heads of departments being provided. The main floor is used as a general packing and shipping department, and here the lighter character of supplies in broken packages are carried in bins and shelves. The basement is used for heavier classes of supplies and unbroken original packages. On the upper floors are stored goods of lighter

OFFICES OF THE MAYER & ENGLUND CO.

weight in larger packages. A portion of the eighth floor is equipped as a factory for the manufacture of trolley vestibule shades, the company having recently purchased the entire business of the Trolley Vestibule Shade Co., of Bridgeport, Conn.

The business of the Mayer & Englund Co., so far as is known, has no duplicate in its characteristics in this country. It is the only large concern in America devoting its entire attention and energy to the designing, manufacturing and jobbing of electrical and mechanical supplies for street and interurban railways and electrically operated industrial plants, including mine haulage systems. The Mayer & Englund Co. ascribes a good deal of its success to the fact that it has consistently followed for years a certain specific line of electrical development—traction. The concern is recognized today as leading and expert in its line. It does a very large volume of business throughout the whole world where electric power is used for propelling cars. It counts as its constant customers purchasers in England, Germany, France, Belgium, Austria, Italy, South Africa, Australia, Japan, Korea, Philippine Islands, Cuba, Porto Rico, Hawaii, and South American countries. It maintains sales offices, either in the shape of salaried men or agencies, in Boston, New York, Pittsburg, Atlanta, New Orleans, Detroit, Chicago, Kansas City, Denver, San Francisco and Los Angeles.

While "Protected" rail bonds are the largest individual line handled by the company, this is but a comparatively small proportion of its gross business. The company represents as district sales representative and distributing agent many of the most important manufacturers catering to street railway trade, among which are the following:

R. D. Nuttall Co., Pittsburg, manufacturer of gears, pinions, and trolleys. Detail repair parts of the principal standard trolleys are carried in Philadelphia stock.

Brady Brass Co., Jersey City, [illegible] motor bearings [illegible] as general sales agent for the [illegible] of the United States.

International Register Co., [illegible] line of single and double fare registers and register operating fixtures. An assortment of standard register fittings is carried in Philadelphia stock.

W. T. C. Macallen Co., Boston, manufacturer of a full line of overhead insulation. The company has acted as general sales agent for this concern for over ten [illegible] overhead material business. The well known "Keystone Compound" used in all insulation is the result of many years experience and has proved to be exceptionally satisfactory. It possesses extraordinary tensile strength and high electrical resistance.

Sterling Varnish Co., Pittsburg, which has been represented by the company for a number of years, and recently a new arrangement was effected whereby a complete stock in can packages of all the Sterling company's products is being carried in Philadelphia as a general eastern distributing point.

Lyon Metallic Manufacturing Co., Chicago, which has recently entered into contract with the Mayer & Englund Co. to act as exclusive eastern agent in the sale of the Lyon sheet steel gear cases.

Garton-Daniels Co., Keokuk, Ia., which has been represented by the Mayer & Englund Co. as district sales agent for Garton lightning arresters for a number of years. A very large business in this line has been built up. Standard forms of both railway and metallic circuit power arresters are carried in Philadelphia stock.

New York & Ohio Co., Warren, O., manufacturer of the well-known "Packard" incandescent lamps. A large assortment of standard lamps for common voltages is carried in Philadelphia stock

STOCK ROOM. OFFICE FORCE. BASEMENT STOCK ROOM.

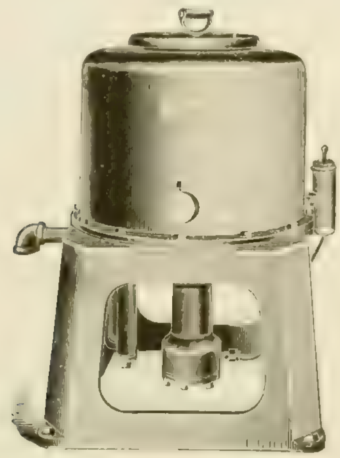
for prompt shipment. The company has acted [illegible] the Packard lamp for a number of years.

In addition to the specialties made by the foregoing manufacturers the company carries a very large and complete stock of practically every detail required in the construction, operation and maintenance of electric roads, including a full line of electric lighting and telephone supplies.

The individual exhibits of the various manufacturers represented by the Mayer & Englund Co. will be found in one general group at the Convention Hall, and delegates will undoubtedly find it a very interesting display.

Oil and Waste Saving Machine Co.

The Oil & Waste Saving Machine Co., 1337 Real Estate Trust Bldg., Philadelphia, is manufacturing machinery for separating and reclaiming oil waste and other substances, of which the accompanying illustration is a type:



OIL AND WASTE SAVING MACHINE

This machine is a turbine engine having a direct connected basket or waste receptacle in which the soiled and oily waste is placed to be reclaimed for future use. It is operated by steam, the engine exhausting itself through the centre of the basket, causing the steam to pass through the waste and the walls of the basket which are perforated, thereby separating the oils and greases from the waste by the centrifugal force and the introduction of steam which liquifies the oil and grease, causing them to leave the waste more easily. These materials, after the machine has run 30 minutes, are forced out of the waste and basket and flow down through the machine and out the oil outlet. This oil and grease can be filtered and used for the same purpose as new oil or grease. The waste is then removed from the basket and after the slight dampness, caused by the condensation of the steam, is taken out by drying and the waste shaken out, it can be used as new waste.

The machine is made in four different sizes, 10, 15, 20 and 36 in., the latter having a capacity of 8 cu. ft. of waste per run of 30 minutes. It is stated that a large machine installed in the Manhattan power station, New York City, Jan. 5, 1904, reclaimed 195 gallons of oil on the first five-hour run and during the rest of January 1,560 gallons of oil were extracted. Its simplicity of operation and maintenance and resultant economy have appealed to engineers and managers, and the company numbers among its patrons in the electric railway field the Public Service Corporation of New Jersey, J. G. White & Co., Cleveland Electric Railway Co., Pittsburg Railways Co., Milwaukee Electric Railway & Light Co., Birmingham Railway, Light & Power Co. and Philadelphia Rapid Transit Co., besides a large number of manufacturers of electric railway apparatus, including the Allis-Chalmers Co., Westinghouse Machine Co., and General Electric Co.

The consolidation of the light and railway properties of Knoxville, Tenn., has been completed and a new charter obtained under the name of the Knoxville Railway & Light Co. The officers of the new company are C. M. Harvey, president; Leon Fender, secretary; [illegible] Baum, treasurer.

Dependable Hydraulic Jacks.

Unless a hydraulic jack is absolutely reliable, the engineer, mechanic, railroad man or whoever is using it, is better without it. Just at the critical moment, when everything depends on a jack "standing up," a poorly made device is liable to give way. The consequences are best left to the imagination; they are not pleasant, even to imagine. In the Watson-Stillman hydraulic jacks, every possible effort has been made to eliminate all elements of uncertainty, and hence the confidence reposed in them by those who have to trust life and limb to the dependability of a hydraulic jack. The cylinders and rams, for which some makers use so-called seamless tubing, are in the Watson-Stillman jacks forged from solid steel billets, forged and bored like the cylinder of a high-class steam engine. Valves, glands, pistons, etc., are made and finished with equal care, packings and other parts subject to wear are easily accessible and replaceable, the result being a hydraulic jack thoroughly dependable and constantly ready for service. The manufacturer, the Watson-Stillman Co., 46 Dey St., New York City, has a list of about 300 styles of hydraulic jacks, which it will send on request.

Herschell—Spillman Co.

Herschell-Spillman Co., of North Tonawanda, N. Y., amusement outfitter and manufacturer of park attractions, reports an excellent year's business, the increase in the sale of its merry-go-rounds having exceeded any previous year and necessitated the enlargement of its plant during the past season, plans for further extensions now being under consideration. Besides the company's standard improved merry-go-round, shown in the accompanying

STANDARD IMPROVED MERRY-GO-ROUND

illustration, the "Tonawanda" merry-go-round, the razzle dazzle, striking machine and other smaller devices installed in street railway amusement parks throughout the country have met with no small degree of success and proved interesting to park patrons as well as remunerative to the management. The company is also in a position to supply ferris wheels and miniature railways, and the long experience it has had in the manufacture and construction of park devices has well qualified the company as designer and outfitter of parks, a specialty being made by the company of designing new and improving old parks.

The Zion City extension of the Chicago & Milwaukee Electric Railway Co.'s line was opened September 2nd.

The Elgin, Aurora & Southern Traction Co. has installed a number of new stations along the route of its Elgin and Yorkville lines. The stations are farther apart than formerly and it is the intention of the company to reduce the running time on these routes.

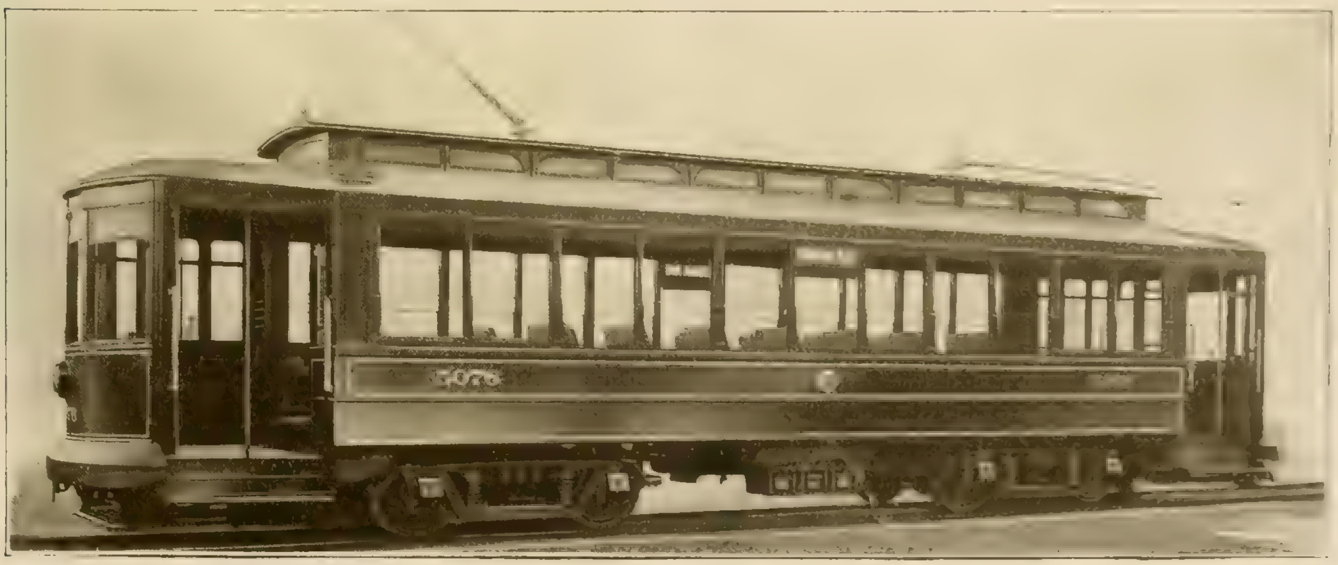
New Standard 1905 Cars of the Chicago City Railway Co.

The Chicago City Railway Co. has ordered 200 cars this [illegible], 125 being built by the J. G. Brill Co. and 75 by the American Car Co., and in the design there have been incorporated a number of new features. These were decided upon only after the most careful thought and investigation by the president, general manager and other officers of the company, in which they were ably assisted by Messrs. Ford, Bacon & Davis, consulting engineers, as well as by suggestions from Mr. C. G. Goodrich, president of the Minne-

CAR FITTED WITH STORM WINDOWS FOR WINTER SERVICE.

apolis & St. Paul Suburban Ry.; Mr. John M. Roach, president of the Chicago Union Traction Co., and other prominent railway officials. An enumeration of these special features and the reasons why they were adopted will be of general interest.

The climate of Chicago is such that the time during which an



ENTRANCE SIDE OF CAR AS IT APPEARS IN SUMMER SERVICE.

open car (unprotected by windows) can be used satisfactorily during all hours of service is usually confined to the months of July and August, and even during this period cold rain storms, driving in from the lake, make riding in cars of this type at times quite uncomfortable. During the months of June and September there are many [illegible] to require that cars used [illegible]. These conditions [illegible] carry windows at all times, precluding consideration of a type of car in which windows are entirely removed during the summer months.

The car [illegible] adopted [illegible] convertible, which can be completely closed for winter use and made nearly open in the summer. The particular advantage of this type lies in the readiness with which it can be changed, in case of storm, from an airy open-door car to one completely enclosed, or vice-versa. This change can readily be made by the train crew without inconveniencing passengers, or interrupting service.

By virtue of the extra wide car body, wide [illegible] there is room for both ingoing and outgoing streams of passengers on each platform as well [illegible] of two windows from the door, the ends of the car having longitudinal instead of cross seats. Thus four streams of passengers can board or leave the car at once. It is also easy for persons to

[illegible]

The car as equipped for winter use has, in addition to the ordinary windows, a set of storm sash which are held in place by the same clamping device which in summer holds a wire netting to prevent passengers from sticking arms and heads out of windows. This is believed to be the first city car in the United States on the latitude of Chicago to be equipped with storm sash for winter. Such storm sash have been used with great success in Minneapolis and St. Paul, where extreme cold weather makes the heating of cars difficult. These storm sash, together with an unusual number of electric heaters, make it possible to maintain a comfortable temperature in the cars, even during the coldest weather experienced in Chicago.

On account of the great number of stops per mile in service and the opening of doors at both ends of the car, necessitated by the heavy traffic, the heating of cars in Chicago requires more than ordinary provisions, presenting probably more difficulties than in any other city in the United States. Electric heaters are located along the truss plank the entire length of the car occupied by cross seats, and panel heaters are placed under the longitudinal seats at the ends of the car. There are twelve truss plank heaters and eight panel heaters; all are of the double coil type, made by the Consolidated Car Heating Co. These heaters give three degrees of heat. On the first point of the heater switch, the smaller coils in each heater are in circuit, giving a very mild heat; on the second

as there is a stop which prevents their being opened until the window has been raised out of its seat preparatory to lowering it into the pocket. This is to prevent passengers from raising the covers or flaps and using the window pockets as cuspidors.

For summer use, the car is made to more nearly approach an open car by removing the end doors and dropping the end windows. The doors slide between a drop sash which is outside the door and an inner sash, which is clamped on after the manner of a storm sash, and acts as a guard for the door, so that passengers cannot stick their fingers in the door pockets.

The door being removed in the summer, this inner protecting sash can be removed also, thus doing away with the closed end, which has always been a disagreeable feature, as it makes a car seem close. In case of a storm the end windows can be raised to afford protection to passengers in the ends of the car.

It is frequently the case in the operation of the semi-convertible car in summer that the motorman, in order to protect himself from draught, will close the car doors behind him, thus shutting off the circulation of air through the car and making a dead pocket in the end. By removal of doors, as described, the motorman can have the vestibule windows closed in front of him and yet a good circulation of air can be obtained through the side vestibule windows and the open end windows and doorways. The motorman's window has stops, so that he may carry his window at a height most comfortable to him.

The vestibule doors fold up against the front of the vestibule

"BLIND" SIDE OF CAR AS IT APPEARS IN SUMMER SERVICE

point, the small coils are cut out and the large coil in each heater is put in circuit; on the third point, both large and small coils are in circuit in parallel, to give maximum heat. The current consumption of these heaters on 500 volts is as follows: First point, 7 amperes; second point, 12 amperes; third point, 19 amperes.

It is a common mistake, in purchasing electric heater equipment for a car, to provide an insufficient number of heaters, thus giving too small radiating surface and making it necessary to work the heaters at a high temperature, which is detrimental to the life of the heater coils and does not produce as good results in heating the car as a larger number of heaters at lower temperature; the latter have a large radiating surface and distribute the heat well through the car instead of concentrating it at a few points under the seats, where it causes discomfort to the passengers who happen to be sitting over the heaters. The manufacturer of the heaters guarantees that with this equipment a temperature of 50 degrees will be maintained inside the car in the coldest weather.

For spring and fall use, the storm sash are removed and wire netting guards placed along the windows. The windows can then be opened or closed according to the weather. The lower window sash drop into pockets in the side of the car, while the upper sash are raised into the roof pockets. By having only one sash drop, a saving of about 3 in. is made in the available inside width of the car and at the same time the roof pockets need not be made unusually large. When the windows are closed, the covers of the pockets into which the sash drop cannot be raised by passengers,

when open. When closed, a heavy horizontal bar serves the triple purpose of locking the doors, forming a solid support to keep them from rattling, and acting as a rail against which passengers so disposed can lean without danger to themselves or disturbing the doors. The horizontal bar pivots near its center on one of the vestibule doors so that it is swung into a vertical position when the doors are to be opened. A guide is provided at the top of the doors so that they will fold themselves into proper position against the front of the vestibule without any attention on the part of the operator.

One of the novel and important features of the platform is the sliding, disappearing step arrangement, the invention of Mr. D. A. Faut, master mechanic of the Chicago City Railway Co. The steps are mounted a fixed distance apart on guides under the platform. When the step on one side is out for use, the other one is under the car. The changing of the step from one side to the other is very quickly and easily accomplished at the end of the run by turning a shaft located beside the brake valve inside the vestibule, the controller handle being used for that purpose. By a half-turn of this shaft the steps are slid over and automatically locked in position. The adoption of this sliding step is but one of the several precautions which have been taken to render the car absolutely "hitch-on-proof" and do away with the evil, which is quite prevalent in Chicago, of boys, and even supposedly responsible persons, riding on dangerous places that were never intended to be so used. The disappearing step also simplifies the question of providing a vestibule door which shall close the left-hand side of the platform with-

out leaving a space over the steps. The steps are [illegible] being 11½ in. with carborundum tread, so that passengers may obtain a firm and full length foothold when entering or leaving the car.

Sheet steel strips or fillers have been placed at an angle of [illegible] degrees above the bumpers to prevent persons [illegible] and riding thereon. This plan of covering the bumper has been satisfactorily used by the International Railway Co. in Buffalo, N. Y., where it was first suggested by its superintendent of transportation, Mr. C. A. Coons. On the whole length of the car on the "blind side" which comes next to the devil strip there is no opportunity for "hitching on," the vestibule doors being closed and the steps withdrawn.

The windows have been so arranged that there is one window opposite each cross seat. The top sash have the quarter oval [illegible] give the general appearance of a Pullman parlor car except the middle window, where the top sash is occupied by a [illegible] destination sign illuminated at night by the lights from the interior of car. Besides the sign in the top sash of the middle window there

between cars [illegible] ance when passing.

[illegible] possible to close the transom very tightly, or to leave it open at any [illegible] reduces the possibility of broken glass falling on passengers, and adds to the artistic effect. Rubber cushions and stops are used here [illegible]

The sides of the car have been given a slight curve and present a graceful appearance. The sheathing or side panels are of standard size sheet steel, thus making repairing easy. A rail at the bottom of the panel is so placed as to receive blows which would otherwise scratch the panel.

The cars are painted dark green, the color scheme being that of the Chicago Union Traction Co. The trimmings are in orange, with

DOORS AND END WINDOWS REMOVED FOR SUMMER

DOORS AND END WINDOWS IN [illegible]

is a similar illumined sign in both front and rear vestibule windows, each supplied with light placed directly back of the signs in boxes provided for that purpose.

The car seats 44 passengers, 8 less than the largest car previously purchased by the company, part of the difference being caused by the shortening of the car body, and part by allowing more knee room between the cross seats, so that the passenger next the aisle need not rise to let his neighbor get out. The cross seats are 33 in. center to center instead of the usual 30 in.; 15 in. is allowed between the seat cushions, and the aisle is of unusual width, 28 in. The seats are also wider than ordinary, being 34 in. in width. The general dimensions of the car are: Length of body over end panels, 32 ft. 5 in.; length over all, 45 ft. 9 in.; width inside, 8 ft. 2½ in.; outside over all, 9 ft. There are seven cross seats on each side of the car, and longitudinal seats in each corner with ample room for four persons.

The dimensions of the car, especially the width, were matters of special consideration. In deciding upon this, the rolling stock of a number of the principal street railway systems of the country was investigated.

The height of the car was determined by the subways through which it must operate. As to the width, it appeared desirable either to make the cars narrow enough so that a person could stand safely between cars when passing on a street, or to make them wide enough to get the full benefit of the space available between tracks and leave no possible question as to whether there would be room for a person to stand between cars. With a distance between cars of 11 or 12 in., there is greater likelihood that persons will attempt to stand between cars and be rolled or crushed to death than if there were but little clearance. This has been demonstrated in Chicago. As the car would necessarily have to be reduced at least to 7 ft. 6 in. in width to make it possible for persons to stand safely

the roof in light buff. The trimmings are very plain and the only lettering is the monogram of the company on the middle side panel, and the number of the car on each end panel and on the dash boards. A simple aluminum stripe is all the decoration on the side of the car aside from a monogram and two car numbers.

The interior wood work is cherry, the lower part up to the lower ventilator rail being rubbed to a dull finish and the upper portion being left in a bright finish. In the interior design there is a careful deference to simplicity, harmony and dignity, in accordance with the present tendency of car building to finish a car in a manner which will look well for many years, and will permit of few corners for the collection of dust. Such an interior can be kept in a presentable condition and wears well in the public eye. As can be seen in the illustrations all obstructions under the seats have been eliminated, and a very simple seat pedestal selected, so that little obstruction would be presented to the cleaning of the car floor. The whole interior, including the windows, is of a character easily cleaned and least likely to collect dirt.

The hardware is of extra heavy oxidized brass, which was chosen in the belief that it will present a good appearance for long wear.

The seats are rattan, the cross seats being of the reversible type. A corner of the back of each seat next to the aisle has been cut away for a grab handle.

No straps for passengers have been provided, for the reason that when the car is crowded, it is not desirable to have passengers stand near the ends and so obstruct the passage way. By standing in the middle, they can obtain a support from the grab handles aforementioned. Furthermore, it will be the attempt of the company to keep the standing loads as low as possible by operating plenty of cars.

Abundant provision has been made for artificial lighting. Along each side over the seats is a row of nine 16-c. p. frosted lamps.

Frosted bulbs were adopted partly on account of their more artistic appearance, but mainly because of the superior soft, diffused light obtained from them. The glare of the bare filaments on a row of incandescent lamps placed as these are produces a blinding effect, and makes reading in the car much more difficult than with the diffused light from the frosted lamp. Furthermore, the advertisements in the racks can be read past a frosted lamp much more readily than past a bare lamp. The rows of seat lights are in circuit with the two lights used for illuminating the end signs. Three 120-watt 32-c. p. Meridian lamps are placed in the ceiling and are wired in series with a 32-c. p. headlight lamp and a rear platform light. All heat, light and compressor motor switches and cut-outs

FRONT VIEW—FENDER OUT.

are plainly labeled, so that the conductor and motorman do not have to experiment to learn which circuit a switch controls.

The headlights have white enameled iron parabolic reflectors and bull's-eye glasses mounted in a cast iron case. These headlights are believed to be as nearly indestructible as anything of the kind can be made, and project but 4 in. beyond the line of the front vestibule.

Any announcements which the company may wish to make to passengers are placed in a space reserved for them in a quarter oval frame over each end window.

The "International" type of fare register is used. Register rods have been abandoned as being difficult to maintain in a long car. In their place are substituted two cords, one on each side of the car, supported on pulleys carried in suitable brackets.

Only one bell rope is used, that being hung from the center of the ceiling for the use of the conductor only. Passengers signal the conductor by means of an electric bell circuit with push button at each seat.

For carrying the trainmen's coats and packages, boxes have been provided under the longitudinal seats. A rack is also placed there for a broom, which is to be carried on every car, the intention being to keep all unsightly articles out of sight.

The trucks are on the lines of what is commonly known as the M. C. B. passenger truck, being slightly modified from those already in use on the Wentworth Ave. cars of the Chicago City Ry., which are showing little evidence of wear after four years of extremely hard service. The truck-frames, equalizers, bolsters and motor suspensions are of forged steel, all parts being machine fitted.

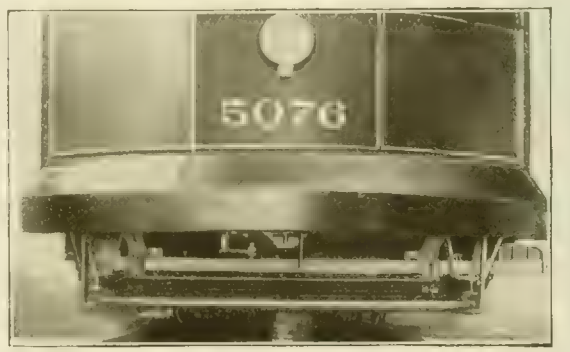
A larger axle has been used than on other cars of the company, the dimensions now being [illegible] in. at journal boxes, 5 [illegible] in. at the wheel fit and gear, and 5 in. at the motor bearings. A 500-lb. double plate, 33-in. chilled cast iron wheel is used with ⅝-in. flange and 2½-in. tread.

The fenders are of the Chicago Union Traction Co. pattern. The upper part of the fender, which, when extended, is locked in position by the coupler, folds down on the lower part and the whole slides back under the car when not in use. These fenders are carried at a fixed height above the track. As an additional protection, V-shaped fenders are placed in front of the wheels back of the regular fender. Attached to this V-shaped wheel fender are scrapers operated from the platform and arranged to be dropped on the rail, and when necessary to clear away any obstruction, snow or dirt which may have gathered thereon.

The car has no permanent drawbar and consequently there is nothing to interfere with the action of the fender. Instead of the usual drawbar a pocket has been provided under the bumper into which a bar can be inserted in emergencies. This also serves as a lock for the fender when in use.

Stools for the motorman are provided which fit into floor receptacles.

Provision has been made in the design of these cars for the adoption of what is known as the Minneapolis gate for the rear platform, should it seem advisable in the future. This is a gate opened and closed by the motorman, and is kept closed at all times except when the car is at a standstill. This gate has been used on the lines in Minneapolis and St. Paul for a number of years and has effectually prevented a certain class of accidents. If such a gate should be adopted on these cars, it will be placed on the rear platform only, as it is thought that the motorman can easily watch the front platform. On a long car it is not always possible for a conductor to collect fares and see what is going on at the rear step. By the use of the Minneapolis gate on the rear platform, and a motorman's mirror, so placed that the motorman can see the rear step, the responsibility for this part of the operation can be shared by him. Furthermore, it is believed that, after cars so equipped have been in operation a short time, it will have a tendency to cause those desiring to board cars to seek the front platform rather than await the opening of the gate. Those desiring to leave the car would under such circumstances naturally move to the rear, and thus avoid the incoming crowd. This would, it is thought, greatly facilitate the movement of the passengers on and off a car at crowded corners. For the present, cars will be operated with front and rear platforms open on the right-hand side, as is customary in Chicago.



REAR VIEW—FENDER FOLDED.

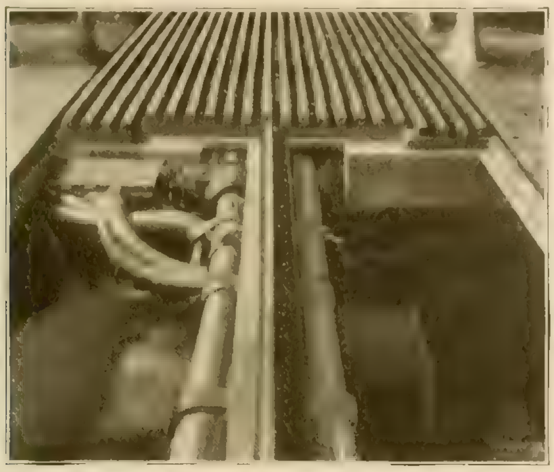
The car wiring was given very careful attention by Mr. H. B. Fleming, chief engineer of the Chicago City Railway Co., and is perhaps the finest work of the kind ever put on a street railway car. It follows the practice recently adopted on a number of elevated roads of putting all wires under the car in iron pipe conduit. The motor wires between controllers are bunched into three cables. One of these cables contains the wires for motors 1 and 2, which motors are placed in one truck. The second cable contains wires for motors 3 and 4 placed on the other truck. The third cable contains wires going to the resistance grids. The compressor wiring is run in separate iron pipe conduits. The iron pipe conduit for the main cables runs along the center longitudinal sills of the car.

Each cable conduit has all wires of different color, so there is no confusion of leads.

Where the taps are taken off from the cable to the motor [illegible] split cast iron junction box containing the joint [illegible] bolted [illegible] conduit. These taps are led to a connection box, which [illegible] vation in car wiring, and is intended to make it possible to [illegible] disconnect the motor leads without the inconvenience of disconnecting joints and removing joint insulation, as has been [illegible] tofore when taking trucks from under a car. The taps [illegible] cable are led into the connection box, where they terminate [illegible] switch jaws. Lugs soldered onto the terminals of the motor leads are made of such shape as to fit into these switch jaws, and when the lid of the connection box is fastened on, they are secured firmly in place.

The controller at each end of the car is connected to the trolley lead through an automatic circuit breaker and a new type of fuse box. While the automatic circuit breaker can ordinarily be depended on, it is felt that a fuse should be provided to save the equipment when the circuit breaker sticks. This fuse box is arranged to take a copper strip fuse, the arrangement for clamping being very powerful and simple, so that the fuse requires no special terminals, being simply a length of copper ribbon.

In addition to placing a kick coil in series with the main motor circuit, as is the usual practice, a kick coil has also been introduced in series with the auxiliary circuits for heating, light and air compressor motors, in order to prevent damage from lightning.



CONNECTION BOX AND WIRE CONDUITS.

The motors are of a new type called the G. E. 80, being practically of the same capacity (40 h. p.) as the G. E. 67, except that the commutator is larger and some other changes have been made, notably an increase in the size of all bolts to a standard of 1⅛ in. These motors open from the bottom. This is another point to which much thought was given. In view of the fact that pit work is being abandoned as far as possible by some companies, and there has been a marked tendency in some quarters, during the past few years, to do all work on motors from above and to demand a motor which opens from above rather than from below, the merits of such motors were duly considered. It was finally concluded, however, that under the Chicago City Railway Co's. conditions, there were no material advantages in having a motor which would open from above and not from below and there were some decided advantages in having it open from below. Armatures and fields can be removed and replaced through the pit at any car house without taking the car to the general repair shop if the motor opens from below. This in itself is a strong argument. On a large system it was not considered advisable to select a type of motor which would make it necessary to take a car many miles to the general repair shops in order to remove armatures and fields. As to convenience of handling when making a general overhauling of a car equipment, it is practically as easy to lift a motor out of the trucks with the crane at the general repair shops and turn it over so as to get the armature out, as it would be to take it out of the trucks and remove the armature if the motor opened from above; the only difference is that the motor must be turned over by the crane, which is the work of but a few seconds.

The K [illegible] controller [illegible] [illegible] troller wires.

[illegible] seat, is a sand box with a Nichols-Lintern air sanding device. The [illegible] engineers. It is placed directly above the stem of the air brake [illegible] while applying the brakes, making a very convenient arrangement. The hand brake provided for emergencies is the "Peacock" type with which the car can be readily controlled should the air fail.

The trucks were built by the McGuire-Cummings Manufacturing Co., the air braking apparatus by the National Electric Co., the [illegible] & Kilburn Manufacturing Co., and the illuminated signs by the Hunter Illuminated Car Sign Co.

The R. D. Nuttal Co.

The R. D. Nuttall Co., of Pittsburg, Pa., which began the manufacture of gears and pinions for street railway service some 15 years ago with but one gear-cutting machine, has developed its business until it now has upwards of 100 machines used in the manufacture of these products, believed to be the largest gear-cutting equipment in the world. With the almost universal adoption of heavy cars and powerful motors for high speed and interurban service has been a corresponding demand for increase in the weight and improvement in the design of motor gearing, which has resulted in the manufacture by this company of a very complete line of gearing for this particular service.

While the company makes a line of gears to meet the requirements of varied axle and gear diameters and has a complete line of patterns and full data on gears for different motors, so that orders may be filled with exceptional dispatch, the general design of its solid gears is the same. The solid type of gear, which is recommended especially for high speed interurban service, is put onto the shaft under a pressure of from 10 to 25 tons, which is sufficient in itself to insure a permanent and tight fit. The design of this gear allows a perfect distribution of material and provides for an exceptionally strong gear without the disadvantage of great weight, eliminating danger of accidents due to breaking or loosening of bolts and the bending of armature shafts and injury to gear cases and other parts connected thereto.

In addition to gears and pinions the company manufactures trolleys, poles and repair parts for both surface cars and mine locomotives, as well as trolley gears and pinions for electric railway, mine, and industrial haulage motors. Mr. F. A. Estep is president and treasurer of the company, and it is under his management that the business of the company and the development of its products have grown to their present status.

Mutual Benefit Association at Birmingham.

Employes of the Birmingham (Ala.) Railway, Light & Power Co. have very recently formed a mutual benefit association, in which a majority of the employes of the various branches of the service have signified their intention of becoming members. Mr. J. A. Emery, general manager of the company, has been active in the organization of the association, and Mr. George H. Harris, superintendent of the railway department, has been elected chairman of the board of directors. Other officers have been elected as follows: C. M. Cory, treasurer; Samuel Sanders, secretary; W. L. Leitch and Samuel Anson, assistant secretaries. The organization is similar in character to other societies of this kind and will pay sick, accident and death benefits to its members or their families.

The question of utilizing trolley poles as sewer ventilators is under consideration in Wakefield (England), and the city surveyor has been instructed to submit plans.

Personal

MR. JOHN MILLAR, who resigned as master mechanic of the International Railway Co., Buffalo, N. Y., May 1st last, returned from Europe August 2d and is visiting friends in Chicago.

MR. F. B. ARCHIBALD, formerly associated with Berry Bros., Ltd., Detroit, in their railway department, has been appointed sales agent for the National Lock Washer Co., Newark, N. J.

MR. W. S. MENDEN, chief engineer of the Metropolitan West Side Elevated Ry., Chicago, was on September 8th, upon the resignation of Mr. H. M. Brinkerhoff as general manager, appointed general superintendent.

MR. CHARLES O. KRUGER, second vice-president and general manager of the Philadelphia Rapid Transit Co., was married on Thursday evening, August 31st, to Miss Elizabeth C. Kauffman, of Oley, Pa.

MR. HENRY GROVER, who has been in the service of the Boston & Northern Street Railway Co. for 26 years, resigned as superintendent of the Chelsea Division, August 26th, and has been succeeded by Mr. George Gray.

MR. P. M. KLING, who for the past five years has been general manager of the John Stephenson Co., has resigned that position to become manager of the passenger car department of the Pressed Steel Car Co., of Pittsburg, Pa.

MR. H. C. STILLWELL, general agent of the Indiana Union Traction Co. at Anderson, Ind., has resigned that position and will devote all of his time to the Muncie & Portland line, now building, of which road he is general manager.

MR. WALTER H. WHITESIDE, formerly vice-president and general manager of the Allis-Chalmers Co., was on September 7th elected president of that company to succeed Mr. B. H. Warren. Mr. Whiteside, preceding his connection with the Allis-Chalmers Co's. interests, was manager of the detail and supply department of the Westinghouse company, and at the same time manager of the Sawyer-Man Electric Co., of New York. His first business connection was with the Hercules Powder Co. in 1881, and four years later he became associated with the Cleveland Electrical Manufacturing Co., where he remained nearly 12 years, being for the greater part of this time manager of the company's Chicago office. In 1896 Mr. Whiteside was appointed manager of engine sales for the Gates Iron Works, of Chicago, and in 1898 he became manager of the Washington office of the Westinghouse Electric & Manufacturing Co.

WALTER H. WHITESIDE

MR. SAMUEL A. FRESHNEY, the retiring general manager of the Muskegon Traction & Lighting Co., who was appointed director of public works at Grand Rapids, Mich., was recently tendered a banquet by the employes of the company.

MR. ELMER M. WHITE, cashier of the Hartford Street Railway Co. and secretary of the Street Railway Accountants' Association of America, has accepted the position of assistant secretary and assistant treasurer of the Birmingham Railway, Light & Power Co., of Birmingham, Ala.

MR. JOHN T. MANSON, president of the Yale National Bank, of New Haven, Conn., has been elected president of the Recording Fare Register Co. Mr. Manson has for several years been identified with the operation of street railways, being president of the Milford & Uxbridge Street Ry. of Milford, Mass.

MR. H. F. J. PORTER, formerly second vice-president of the Nernst Lamp Co. and at one time manager of the publishing department of the Westinghouse companies, has opened an office in the Metropolitan Building, 1 Madison Ave., New York City, as consulting industrial engineer. Mr. Porter was western agent for the Bethlehem Steel Co. from 1894 to 1897, and later became assistant manager of the company, which together with his other experience in organization and management, has well fitted him for the work in which he is now engaged.

MR. C. P. MATTHEWS, M. E., Ph. D., who for several years has been professor of electrical engineering at Purdue University, has been appointed Director of the School of Electrical Engineering, succeeding Prof. W. E. Goldsborough, who resigned as head of the electrical department to join the staff of J. G. White & Co.

MR. H. S. RYKERT, formerly with the Brooklyn Rapid Transit Co. and for the past two years with the Aurora, Elgin & Chicago Railway Co., has been appointed superintendent of the Rockford & Interurban Railway Co., succeeding Mr. H. M. Smith, who has accepted a similar position with the Philadelphia & Western Railroad Co.

MR. P. J. MITTEN, superintendent of overhead lines of the Milwaukee Electric Railway & Light Co., has been appointed superintendent of motive power of the Indiana Union Traction Co., Anderson, Ind. Mr. Mitten was in the service of the Milwaukee Electric Railway & Light Co. for about ten years, prior to which he was with the Denver City Tramway Co.

MR ARTHUR N. DUTTON, assistant superintendent of the elevated lines of the Brooklyn Rapid Transit Co., has been promoted to the position of assistant to the general manager. Mr. Dutton has been in the service of the Brooklyn Rapid Transit Co. since March, 1903, previous to which he had an extensive experience in the operating department of the Santa Fe system.

MR. LEAVENWORTH WHEELER, superintendent of the Worcester & Southbridge Street Railway Co since its opening, has resigned to become superintendent of the Berkshire Street Ry., Pittsfield, Mass., another and larger division of the Consolidated Railway Co. system. He is succeeded at Worcester by Mr. J. B. Potter, superintendent of the Worcester & Connecticut Eastern division of the Consolidated Railway Co.

BATES & NEILSON, consulting electrical engineers, New York City, announce that the co-partnership heretofore existing under the firm name has been dissolved, and Mr. Putnam A. Bates has succeeded to the business of the firm. Mr. Bates will continue the business at 42 Broadway as heretofore, giving special attention to the preparation of plans, specifications and supervision of electrical installations, special investigations and reports, and the application of electrical power to machinery.

MR. RANDOLPH STRICKLAND has resigned as location engineer for the New York Central R. R. and has entered the employ of J. G. White & Co., 43 Exchange Pl., New York, as assistant to the secretary. Since graduating from the Massachusetts Institute of Technology, Mr. Strickland has held positions as assistant engineer, Mare Island Navy Yards; and with the Blake Pump Co., Buckeye Engineering Co., Case Manufacturing Co., Colorado Fuel & Iron Co., Lannius Machine Co. and the New York Central R. R.

PEPPER & REGISTER announce the dissolution of that firm, which is succeeded by A. L. Register & Co., 112 North Broad St., Philadelphia. By mutual agreement the new company will conduct outstanding contracts of the old firm, and as its successor, will continue in the same business of engineering and general contracting. Mr. David Pepper, jr., has since become associated with Mr. John R. Bowie, and offices have been opened in suite 1233 Land Title & Trust Building, Philadelphia, under the firm name of Pepper & Bowie, engineers and general contractors.

MR. GEORGE M. BASFORD, who for the past eight years has been editor of the American Engineering and Railroad Journal, has resigned that position to take charge of the newly established department of publicity for the American Locomotive Co. Mr. Basford will assume his new duties October 1st and have his headquarters at the general offices of the company, 111 Broadway, New York City. Mr. Basford is peculiarly well qualified for the work which he has undertaken in connection with the American Locomotive Co. by reason of his experience in railroad and engineering work as well as in technical journalism. Before his connection with the American Engineering and Railroad Journal, Mr. Basford was editor of the Railway Review.

MR. ALBERT S. RICHEY, chief engineer of the Indiana Union Traction Co., has resigned to become assistant professor of electric railway engineering in the Worcester Polytechnic Institute, Worcester, Mass. Mr. Richey was born in Muncie, Ind., April 10, 1874, and graduated from the electrical engineering department of Purdue University in 1894. In 1899 Mr. Richey entered the service of the Union Traction Co. of Indiana, after several years' experience in the employ of the Citizens' Street Railway Co. of Muncie and

the Marion (Ind.) Street Railway Co. He became [illegible] of the Indiana Union Traction Co. when it absorbed the [illegible] tion Co. in 1903 and remained in that position until [illegible] when he was appointed chief engineer of the entire [illegible] ing some 400 miles of track.

MR. GEORGE R. FOLDS, who recently [illegible] the general manager of the Brooklyn Rapid Transit Co. [illegible] general manager of the South Chicago City, Ry., has assumed his new duties. During the past two years Mr. Folds has taken charge of the editing and publishing of two rule books for Brooklyn [illegible] for the elevated road and one for the surface lines. He [illegible] a great deal of attention also to the education of the men in [illegible] and car service, and has been instrumental in developing [illegible] elaborate and complete system for the education of trolley motormen and conductors. This includes a system of instruction and examination blanks which are planned to be progressive and logical in the order of arrangement.

MR. WALTER E. HARRINGTON, whose resignation as vice-president and general manager of the New York-Philadelphia Co. was announced last month, is to be associated with J. G. White & Co., of New York, as operating manager. Mr. Harrington has had an exceptionally broad experience in the engineering field, particularly in the operation of electric railway, light and gas properties. After graduating from the University of Pennsylvania in 1887 he became associated with Mr. W. G. Griffith in the electrical contracting business. For two years he was electrical engineer for the Pennsylvania Railroad Co. in charge of the electric railway at Atlantic City, N. J., following which he was appointed general superintendent of the Wheeling Traction Co. and the Citizens Railway Co., of Wheeling, W. Va. This was one of the early electric railways. The General Electric then secured the services of Mr. Harrington as supervising engineer in the coal regions of northern Pennsylvania. Leaving the General Electric Co., Mr. Harrington became general manager of the Cutter Co., of Philadelphia, in which capacity he had charge of all the electrical installations. For several years Mr. Harrington acted as consulting engineer for a number of railway systems, supervising the change from horse to electric power. In 1896 he was appointed general manager and vice-president of the Camden & Suburban Railway Co., remaining with it until the company was absorbed by the Public Service Corporation of New Jersey. In 1904 he was placed in charge of all the railway properties south of Trenton, N. J., under the Public Service Corporation and in 1905 assumed charge of the New York-Philadelphia Corporation as vice-president and general manager. Mr. Harrington is an active member of the executive committee of the American Street Railway Association, and a member of the American Institute of Electrical Engineers. As operating manager of J. G. White & Co., Mr. Harrington will supervise all of the railway, electric lighting, gas and other properties operated by it, and will make his headquarters at the New York office of the company, No. 43 Exchange Place.

Obituary

COL. ALBERT CHARLES WOODWORTH, general manager of the Consolidated Car Fender Co., of New York, died at his home in Chicopee, Mass., Saturday, August 26th. Colonel Woodworth was born in Chicopee, June 5, 1841, his family moving to Ohio two years later, making the journey via the Erie Canal and overland. In 1849 his father went to the California gold fields with 20 other young men, of whom only six returned. A few years later the family moved back to Chicopee where the father and two sons entered the employ of the Ames Manufacturing Co., manufacturer of swords, cannon, bronze statuary, silver ware, etc. In 1868 Colonel Woodworth married Miss Sarah T. Ames, and later became president of the company. For several years he was employed by the Gorham Silver Co. in New York, after which he built the Overland Cotton Mill at Denver, Col., said to be the first mill west of the Mississippi River. Shortly after the organization of the Consolidated Car Fender Co., Colonel Woodworth entered its service as manager, in which position he continued until his death. Colonel Woodworth devoted some attention to politics, being a state senator in Massachusetts for two years. He also ran for lieutenant-governor and congress and at one time was chief of Governor [illegible]

Three Recent Accidents

[illegible] across the track. The accident occurred at 11 p. m.

On the same date, late at night, 2 men were killed and from 20 to [illegible] the curve at a very high speed and plunged over the embankment before it could be stopped.

A similar accident occurred September 11th at New York City, when a car on the Ninth Ave. elevated line left the track and was precipitated into the street at 53rd St., killing 12 persons and injuring more [illegible] Ave. line and signals so indicated it. These were disregarded by the motorman and the train jumped the track because of the speed with which it took the curve, which was not banked and was intended to be taken slowly. The second car only fell to the street. The responsibility for the accident apparently lies between the switchman and the motorman, and an investigation is being made to determine which is to blame, as it is reported the switch was thrown for the Ninth Ave. line while the train was passing over it.

Headquarters Hotels.

The Street Railway Accountants' Association will have its headquarters at the Hotel Walton, Broad and Locust Sts.

The headquarters of the American Street Railway Association will be at the Bellevue-Stratford Hotel, corner of Broad and Walnut Sts., Philadelphia.

Pennsylvania Special for Western Delegates.

Western delegates to the Philadelphia conventions are making preparations for their trip and reservations have already been taken for six standard sleepers out of Chicago on the Pennsylvania special, which will leave Chicago Monday, September 25th. The train will consist of observation, dining and club cars and as many sleepers as are necessary to provide ample accommodations for street railway and supply men who desire to use this train. The train will reach Pittsburg the following morning, where cars from Cleveland, Cincinnati and St. Louis, carrying Ohio, Michigan, Indiana, western and southwestern delegates, will be attached to the train, and the run made to Philadelphia by daylight, reaching there in time for 6 o'clock dinner. Tickets for this, as well as all regular trains of the Pennsylvania lines, will be on sale three days before the date of the meetings, it being understood, however, that passengers using the extra-fare trains will be required to pay the extra fare. Detailed information regarding rates, sleeping car reservations, etc., may be had promptly on application to Mr. C. L. Kimball, A. G. P. A., Pennsylvania lines, 2 Sherman Place, Chicago.

Chicago Traction Matters.

The transportation committee of the Chicago city council does not favor the "contract" plan of the mayor, under which he desires the city to build a 264-mile system of street railways to compete with the old companies, not being willing to endorse the plan until further information as to details is forthcoming. The committee has invited the traction companies to again enter into negotiations, and is believed to favor a settlement on the lines of the tentative ordinances formulated about two years ago.

Manila Street Railway.

Some interesting phases of electric railway building and equipment were developed in the reconstruction of the street railway system of the Manila Electric Railway & Light Co., which work has just been completed, being built after American plans. A new power house with one 1,500-kw. and three 750-kw. Westinghouse-Parsons turbine sets has been erected and is now furnishing current for commercial lighting and for the operation of the cars throughout the city. In the construction of this power plant and in the reconstruction and extension of the Manila street railway system the work was largely done by native laborers. It is interesting to note that many Filipinos are now employed as carpenters, machinists and also as conductors and motormen on the street railway cars. During the past two years, in which time the new work has been completed, some 1,500 to 2,000 native laborers have been employed in erecting the power house and car barns, and in installing the complete electric system. Their wages ranged from 50 to 70 cents per day, varying with the nature of the work. It was found that the Filipinos were well satisfied with this rate of pay, which is almost twice that received under Spanish rule, but with their increased wages they felt that two or three consecutive days at work was quite sufficient. This difficulty was adjusted by allowing the observance of a large number of feast days and also permitting them to take a rest during the middle of the day when the heat was intense.

FOURTH OF JULY PARADE IN MANILA — NEW CAR AT TERMINUS OF MANILA ELECTRIC RAILWAY & LIGHT CO'S LINE

In Manila the principal business streets are paved with granite blocks and a large portion of the resident streets are macadamized.

STANDARD SUBURBAN CAR.

The track work in the macadam has 70-lb. A. S. C. E. section rails laid on wooden ties. In the paved streets a 94-lb. girder rail was laid. Because of a white ant and the excessive rains, much care was needed in the choice of wood for ties, poles and also for the car bodies. As an experiment, three kinds of wood were used for ties: the native wood called molave, California redwood and an Australian wood very closely resembling teak. Several experiments were made by treating different ties with preservatives, such as creosote, jodelite, solignum and carbolineum. These tests showed that the treating of the ties would protect them from attack by ants in all but a few cases. To protect the rails from excessive rusting, such as quickly takes place in Manila, due to the peculiarity of the climate, the steel work of the track was given a coat of asphaltum. In low-lying ground, as a further protection, the rails were laid in concrete.

The rolling stock in Manila for the most part consists of open cars, but several convertible and semi-convertible cars are now being operated for experimental purposes. The design of the cars is such that they are simple and therefore easy to keep clean. As the rain storms are severe and occur quite frequently, extra precautions were taken to protect the passengers. All cars are vestibuled and are provided with side curtains of pantosote. These curtains are reinforced by heavy slats to enable them to resist the pressure of high winds. All gutters, water ducts and cables for curtains are made of non-rusting metals, and the dash boards of extra heavy steel. The monitor roofs are built with considerable overhang and the roof system throughout arranged to readily dispose of water from severe rains. In order that these cars might not suffer from attack by ants they were built of teak wood, combined with a steel under framing of heavy design carefully protected with rust-proof paint. Teak is a dense, hard wood which needs no chemical treatment to protect it from the white ants. The cars were finished in the natural color of the wood, wherever possible, as this color presents a pleasing appearance. The present equipment consists of 95 passenger cars furnished with Westinghouse two-motor equipments. On account of the low price of teak wood in Europe most of the car bodies were purchased there, but the trucks were purchased in America.

A large shop building containing suitable equipment for designing and building cars from native woods has been erected near the power house. These car barns and the other buildings of the company are built entirely of steel and concrete, all metal being painted to guard against deterioration. The design and construction work of this Manila system has been carried out and the road is now being operated by J. G. White & Co., New York.

Washburn Couplers

Washburn pilot couplers, of which four general types are made, are illustrated and their details explained by a late folder of the Washburn Co., Minneapolis, Minn. These four patterns are described: The box pilot coupler, in which the buffing and pulling shocks are transmitted to the pilot through a compound spring, completely enclosed in a box. The compound switch engine coupler, which has its locking parts connected to the bumper beam through two pivotal points, thus giving a maximum side play for switching cars on sharp curves. The fold-back pilot coupler, which has a head fastened by means of a pivot allowing side play for curves, and a second pivot placed horizontally connecting the flexible head so that it may be folded back on top of the pilot. The flexible head engine coupler for standard use on either pilots or tenders.

The design of these types of couplers is the outcome of several years of experimenting with various types. They have been found to be simple, durable and at the same time give satisfactory working results.

The National Curtain Fixture.

The National Lock Washer Co., 65 to 77 Johnson St., Newark, N. J., is manufacturing a curtain fixture for which it is claimed that it positively locks the curtain against upward tension, and that its heads being stationary, it will not come out of the grooves in the casing. The design and operation may be seen in the illustration. The device automatically locks against spring roller tension by means of an eccentric on each side of the window, which is pivoted within the heads or guides. The strong tension on the spring roller at the top insures quick action when the curtain is

NATIONAL CURTAIN FIXTURE.

raised or lowered and together with the lock at the bottom, causes the curtain to set perfectly smooth. As may be seen, by compressing the handles the locking cams are drawn within the heads (the heads or guides remain stationary, the eccentrics only being released, so that the curtain may be raised or lowered. Each head or fixture is provided with two non friction rollers, bearing lightly on the casing, which makes a smooth running curtain and keeps the fixture in a horizontal position. The locking cams are self-adjusting to swelling and shrinking of woodwork, and varnish, paint, wet or dry weather will not interfere with the operation of the fixture.

"Eureka" Automatic Electric Signals.

The design of a block signal system which will protect electric railway cars against collisions, and which can be installed for this purpose at a moderate cost, is a problem that has offered an inviting field for the exercise of much inventive ability. Two systems of such signals, automatic and employing what are known as shunted lamps, have been developed by the Eureka Automatic Signal Co., of Lansford, Pa. These systems of "Eureka" signals have been installed on electric railways having widely different local requirements, and have been found to satisfactorily space the cars. The two types of systems are the single-wire system, simple and of low cost, furnishing a closed block in which one car at a time is permitted, and the two-wire system providing protection to any number of cars going through a block in the same direction.

The appliances common to both systems are the contact makers, lamps, controller boxes and frames. The contact maker of a railway signal system plays a most important part and, therefore, it should be reliable in operation. The "Eureka" contact maker which performs the duty of causing the operation of the signals to danger when cars make contact in going through the block, and to safety when they make contact on leaving the block, operates by the wheel crossing the gap between oppositely placed contact plates, one of which is permanently connected with the source of power, and the other with the signal system. The contact plates are steel combs with teeth sufficiently flexible to permit the trolley wheel to accomplish its bridging action without serious shock to the overhead work, even when at high speed.

The lanterns which are the signals of this system are made of heavy galvanized iron designed to furnish ventilation and yet be weatherproof and easily accessible. By means of reflectors placed behind the lamps the light is thrown through red colored glass and properly arranged screens cut off the counter effect of the sun's rays, which are prevented from falling directly on the colored glass. The signals thus produced are visible at long distances by day as well as night and make a simple and effective substitute for [illegible]. Each end of the block is guarded by a red lantern located [illegible] contact maker. In the single-wire system both the red lights are aglow when the block is occupied. In the two-wire system, however, the red lantern at the distant end [illegible] by the [illegible] block.

Several hundred feet [illegible] single-wire block is placed a green lantern. Both of these lanterns always burn while the block is occupied.

In the two-wire system, two green lanterns are similarly placed at each end of the block, one of which (always the same one) is aglow at the distant end of the block when it is occupied, as is always the case at the rear end, but here the lanterns alternate, one going out and the other lighting up as each successive car enters the block. Intermediate lights are introduced along the block, which if not burning warn the motorman that another car has disregarded a red signal and entered the block against him.

The operation of the [illegible] the system to danger when cars enter the block and to safety when they leave it. To fully protect the block two controllers are used, one at each end but not wired in series, their operation being independent of each other. This arrangement secures certainty of action because the two machines must work together as a unit, affording means to cars at opposite ends of a block for automatically signaling each other and protecting either car remaining in the block when two cars have taken it simultaneously at opposite ends. When one of the cars backs out it automatically sets the signals to the proper position for the car keeping the right of way.

In this system no magnets are in series, in circuit with lamps or with overhead wiring. The connecting of the signal lamps in series with resistances in shunt around them permits sufficient current to pass damaged lamps to keep the other lamps burning and the system in operative condition.

Card Index of Exporters.

The United States Department of Commerce and Labor, Bureau of Manufactures, has sent the following notice to manufacturers and exporters:

"The Department of Commerce and Labor is desirous of securing the co-operation of manufacturers and other persons interested in the efforts being made by this department, through the Bureau of Manufactures, to extend the foreign trade of the United States. In furtherance of this work, it is proposed to establish a comprehensive card index which will enable the department, upon application, to furnish information desired by manufacturers, or by intending purchasers, and it is contemplated to extend the system, if the necessary authority shall be granted by Congress, to our principal consulates. To enable the bureau to prepare such an index, you are respectfully requested to fill in the accompanying blank, and furnish briefly any additional information which you may desire to have recorded in connection with your business. In mailing reply please use the inclosed envelope."

The blank referred to calls for the following data:

1. Name and address (main office).
2. Location of branch establishments.
3. Description of product.
4. Capital.
5. Capacity per day, month, or year.
6. Where product is sold (if abroad, give countries and ports to which shipped).
7. Any other information.

Officials of the Illinois Traction System expect to have cars running on the interurban line between Decatur and Clinton, Ill., by November 1st.

The Western Ohio Railway Co. and the Dayton & Troy Electric Railway Co. have removed the extra fare charged on their limited trains between Lima and Dayton for passengers between points touching both roads.

J. A. Fay & Egan Co.

The accompanying illustration shows the plant of the J. A. Fay & Egan Co., Cincinnati, O., which controls and operates the J. A. Fay Co. and the Egan Co., manufacturers of wood working machinery especially adapted for planing mills, furniture factories, vehicle builders, car, railway, bridge and agricultural works. The company through three-quarters of a century of continual application and an extensive experience in the design and manufacture of tools for cutting and working wood in nearly every manner, has developed this industry and the success it has achieved is apparent in the magnitude of its plant, the excellence of its well-known products and the extent of its busines. In its plant, which covers about 13 acres, over 1,200 workmen are employed, including designers, draftsmen and skilled mechanics. Modern and labor saving equipment enables the company to build and ship its products in a prompt and efficient manner. A notable point in this connection is the specializing of the different departments; one department is devoted exclusively to building sanding machines, another makes nothing but flooring and planing machines, while the product of still another is molding machines.

With these large and modern facilities at hand single machines or complete outfits can be furnished with equal facility, and for nearly all purposes, among which might be mentioned street car shops, arsenals, navy yards, technical schools, saw and planing mills, furniture, sash, door and blind factories, carriage, wagon and wheel factories, chair works, farm machinery builders, and many others. Entire factories can be installed with modern machines for doing their work, plans and designs being submitted showing how the machines can be installed to save space and labor. Special attention has been given to the design and perfecting of motor driven tools and the company is prepared to make plans and estimates for installing this modern apparatus where electricity as a motive power is available.

Further evidence of the excellence of the company's products and the progress made in their design and manufacture is attested to in the awarding of several prizes at various exhibitions. Beginning with the Crystal Palace Exhibition at London in 1851, are included highest awards at the World's Fair at Chicago in 1893; gold medals at Antwerp in 1894 and Santiago in 1895; the "Grand Prix" at Paris in 1900, and the decoration of Mr. Thomas P. Egan, president of the company, with the medal of the Legion of Honor by the French Government; and the highest awards at the Louisiana Purchase Exposition in 1904.

PLANT OF THE J. A. FAY & EGAN CO., CINCINNATI, O.

The Boston Elevated Railway Co. has equipped all of its elevated stations with signs that show the destination and route of each train as it approaches the station platform. The device consists of a roller-curtain sign operated by the station master, upon which is printed in plain letters the destination and route of the trains.

The "Climax" Clay Cattle Guard.

The accompanying illustration shows an installation of the "Climax" clay cattle guard on the line of the Long Island R. R. This guard is manufactured by the Climax Stock Guard Co., Canton, O., which has its general sales office at suite 503 Title & Trust Building, Chicago.

The small blocks shown in the illustration were assembled for an 8-ft. double track guard on the third rail division of the Long Island railroad and show the adaptability of this size block for such unusual locations as are found on this line. In some places the guards are placed across four and six tracks, being built around the third rails and ground wires. In other places switches and switch stands are located in the center of the guards, but the blocks are of such size that they may be placed to allow for these contingencies and at the same time taken up and removed to other locations and fitted there without any loss.

CLIMAX CLAY CATTLE GUARD

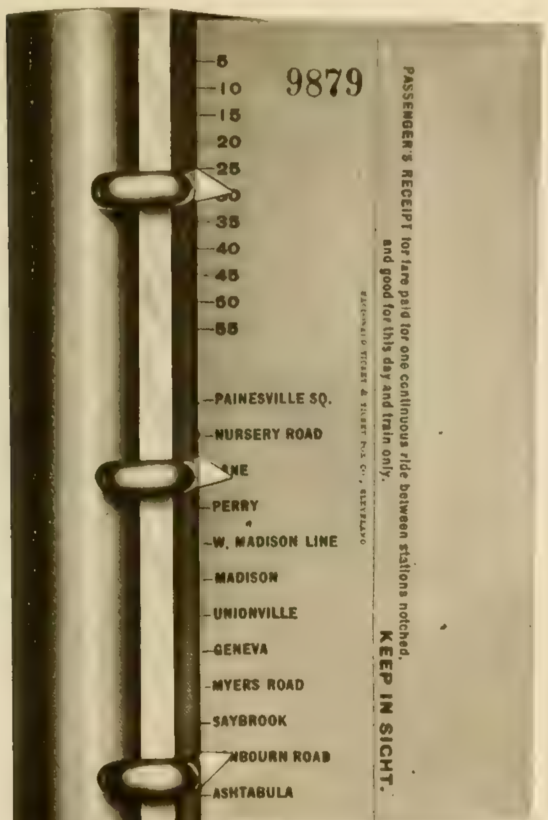
The Long Island Railroad Co. has installed from 20 to 25 carloads of these guards to date on the division of its line which has recently been changed for electrical operation. The success with which these guards have met is attested to by their extensive use on such systems as the Pennsylvania Lines, the New York Central, the Lake Shore & Michigan Southern, the Chicago, Milwaukee & St. Paul, the Chicago & Alton and the Illinois Central R. R., as well as by many of the new electric interurban lines throughout the country. The sales of the company have increased to such an extent that plans are now under consideration for increasing the facilities for the manufacture of these guards. The company will be represented at the Philadelphia convention.

McDonald Cash Fare Receipts.

After a trial extending over a period of [illegible] months the new MacDonald system of cash fare receipts has been adopted by the Columbus, London & Springfield, the Dayton, Springfield & Urbana, the Columbus, Grove City & Southwestern Ry., the Urbana, Bellefontaine & Northern, and the Columbus, Delaware & Marion electric railway companies, all of Columbus, O.

It is claimed for this system that it can be handled rapidly enough to meet the most trying conditions, and that it will give to the company, the conductor and the traveling public a degree of protection never before secured. These points will make the adoption of the system desirable.

As shown in the illustration, the holder is arranged with three pointers, one each to indent the amount of fare paid, the destination, the point of entrance; if deemed desirable the classification of fare and direction or agent's ticket may also be so indicated. In this case the passenger would receive a receipt showing indentations opposite "Lane; Sanbourn Road, 30 cents," while the audit stub would contain the corresponding projections. If a receipt were issued for an agent's ticket it would show indentations opposite



MCDONALD TICKET AND HOLDER.

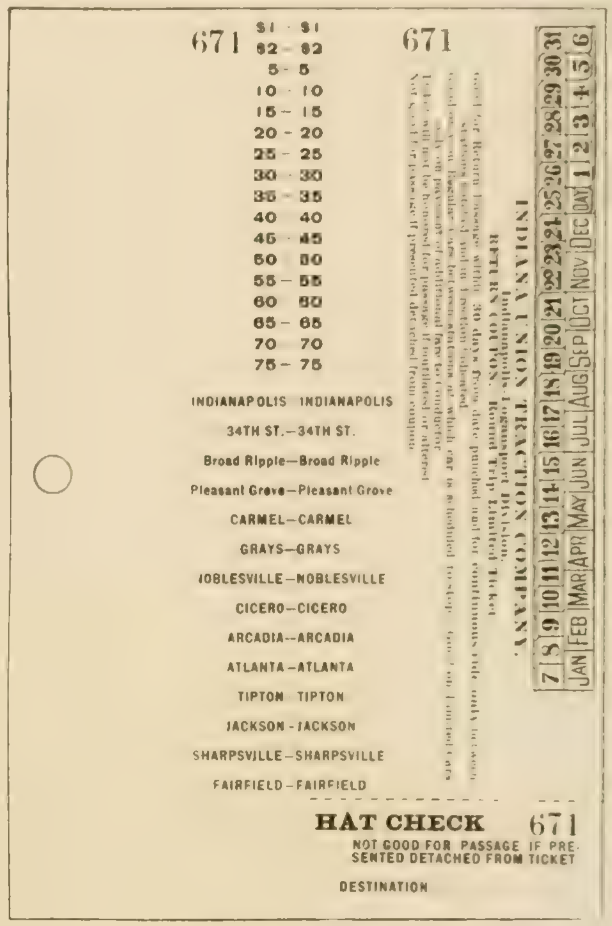
"Lane, Sanbourn Road, Agent's Ticket," thus showing to the company that an agent's ticket had been collected between those particular points upon a certain train at a certain hour of the day.

Owing to the peculiar construction of the device the audit stubs remain locked in the holder by a seal bolt arrangement, which cannot be opened or tampered with without the consent or knowledge of the company. The conductor, therefore, not having access to the audit stubs settles according to the actual cash collected regardless of what his audit stub calls for; and a credit and debit account for each conductor is kept in the auditing department, where it belongs. This is not done, as is generally supposed, to protect the company against dishonest employes, although it will do that to a very large extent and in many ways, but rather to remove the opportunity and to make conditions so fair and equitable between employer and employe that a dishonest course will appear unattractive. This account will also give the company an accurate knowledge of the value and accuracy of each conductor's services.

[illegible] there can be no doubt [illegible]

Among the advantages claimed for this system are its speed, its safety and its elasticity. By this last is meant the design of the 7 in. ticket, which [illegible] cannot well get out of order.

A return ticket [illegible] holder that promises to eliminate the great objection railway companies have to selling return tickets on cars. The ticket as shown in the illustration is arranged with a perforated coupon or hat check upon which the issuing conductor marks under the head of "Destination" the number of the station to which the passenger is traveling. The conductor with whom he returns detaches this coupon and gives it to the passenger as a receipt for his transportation. The ticket is marked, "Not good for passage if presented detached from coupon." The [illegible]



presented detached from ticket." Thus, if the ticket were re-sold after it had served its purpose, the purchaser would be getting non-negotiable paper, and would be out the cost of his purchase.

The office of the Macdonald Ticket & Ticket Box Co. is 811 Citizens Bldg., Cleveland, O.

Baltimore Air-Brake Order.

The Westinghouse Traction Brake Co. advises us that, after making exhaustive tests of air brake equipment, the United Railways & Electric Co., of Baltimore, awarded to it the contract for air brakes for 160 of the 200 new cars recently ordered by that road.

The lines of the Pittsburg & Westmoreland Railway Co. have been completed to the city limits of McKeesport, Pa., and an entrance into the city is being secured.

New Corrugated Trolley Pole.

Herbert W. Smith, of Boston, Mass., dealer and manufacturer of electrical specialties, is placing on the market a new design in trolley poles. This trolley pole is made of seamless steel taper tube, No. 16 gage, and is then corrugated. By being corrugated it permits of a much lighter pole for a given service. It is claimed for the pole that it is practically indestructible. These poles are made in all lengths and fit the standard harp and base. Mr. Smith reports that he has booked a large number of orders for these poles, both in this country and abroad.

SMITH CORRUGATED TROLLEY POLE

New Process Babbit Metal.

In the manufacture of bearing metals the inventions and improvements of the last few decades in reducing the cost of production of the rarer metals have been of the greatest importance, because of the value of these elements as tempering agents in preparing metallic alloys for different mechanical purposes. A correct understanding and proper use of these elements in the manufacture of metallic alloys makes it possible to produce alloys far superior to the all process mixtures and in many instances at considerable less than the first cost of the old process.

Many of the old process babbitt metals are but mechanical mixtures of metallic elements, the cost of which bears no relation to the real value as bearing metals. For instance, take copper genuine babbitt, the standard formula for which is tin, 88 lb.; antimony, 8 lb.; copper, 5 lb. This is one of the most expensive old process babbitts made and no doubt owes a large portion of its popularity to that fact.

If gold were substituted for the copper in the formula, it would make the metal about 55 times as expensive; but there is no reason to expect that it would wear 55 times as long. And yet it would be just as reasonable to expect such a result as it is to expect tin (because it is a relatively expensive element) to add to the real value of a bearing metal, when combined in excess of the amount required to secure the desired molecular condition of the alloy.

Cost does not necessarily bear any relation to the real wearing value of mechanical mixtures of metallic elements. Service, not cost, is the factor to be considered.

All metallic elements have their peculiar physical and chemical characteristics, each of which should receive due consideration in the combining of metallic alloys for different purposes. The expert metallurgist, having a practical knowledge of these characteristics and having at his command the valuable reducing and tempering agents which discovery and invention of recent years have made available for his use, is able to produce alloys to meet varied requirements. Given the crushing strain which a bearing metal is expected to resist, the pounding it will have to withstand in service (such as is occasioned in car journal bearings in passing over rail joints), the degree of anti-friction quality desired in the metal and the surface speed under which it will be used, he is prepared to produce, in a practical and scientific way, an alloy that will meet the required conditions. Through the use of these modern agencies it is possible to produce bearing alloys of extraordinary anti-friction quality without sacrificing the very desirable feature of extreme high molecular tension, commonly designated as hardness. These alloys, which are known as the new process babbitt metals, are constructed in several grades to meet the requirements of different lines of work, but each brand is the result of a complete and perfect chemical union of all the elements involved and is intended to meet, in the most perfect and economical manner possible, the conditions for which it was especially designed.

The late improvements in the art of producing metallic alloys make it desirable for the mechanic to specify the conditions under which his babbitt is required to work and enables a competent metallurgist to design an alloy to meet these requirements, the result of which is the production of a metal of greatly improved service at a reduction in cost of from 10 to 25 per cent. Among the manufacturers who have been active in the development of babbitt metals and who are prepared to furnish the new process babbitt metals for all requirements is the New Era Manufacturing Co., of Kalamazoo, Mich., manufacturer of metallic phosphoro, nickelumen, aluminized zinc and babbitt metals.

About Rooms for Employes.

Editor "Review":

Recently this question came to me from Texas: "How should a street railway employes' clubroom be equipped and conducted?" As this question is in line with my lunch-hour talks, I wish to tell what I would do and why, if I had a chance to furnish and manage a clubroom. There should be provided:

1. As much room with as good ventilation, light and temperature as possible.
2. Chairs and tables to suit those who are to use them.
3. Bright, interesting and useful books and periodicals.
4. Scrapbooks made from material selected from contributions from the members.
5. Maps, charts and mental exercises on the walls.
6. A collection of games and puzzles requiring short and rapid thought and action.
7. A blackboard discussion of some desirable subject.
8. A suggestion box for hints to passengers for the public press.

An employes' rest, waiting, or clubroom can be made personally useful to the members and profitable to the employers who encourage it. The reason why some rooms are not a success is that the useful subjects are neglected. The cultivation of the desirable is the best remedy for all that is undesirable.

This morning I noticed in a store window a series of pictures for sale which catered to and encouraged the morbid tendencies for the individual. If an aggressive and economic effort be made to unite employes, in producing illustrated booklets useful to themselves and others, it will amount to more than advice, sermons and rules combined.

At least once a year I would have the club publish a report in which would be some of the best things seen, heard, read and thought by the members. This report would go on sale on trains, stands and by mail. If there were any profits they would be devoted to inventions in the interest of greater individual accuracy and forethought, better health, memory and self-control.

Every person knows something worth recording for others and every person needs to know something possible to secure by the agitation of useful information. The latter is the most useful exercise for all concerned possible to start: I would like to be the best friend of the employe who is trying to do better work with less effort. When I notice any one working hard to do a small amount of poor work I begin to study how to interest that person in methods useful to himself and all humanity. Sometimes only a few words are necessary. Other times it is necessary to attract, animate and educate.

EARL M. PRATT.

Oak Park, Ill., Sept. 11, 1905.

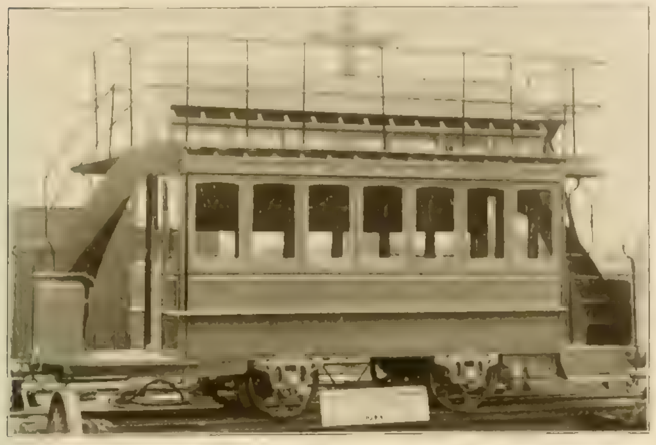
Link-Belt Catalogs.

The Link-Belt Machinery Co., Chicago, has recently issued two interesting pamphlets in the interest of its products; special booklet No. 42, "Washing Bituminous Coal," and No. 45, "Link-Belt Car Hauls." The former is an illustrated description of the washeries designed by this company based upon analyses and washing tests of samples submitted, which include some of the largest and most successful coal washing plants in America. No. 45 describes the link-belt automatic car haul system as installed for handling coal and coke at power plants, and is illustrated with numerous half-tones and tracings.

Construction work on the lines of the Alton, Jacksonville & Peoria Traction Co. will be begun October 1st, at Alton, Ill.

Stephenson Cars for Peru.

The John Stephenson Co. has lately shipped cars of the double deck type shown in the engraving to the Pisco Tramway Co., of Pisco, Peru. The order was placed through W. R. Grace & Co., of New York. The builder has furnished a large share of the equipment of South American cities, where its cars are known for their durability and suitability in tropical and semi-tropical countries. Pisco is one of the seaboard cities of Peru, about 125 miles south of Lima, and has an excellent harbor. It is connected by a 50-mile steam line with Ica, one of the principal inland departmental cities. The car illustrated measures 14 ft. over the end panels and 22 ft.



STEPHENSON CAR FOR PERU.

over the crown pieces. Platforms are 4 ft. over panel from crown piece. The other principal dimensions are: Width over sills, 6 ft. 7⅛ in.; over posts at belt, rail, 6 ft. 6 in.; sweep of posts, 2⅛ in.; height of car from bottom of sill to top of roof, 7 ft. 10⅞ in.; over seat backs, 9 ft. 6⅞ in.; side sills, 4 x 5 in.; end sills, 4 x 5½ in.; thickness of corner posts, 3¾ in.; side posts, 1¾ in. The interior finish is ash with ceilings of painted veneer. The seats in the car and upon the deck are longitudinal and composed of ash slats. The cars are mounted on Stephenson running gear for horse cars.

New Publications.

MASSACHUSETTS RAILROAD COMMISSIONERS INDEX-DIGEST, being an index-digest of the reported decisions, precedents and general principles enunciated by the Board of Railroad Commissioners from 1870 to 1904, inclusive, prepared and published by the clerk of the board. The present digest includes the decisions found in a compilation, covering the period from 1870 to 1888, prepared by Prof. John H. Wigmore, and brings the work down to date.

THE ELECTRIC CLUB JOURNAL; Vol. 1, 1904, bound in cloth; price, $3.00; postage 25 cents; published by The Electric Club, 735-737 Penn Ave., Pittsburg, Pa. The publication at the beginning of its career was expected to be rather a record of the proceedings of the club, announcing that it would print "a judicious selection of what is best in the current work of The Electric Club, supplemented by other appropriate engineering material." The result has been the publication of data and articles which proved acceptable to men in all positions of electrical and mechanical work and the reprinting and binding of Volume I, a limited number of copies of which were available on September 1st.

Trade Notes.

THE NEW ORLEANS RAILWAYS CO., of New Orleans, La., has through its engineers, Sanderson & Porter, of New York City, recently purchased from B. F. Sturtevant Co., of Boston, six large economizers which will be unique in that they are being built to withstand the highest pressure to which any economizer is known to have been subjected. All pipes are being tested to 600 lb. pressure before they leave the works; and each section is tested to 500

[illegible] running through the machine; this joint being made by two very heavy flanges with a special gasket which has [illegible] through the entire circle.

THE RECORDING FARE REGISTER CO., of New Haven, [illegible] a number of street railway supplies to the lines carried. The company will have a very fine and complete exhibit at the Philadelphia convention. The following officers have just been elected: President, John T. Manson; vice-president, M. DeForest Yates; secretary and treasurer, Henry L. Bradley.

THE ELECTRICAL INSTALLATION CO., Monadnock Building, Chicago, has been awarded the contract for the complete construction and equipment of the Warsaw-Goshen (Ind.) line of the Winona Interurban Railway Co's. system. Allis-Chalmers-Bullock steam and electrical machinery, including car equipments, will be used. The contract calls for completion Apr. 15, 1906, and the price is between $600,000 and $700,000.

WHAT IS BELIEVED TO BE THE largest economizer in the New England states has just been installed by the B. F. Sturtevant Co., Boston, for the American Woolen Co., at Maynard, Mass. It is divided into two groups, the first being used for heating feed water for the boilers and the second for furnishing hot water for dyeing purposes. Even before the installation was entirely completed a very large saving in coal was attained.

THE J. G. BRILL CO. has just received an order from the United Railroads of San Francisco for 200 of its patented No. 27 G-E-I type of double truck. This is a short-base double truck having the Brill system of equalization which in this type consists of semi-elliptic equalizers which carry a truss form of bolster at either end and which are suspended from the side frames by spring links at wide apart points close to the yokes. Each side frame is solid forged and the angle iron transoms are secured to the side frames with forged double and single-corner brackets. The brakes are usually inside hung.

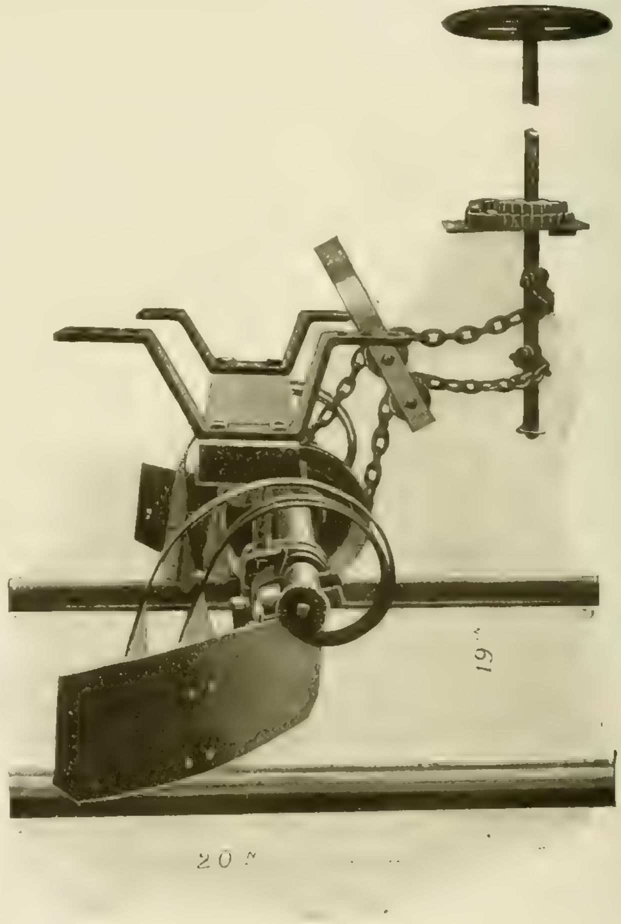
THE RUSSELL ENGINE CO., Massillon, O., is now building a new engine of the enclosed type, which has recently been placed on the market by it and in which the company has endeavored to embody in its design and construction all the features that long experience in engine building has from time to time suggested. It has been the company's aim to so construct wearing surfaces and the method of lubricating them as to render unnecessary any attention whatever beyond that of turning on and off the steam, a feature that will appeal to engineers in charge of isolated plants, and to perfect an engine, that for economy, durability and appearance, will meet the demands and requirements of the most exacting.

THE MAYER & ENGLUND CO., of Philadelphia, advises us that it is doing a larger business this season than at any previous time in the history of the company. Contracts for its well known "Protected" rail bonds and overhead line material have been very large from all parts of the country. Business in other lines is also very active, an example being that of fare registers, in which line the Mayer & Englund Co. represents the International Register Co. of Chicago. Recent orders secured for "International" registers and fixtures are: United Railways & Electric Co., Baltimore, 400 single type machines; United Traction Co., Albany, 100 single type machines; Georgia Railway & Electric Co., Atlanta, 24 single type machines; Ford, Bacon & Davis (for Nashville), 24 single type machines; Ford, Bacon & Davis (for Memphis), 200 double type machines and 185 car equipments of register rod fixtures also for Memphis; Washington (D. C.) Railway & Electric Co., 75 double type machines; Philadelphia & West Chester Traction Co., Llanerch, Pa., 19 single type machines; American Railways Co., Philadelphia, 19 double type machines. These orders with numerous smaller ones make the total register sales of the Mayer & Englund Co. during the past four months more than one thousand registers.

THE GREEN FUEL ECONOMIZER CO. of Matteawan, N. Y., has just completed the erection of a large shop designed to provide for its rapidly increasing business. This company not only supplies special exhausters with bearings removed from the action of the flue gases for mechanical draft in connection with the widely used Green fuel economizer, but also builds fans, blowers and exhausters for every purpose, having, for instance, recently sold fans for heating, ventilating and humidifying in textile mills, ventilating and drying in paper mills, heating and ventilating in large buildings, etc. It is just now installing for a factory in Massachusetts what is believed to be the largest mechanical draft exhauster ever built. New designs have been worked out for all types of "Green-Matteawan" fans with the special object of reducing the power required for driving. Fans are often driven by small non-condensing engines or by electric motors using purchased electric power, so this is quite an important matter. It should be remembered that the power consumed by a fan runs up very rapidly with the speed. The Green Fuel Economizer Co. does not contract for the engineering of plants, or for the installation of heating and ventilating plants in competition with the heating and ventilating contractors, but freely offers the advantages of its engineering skill and 60 years' experience in the construction and operation of air-moving plants.

The Root No. 2 Special Scraper.

The illustration herewith shows the Root No. 2 special scraper, designed and manufactured by the Kalamazoo Railway Supply Co., Kalamazoo, Mich., for heavy work and high speed service. This is a very substantial scraper, the springs being manufactured of .90 per cent carbon oil tempered spring steel, while the shovels are 24 x 8 in. and are made of a .75 to .80 per cent carbon spring steel. The manner of installing these scrapers is shown in the illustration, from which may be noted the small space required for installing this scraper, and also that by the use of the desired length of brackets and chain they may be installed on any height of car above 19 in. from the top of the rail to the bottom of the sills or platform knees. In the illustration shown the hanger board is fastened in the rear of the scraper shaft with the staff in front; this, however, may be reversed if so desired. The successful operation of these scrapers and their adoption by a large number of city and interurban lines throughout the country attest the merit of the scraper and mark it worthy of consideration by those contemplating the installation of such equipment.



NO. 2 SPECIAL ROOT SCRAPER.

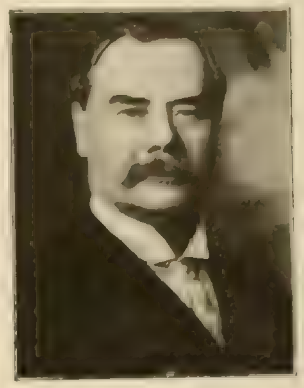
DAILY STREET RAILWAY REVIEW

7TH YEAR, NO. 1 — SEPTEMBER 26, 1905. — SERIAL NO. { VOL. XV. NO. 9 A

OFFICERS OF THE AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

H. H. ADAMS,
First Vice-President.

C. F. BAKER,
President.



JOHN MILLAR,
Second Vice-President.

F. G. SIMMONS,
Third Vice-President.

S. W. MOWER,
Secretary-Treasurer.

J. S. DOYLE.

D. F. CARVER.

E. W. OLDS.

W. H. McALONEY.

It is doubtful if the 17 men attending the meeting of the A. S. R. A. at Detroit, who met at the power house of the Detroit United Ry., on Oct. 9, 1902, realized that the organization there founded would rise to the position it now holds in the electric railway field in such short time. At this meeting a committee of six was appointed to arrange for a permanent organization, consisting of Thomas Farmer, chairman, C. A. Brown, W. O. Mundy, E. W. Olds, G. W. Palmer, jr., and William Pestell. At a meeting of this committee, October 10th, S. Walter Mower was appointed secretary of the meeting, and arrangements made for addressing letters to electric railway companies, notifying them of the proposed organization and calling a meeting for January 12, 1903. The meeting was held at the Hollenden Hotel, Cleveland, O., Feb. 16, 1903, at which time an organization was perfected, officers were elected, and arrangements begun for the first annual meeting, to be held at Saratoga Springs, N. Y., Aug. 31, 1903.

THE POWER DISTRIBUTING SYSTEM OF THE BOSTON ELEVATED RAILWAY CO.*

BY C. H. HILE,
Superintendent of Wires, Boston Elevated Ry.

In considering an established power distribution system for the best understanding of its advantages and efficiency, it is essential that one have a knowledge of the conditions and disposition of the power plants in their relation to the territory served.

Among engineers entrusted with the laying out and designing of power plants and transmission systems there are two recognized tendencies in their treatment of such questions. The most prominent, perhaps, because the most radical of these two tendencies of late years, is for large central power stations, correspondingly large power units, and the alternating current transmission system with sub-station conversions. The development in the science of engine and dynamo construction, in connection with the progress made in high voltage transmission systems has made such engineering ventures easily possible as well as practicable. The other tendency, while not necessarily opposite in method and effect, is more the result of a growth and development, based upon conditions as they have presented themselves to the engineer, covering years of progress and expansion of a single or a number of power systems.

At present writing it cannot be said that the merits and advantages of either practice over the other have been conclusively proved. Each power and transmission problem has its individual conditions, and these in connection with the requirements of good engineering must determine the type and system of power plants and transmission systems.

It is the purpose of this paper to deal with an established system of separate power plants, with their interconnected power distributing systems, and to present facts, results and experiences which may be taken as fairly representative of such engineering practice.

To illustrate the practice, its results and possibilities for the purpose of this discussion, only five of the eight stations on the system will be considered (the three stations not considered being of obsolete construction and operated only part of the time, or so situated as to have no bearing upon the main proposition).

The five power stations considered are fairly representative of the modern type of station, and include in their equipment direct connected direct current units varying in size from 800 to 2,700 kw. rated capacity.

The diagram, Fig. 1, with the information contained therein, gives a very fair idea of the relative locations of the several stations with regard to each other, and to the territory each supplies with power.

TABLE 1.

Power Stations	Boilers						Engines				Generators		
	No.	Type	Rated H.P.	Method of Firing	Draft	Type Economizer	No.	Type	H.P.	Type Condensers	No.	Type	Capacity K.W.
Central	24 6	Water-Tube "	250 500	Hand "	Forced "	Green "	1 2 6	Vertical Cross Compound Condensing Horizontal " " " Triple Expansion "	4200 2000 1800	Bulkley Siphon " " " "	1 2 6	Multipolar " "	2700 1500 1200
Lincoln	6 [illegible]	Water-Tube "	450 475	Mechanical Stokers "	Natural "	Green "	3	Vertical Cross Compound Condensing	4200	Jet	3	Multipolar	2700
Charlestown		Water-Tube				Green	1 2	Vertical Cross Compound Condensing Horizontal " " "	4200 1000	Bulkley Siphon Jet	1 2	Multipolar "	2700 800
Harvard	6	Water-Tube	500	Mechanical Stokers	Natural	Green	3	Horizontal Cross Compound Condensing	1800	Jet	3	Multipolar	1200
Dorchester	2 2	Water-Tube "	500 300	Hand "	Natural Forced	Green "	2	Horizontal Cross Compound Condensing	1500	Jet	2	Multipolar	1000

In Table 1 are shown the rated capacity, type and size of generating units, and such other features necessary to a fair knowledge of the conditions under which each station operates.

The yearly output of the several stations under consideration during the year of 1904 was as follows:

Central Power Station	51,146,535	kw. h.
Lincoln " "	31,978,676	" "
Charlestown " "	17,449,968	" "
Harvard " "	15,813,669	" "
Dorchester " "	8,487,644	" "
Total	124,876,492	" "

* Read before the American Railway Mechanical and Electrical Association, Sept. 25, 1905.

In Fig. 1 it is shown how the several stations are tied together and operated in parallel. The tie between stations is accomplished through feeder wires running into so-called feeder sections common to two or more stations.

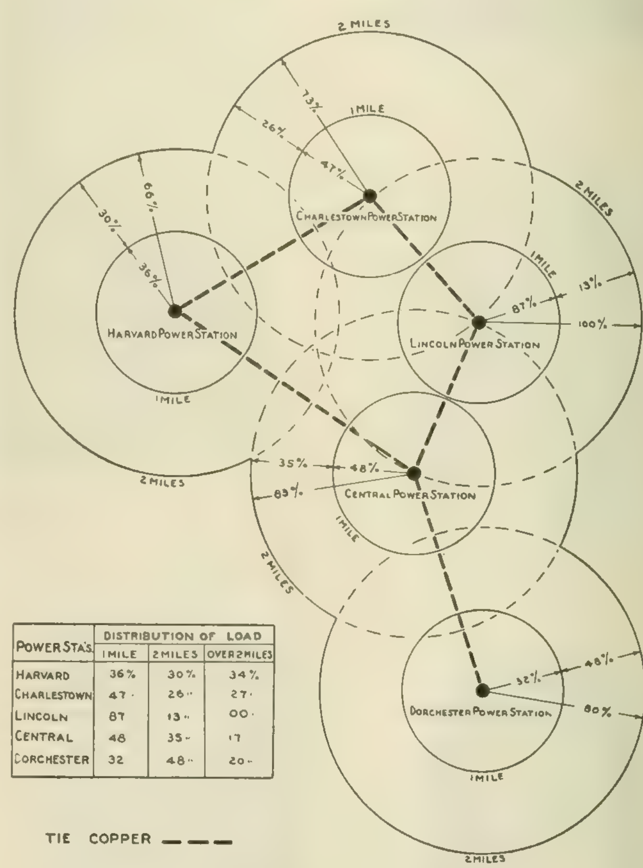
Sufficient copper is run from each station into the common feeder sections, so that in the emergency of a disabled machine, or an unusual load in any one of them, the others immediately respond by taking up more load from the tie feeder sections, either automatically or through an adjustment of the voltage in the stations affected.

By thus operating the stations, heavy and extreme fluctuations of load are avoided, and, with the movement of maximum morning and evening loads from the outer to the inner feeder sections and from the inner to the outer feeder sections, the several stations are so located as to materially help each other when the need is most urgent.

While it is true that there is more copper required to thus distribute the power, than if just a sufficient amount were strung to

BOSTON ELEVATED RY. CO.

PLAN SHOWING RELATIVE LOCATION OF FIVE PRINCIPAL STATIONS WITH DISTRIBUTION OF LOAD WITHIN 1 MILE AND 2 MILE RADII.
WINTER 1903-04



POWER STA'S.	DISTRIBUTION OF LOAD		
	1 MILE	2 MILES	OVER 2 MILES
HARVARD	36%	30%	34%
CHARLESTOWN	47 "	26 "	27 "
LINCOLN	87	13 "	00 "
CENTRAL	48	35 "	17
DORCHESTER	32	48 "	20 "

DISTRIBUTION DIAGRAM.

satisfactorily distribute the power output of each station individually, it is a fact that none of the copper is ever idle, and is always contributing to better conditions, both for the stations and for the operation of cars; and it is also believed that the extra expense occasioned by this additional copper is more than compensated for by the smaller surplus generating capacity required than is the case in the single generating station idea.

That which is equally interesting and best brings out the advantage of operating the several stations in parallel (thus practically getting the advantage of the high load factor obtained in the single large central station) is the data given in Table 3. These figures are presented as being fairly representative of the average load factor for machines in service throughout the 18 hours of day service operation, and also shows the machine load factor for the same period.

TABLE 3.

Table giving the approximate load factors under given conditions:

STATIONS	Load factor for station in operation for 18 hours 6 A.M. to 12 P.M.	Load factor for machines in operation during 18 hours 6 A.M. to 12 P.M.
Central	.744	.817
Lincoln	.632	.916
Charlestown	.637	.929
Harvard	.807	.874
Dorchester	.881	.883

The graphic statement given in Fig. 2, and which represents average costs for the four years ending Sept. 30, 1904, is well worth careful consideration, and well illustrates the possibilities in small stations when operated in parallel with other stations. With regard to the costs per kilowatt-hour given in Fig. 2, consideration should be given to the fact that the year 1903 is included in the four years taken. During this year, on account of the coal strike, the cost for coal was more than 35 per cent above that paid in normal periods.

It will be a long and difficult task to satisfactorily show in dollars and cents what advantage there may be and what saving accomplished by having the several stations so nearly located to the load center of their districts, but in considering this fact as offset by the advantage there may be in the reduction in operating and maintenance expenses in the large central station, the costs given in the graphic statement afford interesting figures as a basis for comparison.

As a summarized statement, using the station outputs, cost for coal and power for the fiscal year ending Sept. 30, 1904, we have the following table:

TABLE 4.

STATIONS	Rated capacity in k. w.	Output in k. w. hours 1904	Per cent of load within 2 miles	Station load factor for 18 hours	Machine load factor for 18 hours	Cost of coal per ton at Station	Cost of power per k. w. hour at sw. board
Central	12900	51,146,535	83%	74.4%	81.7%	3.55	.00786+
Lincoln	8100	31,978,676	100%	63.2%	91.5%	3.50	.00760+
Charlestown	4300	17,449,968	73%	63.7%	92.9%	3.61	.00803+
Harvard	3600	15,813,669	66%	80.7%	87.4%	3.63	.00769+
Dorchester	2000	8,487,644	80%	88.1%	88 3%	3.73	.00759+
Average cost per k. w. hour for all stations....							.00778+

FEEDER SYSTEM.

We may now take up the consideration of the power distributing system in its relation to the districts to which power is supplied from the several power stations just described.

Not taking into consideration the territory served beyond the limits of the railway company's tracks, there are approximately 72 square miles of populated territory included within the limits of 12 cities and towns served by the company's lines.

This total territory is divided into 64 feeder sections.

The smallest feeder section has 1.6 miles of single track.

The largest feeder section includes 16.2 miles of single track.

The most heavily loaded section during the hour of greatest travel and in the winter months requires, approximately, 2,300 amperes, which are supplied through 5 feeders aggregating 4,000,000 circular mills of copper.

The smallest section with regard to power required during the hour of heaviest travel takes during the winter months approximately 55 amperes, supplied through 1,000,000 circular mills of copper. This large amount of copper capacity is required since unusual loads may be thrown upon this section, due to temporary changing of routes in case blockades occur on certain streets.

In addition to the subdivision of the territory served by feeder sections there is still further division made by keeping the Elevated Division feeder system separate from the surface line sections, and the Subway and Tunnel sections independent of both the elevated and the surface feeder sections.

The general scheme of the distribution system is largely the result of growth with its accompanying experience, and may be said to be a compromise between two extremes of feeder layouts.

While it would seem to be an ideal system from the operating point of view to have the feeder sections so disposed and limited that each might be supplied with power through a single feeder, thus giving the most complete control of the feeder system at the switchboard and securing the least disturbance to the general system in case of trouble on any part of a single feeder or its section, it is not believed that these advantages are sufficient to compensate for the extra copper required, and loss of the more efficient use of the copper installed.

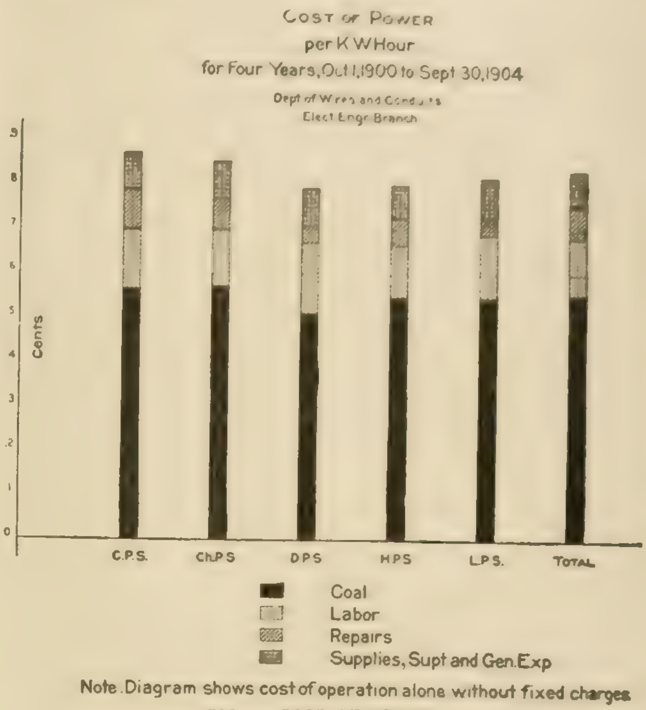


FIG. 2. COST OF POWER.

The other extreme, which is seldom resorted to, is where all feeders supply power to one large common section, which may embrace an entire system. While this scheme has the advantage of securing the most efficient use of the least possible amount of copper, it practically takes all control of the feeder system out of the hands of the operator at the station and in case of trouble on any part of the system or upon a feeder, the entire feeder system may be seriously affected.

With us the size of the feeder section is determined by the location of the line to be supplied with power, its relation to connecting or cross-lines, how heavy the traffic may be, the importance of quick control of any section in case of fire, and the number and size of feeders which the load conditions would seem to justify in running in parallel for the best operation at the switchboard.

By the use of section insulators in the trolley wires in connection with legs leading from the trolley wires to a switch in a box on the pole opposite from where the section insulators are installed, any two sections or number of sections may be tied together and run as one large section. In addition to this means of tying the feeder sections together, at suitable or advantageous locations in the feeder system, switches in pole boxes are installed so that any desired number of feeders may be tied together or thrown from one section to another.

With respect to the Elevated Division, Subway, Tunnel and Surface feeders, emergency switchboxes, or switching stations are located at the most advantageous points, so that the feeders of one division can be connected in with those of another, or so that feeders of one division can be disconnected from their regular section and utilized in another.

For the manipulation of the feeder system outside the power stations in cases of emergencies, tests, or repairs, 964 section insulators and 1,540 switches are maintained as important features in the feeder system.

By the foregoing arrangements any feeder wire or group of feeder wires if disabled may be quickly disconnected from the system and the service still be maintained by the use of feeders from other sections, or by tying sections together.

Considering the distribution system with reference to its physical construction the following amounts, sizes, kinds of material and types of construction enter into its make-up.

The standard sizes of conductors used are 500,000 c. m., 1,000,000 c. m and 2,000,000 c. m. overhead wires or underground cables.

About ten years ago, for the purpose of keeping down the number of kinds and sizes of wires to be carried in stock, 500,000 c. m. was adopted as the standard size for both overhead and underground conductors.

Later, as the feeder sections increased in the amount of power required, transmission distance grew and when general feeder wire adjustments became necessary on account of new power plants being added to the system, it was found desirable to include the 1,000,000 c. m. conductor as a standard.

With the construction and installation for the Elevated Division to meet the heavy current demands for this new kind of service, 2,000,000 c. m. was determined upon as a suitable and standard sized conductor.

On Oct. 1, 1904, there were 424.078 miles of trolley wire and 16.015 miles of third rail being served by the following amount of copper conductor:

Total miles of overhead conductor	545.469
Total miles of conductor in conduits or buried	255.743
Total miles of conductor in submarine cables	5.254
Total miles of conductor not including trolley wire	806.466
Approximate weight of copper in conductor	7,101,542 lb.
Amount in weight of copper for each kilowatt capacity at stations	195 lb.

UNDERGROUND CONDUITS AND CABLES.

About 32 per cent of the power distributing system is carried underground, all feeder cables and a large portion of the return copper being carried in conduits, and the rest of the return wires buried directly in trenches or just outside the conduits.

The following shows the total amount of underground conduit in service in 1904:

Total length of conduit	28.386 miles
Duct length in conduit (cement lined iron pipe)	76.341 "
" " " " (vitrified clay pipe)	195.360 "
" " " " (wrought iron pipe)	9.106 "
Total number of manholes	683

The underground conduit system was begun in 1894, and has been added to each year in varying amounts.

Practically the whole of the conduit system has been built by contract under the direction and supervision of the Railway company's engineers. It may not be foreign to the purpose of this paper to briefly outline some of our practice and experience with underground conduits.

In the matter of construction our experience has shown that the less a conduit deviates in depth from 3 ft. between the top covering and the surface of the street the more satisfactory will be the conditions for the conduit system. The deeper a conduit is constructed in the street or highway the more likely it is to become a sub-surface drain for the surrounding soil, the deeper and more expensive becomes the manhole construction, and the more difficult is their drainage. As more or less water will seek a drainage way in most street subsoils, it is an advantage in all cases where it is practicable to construct a conduit so that in cross section its height is greater than its width, thus having the fewer ducts on the bottom layer and therefore the fewer wet ducts in the conduit since any water leaking into a conduit will invariably get to the bottom ducts in any vitrified clay pipe conduit.

Experience has shown that it is desirable to drain manholes wherever practicable, as it is not possible within reasonable cost of construction to build them water-tight, nor is it believed practicable to maintain water-tight frames and covers to prevent surface water from getting into the manholes.

Where conduits are built in streets containing gas mains and service pipes, it is believed that all danger from gas explosions can be avoided by maintaining perforated covers on the manholes. In so maintaining the covers the necessity as well as the advantage of having the manholes drained is obvious.

In laying out a system of conduits for street railway service, large trunk lines with one set of manholes should be avoided. Any large and important traffic section should be so supplied with power that a burnout or the disabling of any one section of conduit would not seriously interfere with or suspend car service. Cable burnouts or breakdowns due to various causes, and in spite of all precautions will, sometimes, occur, and in such instances either in the conduits or in the manholes one or more adjoining cables may be injured by the escaping current. It is, therefore, deemed to be good engineering to divide up trunk line conduits into two or more distinct lines, separated by at least six inches of concrete and having separate system of manholes.

It is important throughout any conduit system to isolate, so far as practicable, each cable conductor, both for its safety and for the safety of other conductors in case a burnout occurs.

For street railway service, where cables are always required to carry their full current capacity, and when it is considered that single conductors as large as 2,000,000 c. m. may be carrying 1,600 to 1,800 amperes, the chances for serious damage in case of a breakdown

In view of these considerations it is believed that single duct or pipe sections, built in the conduit, with all joints carefully sealed with cement mortar and well staggered in relation to joints in other ducts, will be found to give the most satisfactory conduit.

For the construction of manholes in city streets where water and gas pipes and other underground construction are plentiful, it is believed that the use of good sewer bricks will give the best satisfaction, since it will be found that the shapes of the manholes will be constantly varying on account of the limiting spaces and obstructions in the street.

An eight-inch wall is considered sufficiently strong for all sizes of manholes up to 6 ft. by 6 ft. by 8 ft. deep.

For ordinary feeder cable transmission, manholes built with brick recesses, or with cast iron, or other type of hanger will give good satisfaction.

Where conduits and manholes are to be used for carrying high tension cables, it is believed that the importance of each conducting cable is such as to justify taking extra precautions in both conduit and manhole construction in order to secure complete isolation and safety from outside sources of injury.

CABLES.

Taking into consideration the fact that our experience with underground cables has extended over a period of nearly eleven years, Table 5 is interesting as an indication of what may be expected in the life of lead covered conductors.

The installation and maintenance of underground cables is much more expensive than is the case with overhead lines, and the chances for trouble to the transmission system, in our experience, are greatly increased.

Faults will develop in the cable from defects in the insulation, injury to the lead covering in handling it in the ducts, or from picks or bars when digging is being done in the streets, and in case of burnouts due to to a breakdown in the insulation of one cable every cable in the conduit may be more or less injured.

Ever since the underground cables were installed, a regular system of testing for trouble has been maintained. Depending upon the importance of the cables, size of conduit and the condition of insulation, tests are made on every cable varying in frequency from twice a week to once a month.

The insulation resistance test is used in keeping tab on the condition of the cable for the work it has to perform.

While this method is somewhat expensive, in our experience it has proved fairly effective, and our records show that nearly 90 per cent of the defects which develop in cables are found by the tests and removed before a breakdown and burnout in the insulation occurs.

For convenience and safety in the installation and maintenance of underground cables the following methods and practices have been found to give good results:

Preparatory to the installation of the cables, careful and accurate plans are made showing the size of the conduit, duct, distance between manholes, size and shape of manholes and the relative locations of the conduits entering the manholes. Each manhole is designated by number and each duct entering and leaving a manhole is numbered.

Each individual cable is assigned its proper location in the conduit system, from the switchboard at the station to its terminal where it feeds into the overhead wires, and is diagrammatically shown and located in plan, by its own number and the number of the duct it occupies throughout the conduit system.

The cable lengths are required to be furnished by the manufacturer in proper lengths, according to lists furnished by the railway, each reel being marked with length numbers, number of feet in each length and the section of conduit indicated by the number of the manholes between which the lengths are to be installed. The pulling-in gang is supplied with the diagrammatic plans of the conduit, and also lists giving reel numbers, length numbers, number of feet in each length and the location of each length in the conduit system.

By such precautions there is secured the least amount of waste in cable, and of labor of handling and the avoidance of trouble in jointing, testing and the making up of the cable records for future use.

When installed and jointed up ready for service every cable is stamped with its number in each manhole throughout its length.

It is important that each cable be as fully individualized as possible from the switchboard to its street terminal, so as to give the least possible chance for a mistake occurring in case of handling it as a feeder, testing it, or making repairs.

The following figures are believed to represent a fair average cost per foot for complete installation ready for service:

500,000 c. m. conductor, average weight per ft. 6.6 lb.
Cost of installing............................ 2 cents per ft.
1,000,000 c. m conductor, average weight per ft. 7 lb.
Cost of installing.............................2.5 cents per ft.
2,000,000 c. m. conductor, average weight per ft. 11.5 lb.
Cost of installing............................3.25 cents per ft.

The cost of maintenance per foot per year, which includes testing, inspection, repairs and changes, will be from one to one and one quarter cents.

To date there is little conclusive evidence upon which to base a prediction regarding the life of an underground cable. With proper usage and care the life of a first-class cable would seem to be limited only by the period during which the lead covering remained intact. Under fair conduit conditions and with proper care and usage, I cannot see why an average life of from 25 to 30 years should not be experienced.

With regard to the question of type or kind of insulated cable which may be expected to give the best satisfaction, I would say that while our experience has included fibre, rubber and paper insulated cables, covering a period of nearly 11 years, to date there has not developed sufficient conclusive information to allow of a statement which would show how much better one type of cable was than another.

In a few instances in recent years, consideration has been given to the possibility of using in underground conduits, rubber-insulated, heavily-braided and waterproofed cables without lead covering.

As yet the experience with this type of cable has not extended over a sufficient period to prove its advantage over the lead-covered type, but if the manufacturer can cover the insulation with a waterproof braiding and compound having good lasting qualities, there is much to commend such a type of cable over the lead-covered type. The chance of breakdown in the insulation would certainly be reduced to a minimum.

If a burnout or breakdown in the insulation should occur, the chances of the trouble spreading would be very small. The testing which is so important and desirable in the maintenance of lead-covered cables could practically be dispensed with.

In conclusion and in general, since the function of any power-distributing system is to supply adequate power whenever and wherever needed for the continuous and uninterrupted service as scheduled, the engineer has performed only a part of his duty when he has determined the amount and general layout of the copper required for carrying power for street car traffic in thickly populated sections such as we have in Boston and vicinity.

In the event of fire, streets are blocked, cars must be sent over roundabout routes, all power in wires within the sphere of the fire-fighting force must be quickly cut off, and at the same time the least disturbance to the general traffic be secured.

The blockade of any track may occur, due to various causes. In such event cars must be diverted to other streets, and the feeder system must meet this new condition at any time and with practically no delay to the service.

Burnouts on underground cables or the breaking down of overhead wires are occurrences which must be met, and the inconvenience which such interruptions may cause to traffic must be reduced to the smallest practicable degree.

A good working system for power distribution must, therefore, be studied and perfected with the view of securing the least interruption to service within reasonable provision and cost, and having laid out and constructed such a system, its best use and successful operation is no small part of the consideration which must be given to secure desired results.

The construction and maintenance of the distributing system of the Railway company is carried on through the Department of Wires and Conduits, organized under a superintendent.

The operation or use of the system is directly in charge of an official with the title of Superintendent of Power Distribution.

The switchboard operators are directly responsible to this official for the distribution of the power delivered at the switchboard and the best use of the system of feeders with their connections.

Complete plans of the distribution system, showing details of every feeder, with their switches and connections, are kept at every station for the use of the operators.

Seven emergency crews are maintained, conveniently located in the several districts into which the territory served by the Railway company is divided. These crews respond to all trouble calls and to all fire calls which may affect the lines and property of the Railway company.

These crews and also the entire organization of the Department of Wires and Conduits are at the call of the power station operators at all times in case of trouble, or if the need arises for changes in the feeder system outside the stations.

In review of the power distribution system herein treated, considering it as a whole, the cardinal features distinguishing its construction, maintenance and operation are:

1. The construction and operation of several power stations conveniently located with respect to the territory served.

2. The operation of all stations in parallel, their bus bars being tied together through feeder conductors which supply power to feeder sections common to two or more stations.

3. The great flexibility of the power distributing systems which enables the operators to quickly meet all possible contingencies either in power stations, or in elevated, subway, tunnel, or surface feeder sections.

4. The organization for the operation and maintenance of the distributing system.

5. The systematic testing, inspection and care of all underground cables and structures

TABLE 5.

Table showing quantities of cable in conduits each year for a period of ten years, and the amounts of cable removed each year on account of defects discovered by testing and on account of burnouts:

Year	Total amount in all conduits	Total amount removed a c repairs	Per cent of total removed	Total amount removed a c burnouts due to breakdown of insulation	Per cent of total removed
1895	135,593′	2,969′	2.19	......	....
1896	224,404′	1,009′	.45	700′	.31
1897	339,245′	1,290′	.38	3,765′	1.11
1898	431,733′	1,671′	.39	......	....
1899	480,111′	2,587′	.54	16,708′	3.48
1900	599,229′	3,402′	.57	1,742′	.29
1901	657,979′	9,712′	1.48	1,815′	.27
1902	687,932′	6,770′	1.00	2,847′	.41
1903	698,361′	4,699′	.67	1,747′	.25
1904	777,406′	5,759′	.74	6,878′	.88
		39,868′	.841	36,202′	.70

Average per cent per year for the ten years:

Account repairs ....0.841—av. ft. per year 3,986.8
Account burnouts ....0.7 —av. ft. per year 3,620.2
Total av. 1.541

THE POWER STATION LOAD FACTOR AS A FACTOR IN THE COST OF OPERATION.

BY LAWRENCE P. CRECELIUS,
Chief Electrician United Railways Co. of St. Louis, Mo.

The question of keeping proper load charts of the power station loads has already been given much attention, and its value has long been recognized.

The irregularities of a power station load diagram of a railway system depend entirely upon the nature of the travel on that system. In urban railway system the load curve is double peaked, having the characteristic morning and evening peaks of city travel when the people go to and from work; the breadth, magnitude and duration of these peaks depend, of course, upon local conditions, such as the size and lay-out of a town, and upon its sociology. In a manufacturing center the peaks are often remarkably symmetrical, and are little affected by climatic conditions, as the people usually usually go to work at about the same time in the morning and leave to go home at nearly the same time in the evening. In the larger cities, where it becomes necessary to transport a mixed community consisting of factory employes, merchants, clerks, shoppers, theatergoers, etc., the peaks lose their symmetry, the morning peak becoming lower and not so sharp as the evening peak. This is accounted for in the fact that in these cities the morning travel generally extends over a period from 6 a. m. to 11 a. m., while in the evening the homeward-bound passengers leave the business districts at about the same hour. Here also the condition of the weather and the season of the year become governing factors in the shaping of load curves.

Any method that will tend to smooth up the load curve is indeed worthy of consideration, as an increase in the load factor means a corresponding decrease in the cost of power per car-mile. This becomes very apparent when we compare the amount of station apparatus which is required to carry the peaks with that which is required to carry the average, and the manifest inefficiency of this arrangement when the load factor is small. The load factor is the ratio between the average load and the maximum, and, therefore, represents the ratio between the amount of station apparatus required for the average and that required to do the peaks. Further, since the morning and evening peaks are both three and four hours respectively in duration, we find that from 45 per cent to 60 per cent of the station apparatus of a system is idle for 17 hours or more out of 24.

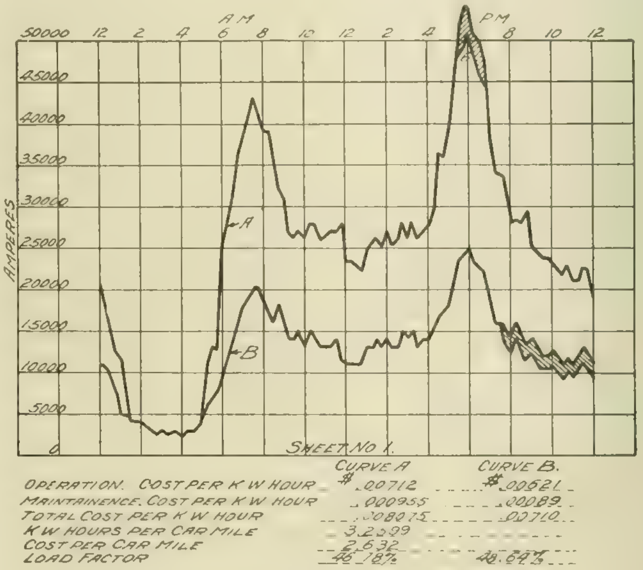
Since there are so many causes, depending upon local conditions, which become governing factors in the shaping of a power station load diagram, and therefore determining the load factor of a system, it would be very presumptuous on my part to attempt to describe to you a certain fixed method by which the load factor of a system might be brought up and the advantages derived thereby. Each and every system has its own peculiarities, which have to be met, and which prohibit the application of a general method, hence they must necessarily be dealt with separately. I shall, therefore, confine myself to outlining a method employed by the United Railways Co. of St. Louis in increasing the load factors of the main power stations, and showing how the load factor in this case plays a prominent part in the cost of power per car-mile.

A good many of the larger railway systems are the result of consolidations of the different independent companies in a locality, each having its own power stations, some of which it becomes necessary (for various reasons) to continue in service, and this, in the majority of cases, seldom constitutes the most economical arrangement of power stations for the consolidation. The power station layout of the United Railways Co. of St. Louis is of this order. It would be a real treat indeed to have charge of a lay-out where the necessary central station or stations are located at a point where both fuel and water can be conveniently handled together with enough sub-stations sensibly located, containing storage batteries, to cap off the peaks, etc., as in that event it would be possible to generate power at the lowest price without any apparent effort on the part of the power superintendent.

The United Railways System of St. Louis has in operation four power stations at the time of writing. Two of the larger stations, one of 13,950 kw. and one of 7,000 kw. capacity, are kept in operation continuously, and constitute the main central stations. The two smaller stations are operated on swing watches on week days, that is, operated during the peak hours only. Bus wires have been run from the larger stations to both of the smaller ones and there connected through circuit breakers and double-throw switches to either one of the two feeder busses, with which the smaller stations have been supplied. Installing double-throw switches on both the feeders and bus wires in these stations makes it possible to operate them on one bus to which any number of feeder sections can be connected, and at the same time operate the bus wires, independent of the station on the other bus to which the rest of the feeder sections can be connected. During the rush hours the bus wires are connected to the same bus on which the stations are operated, thereby becoming equalizer wires. The amount of copper in the bus wires is just sufficient to carry the load of the smaller stations during the lighter part of the day, allowing a reasonable drop in potential.

The resulting economy of operation in this case more than justifies the expenditure of a good many dollars in the bus wires, and also the resulting increase in the cost per kilowatt-hour of the power generated under this arrangement in the smaller stations, as may be seen by referring to the load curves.

In the following load diagrams on Sheet No. 1 are shown two curves. The upper curve represents the total load of all the power stations for a period of 24 hours. The second curve represents the load on the 13,950-kw. station before the installation of the bus wires. Under the curves are shown the cost of operation and

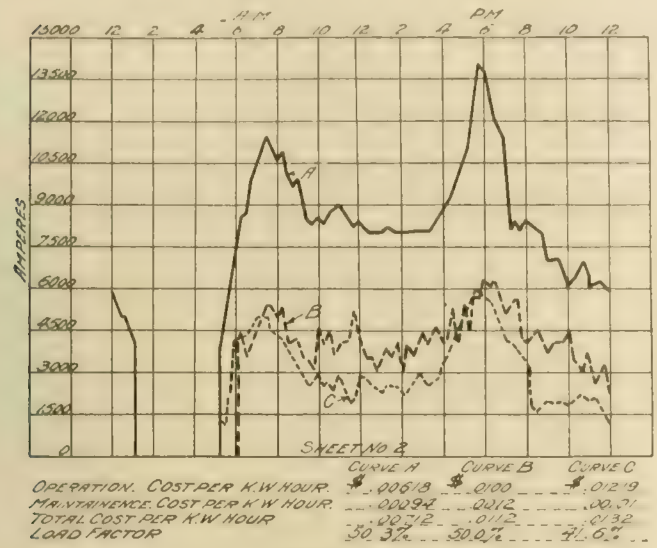


SHEET No. 1.

maintenance per kilowatt-hour, the cost per car-mile, the kilowatt-hours per car-mile and the load factor. Curve sheet No. 2 represents the performances of the other stations on the same day. Curve sheets Nos. 3 and 4 are carried out on the same order, and represent the output of each of the stations under the new arrangement, after the installation of the bus wires. The summary of the foregoing is as follows: By plotting a curve which is the sum of the loads of both the main stations, we can arrive at a curve, the load factor of which is nearly the correct factor to work by, as obviously the effect of the load factors of the smaller stations will have little bearing upon the total cost of operation as compared with that of the larger stations. Nevertheless the shutting down of these stations during the lighter part of the day, thus operating them at an absolute disregard towards economy, does influence the load factor of the main station curves very materially, ultimately effecting a saving. This is clearly shown by the curves on sheet No. 5. Curve sheet No. 5 represents the sum curves of the two main stations when working under both conditions. Curve "A" represents the load of the main stations for the same day on which all four stations were in operation all day. Curve "B" represents the load of the same stations when taking the load off the smaller stations during the lighter part of the day. Thus it is found that in bringing up the load factor of the sum curves of the main stations from 50.23 per cent in the first case to 57.7 per cent in the second, that a saving of .000575 of a cent per

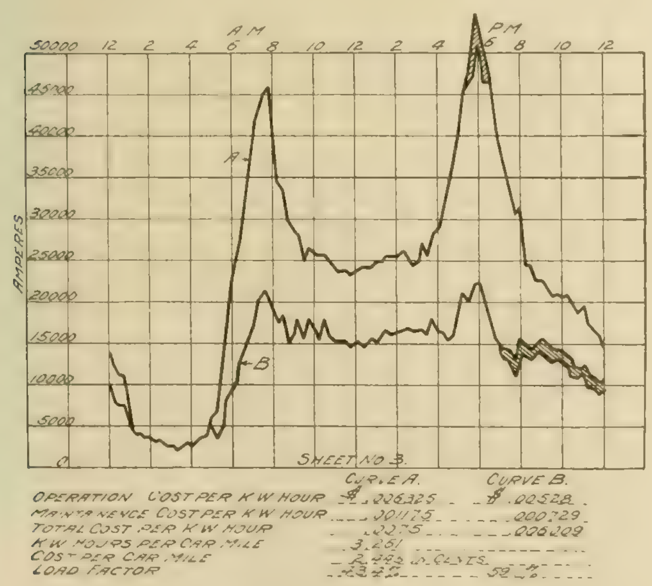
* Read before the American Railway Mechanical and Electrical Association, September 25, 1905.

kilowatt-hour has been made on the total power cost. And on a basis of 310,000 kilowatt hours per day, which is about the average output of the stations of this system during the summer months, this would represent a saving of $178.00 per day when operating under these conditions. All of the above figures, giving the cost of operation and maintenance per kilowatt-hour, were taken from a report received monthly from the auditing department, while the curves were plotted from readings taken daily, therefore, it is possible that the cost of power per kilowatt-hour for the specific days shown on the curve sheets may have been a trifle more or less than given.



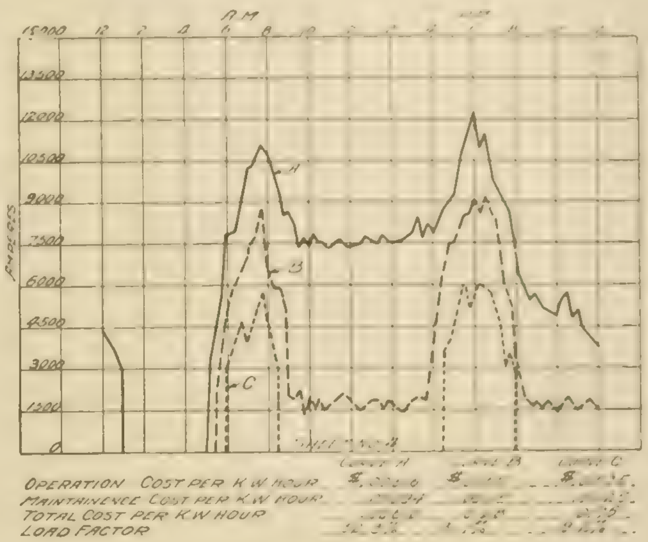
SHEET No. 2.

The curve sheets show the use of a storage battery to level the evening peak. The charge and discharge of the battery are shown by shaded areas above and below the load line. It has been found that since the installation of the battery, which is located in the business district of the city where the traffic is very congested, the service has been increased to a marked degree during the rush hours. Also a large reduction in the amount of copper required to handle the sections located in this district from the four stations has been effected. This, together with the fact that a battery can always be called upon in cases of emergency to take hold of the load, points to the advantages to be derived in using storage batteries to smooth up the load curve when conditions warrant their use.



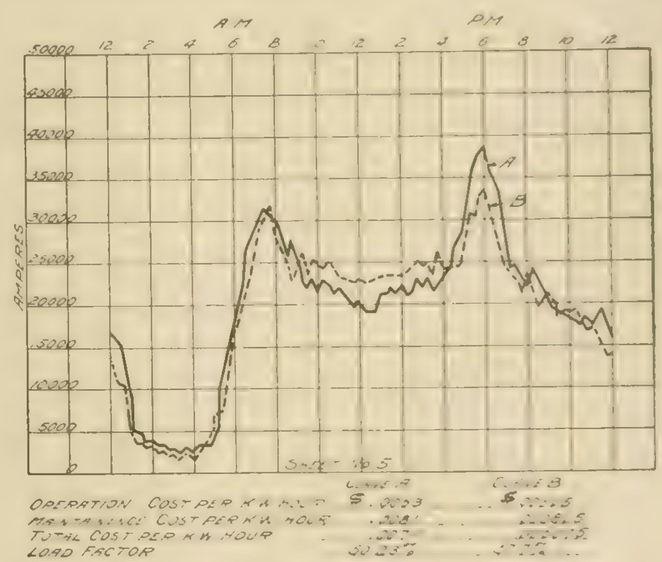
SHEET No. 3.

There is still a tendency among power men to regard batteries with suspicion and distrust, owing partly to the enormous cost of a complete battery installation, and partly to the rapid depreciation of a battery when overloaded. [illegible] storage batteries abroad, with their attendant economical results by leveling load curves, has gradually led to the adoption of them here, until now we find that in every modern installation they form an integral part of the power equipment.



SHEET No. 4.

It is not my intention to take up the effects of storage batteries on power station load diagrams in detail in this paper. But from the resulting economy, as pointed out by the crude and uneconomical arrangement of operating power stations in swing watches to bring up the load factor, it would seem that the question of employing batteries for that purpose should be given some attention and might be made the subject of a paper which would prove of considerable value to the members of the Association.



SHEET No. 5.

THE WEBER RAILWAY JOINT.

The Weber railway joints for T and girder rails are shown at the company's exhibit, spaces 19 and 20, section C. The company has a large representation at the convention and among those in attendance looking after the interest of Weber joints are Percy Holbrook, general manager; James A. Greer, assistant general manager; James C. Barr, general sales agent; W. T. Smettem, engineer; A. K. Downes, inspector; F. A. Poor, western representative, and H. C. Holloway and F. P. Thompson, representatives.

The Consolidated Car-Heating Co. is represented at the convention by Francis C. Green, Cornell S. Hawley, W. S. Hammond, jr., S. B. Keys, and C. C. Nuckols.

Report of Committee on "Controlling Apparatus."*

Mr. J. S. Doyle, Superintendent of Car Equipment, Interborough Rapid Transit Co. of New York, as Chairman, presented the report on this subject. It comprised two papers as follows:

THE SERIES-PARALLEL RAILWAY CONTROLLER.

BY W. A. PEARSON,
Electrical Engineer, New York City Railway Co.

When the first electric railways were put into operation one small motor was considered sufficient to propel a car.

On some of these early equipments in which shunt motors were used, the brushes were designed to be moved around the commutator for the purpose of reversing the direction of rotation, it being considered impossible to provide the same neutral commutating points for both directions.

In developing the series motor it was found that common neutral points for both directions of rotation could be produced, permitting the use of a double pole, double throw switch for reversing the connections of the armature leads.

The simplest way to start and control the speed of the single motor was to use a dead resistance in series with it. This method, which was adopted, has beeen successfully used for single motor equipments since the earliest days of the art.

To meet the increased requirements of heavier cars and higher speeds, a second motor was added to the equipment. As the rheostatic control had proved sufficiently satisfactory for one motor equipment, it was also considered suitable for two motors permanently connected in parallel. Consequently a heavier rheostat was used with two motors connected in this manner.

At first a reversing switch similar to that used for a single motor was employed, the armature leads from the two motors being connected in parallel. This connection was soon found to be impracticable owing to the unbalancing of the load on the two motors, and necessitated the use of separate reversing switches.

In order to obtain an efficient running speed at somewhat less than the full speed of the motor, several methods of varying the field strength were tried with different degrees of success. Some motors were provided with field taps, or "loops," the full field being intended for use in starting and in ascending heavy grades.

The field strength was weakened by cutting out a portion of the winding by means of the tap, thereby allowing more current to pass through the armature, increasing accordingly the speed of the motor. Another method consisted in connecting sections of the field coils, first in series and then in parallel to produce different field strengths. These two methods were used for a few years, and finally abandoned owing to troubles resulting from the burning out of field coils. In the next field variation method that was used, a resistance was placed in shunt around the fields of each motor, thereby accomplishing the same result but in a somewhat different manner. This also led to complications, as motors were operated under such varying conditions. In some cases the full field point was used excessively by the motorman, the coils becoming overheated, and in other cases the shunt point was used too much on heavy grades, resulting in armature and commutator troubles.

Field variation for obtaining speed control was abandoned by the manufacturers of railway motors about nine years ago, and since that time but two speeds have been provided without series resistance in controllers supplied with two motor equipments.

About fourteen years ago the attention and energies of manufacturers of railway apparatus were applied to the development of a control for two motors which, when starting or running slowly, would waste less power than the rheostat and would permit running efficiently at half speed.

The method which seemed to promise the best result was to start the motors in series, and after they had reached their full speed for this position, re-connect them in parallel. Many different experimental controllers were constructed in the attempt to produce a satisfactory piece of apparatus.

Nearly all original electrical apparatus was crude as viewed from our present standpoint, to which view these early series-parallel controllers formed no exception.

* Presented to the American Railway Mechanical and Electrical Association, Sept. 25, 1905.

One of the forms was fan-shaped with a stationary slate board to which were secured the motor, resistance and other contacts, with a movable arm, pivoted at its lower end, and adapted to move from side to side of the slate board, thereby making the necessary circuit combinations. This form was defective for two reasons. The circuits made were not suitable for giving proper speed variations and no adequate means were provided for breaking the arcs formed at the contacts. Several different manufacturers attempted to design controllers of this shape, both for single motors and two motors, but without success.

A more successful series-parallel controller was brought out in 1892, which was located beneath the car and operated by means of rods and bevel gears from either platform. This controller was used in conjunction with the same reverse switch as was used with the rheostatic control. It was expected to fill the great want, but after several hundred had been put into service it was found that improvements were necessary. The starting of the car with this form of controller was jerky, as an insufficient number of points had been provided, while the impossibility of properly installing the controller under the car, so that lost motion in the gears would not be excessive, produced serious burning at the contacts.

This controller contained a magnetic blowout for disrupting arcs, which was very much superior to anything made previously and which served its purpose in proving the value of the magnetic blowout. It was also the first controller which shunted one motor in passing from series to parallel.

At about the same time another form of series-parallel controller was brought out by another manufacturer, in which a cylinder was used in conjunction with stationary contacts, or fingers, for producing the different resistance and motor combinations. As it was installed on the car platform it did not require operating mechanisms and

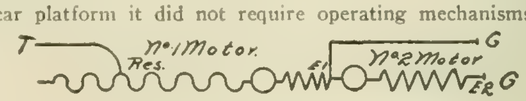


Fig 1.

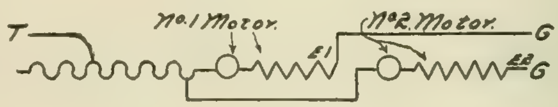


Fig 2.

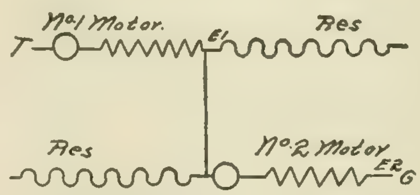


Fig 3.

was in consequence simpler in construction and not liable to the troubles due to lost motions in transmitting the turning effort from the operating handle. This controller also met with partial success, although the arcing at contacts was considerable, which, in the absence of a magnetic blowout, caused the principal trouble.

These two forms of controllers clearly demonstrated the practicability of series-parallel control, and demonstrated that the magnetic blowout to take care of arcing, and the cylinder for compactness and simplicity, were necessities in the design of a controller for operating two motors of the capacity, about 30 h. p., then used.

The final outcome of the series-parallel controller for street car service was the present well-known K type, which has been practically standard for about twelve years.

This controller owes its success very largely to the form of magnetic blowout employed for extinguishing the arcs formed in opening the circuits and the method of making the transition from series to parallel.

Other forms of magnetic blowouts differing in detail have since been designed which have operated satisfactorily, but the form used in the K type of controllers was the first to be made commercially successful.

In this type of controller, after the motors have reached the full series positions, a portion of the starting resistance is quickly re-

inserted in the circuit and a shunt is put around the No. 2 motor by connecting E-1 to ground, thereby eliminating that motor from the circuit, as shown in Fig. 1.

Immediately after this circuit has been established the connection between No. 1 and No. 2 motors is broken, and the positive lead to armature of No. 2 motor is connected to the rheostat, while the line current then passes to No. 2 motor and the motors are in parallel, as shown in Fig. 2.

In the L type of series-parallel controllers, instead of maintaining the current through one motor during the transition, the circuits of both motors are broken. This method of passing from series to parallel was adopted in railway controllers for motors of a total of over 250 h. p. It was found that the arcing in the controller when using the K type of connections was too great to permit their use in large controllers.

In the development of multiple unit control it was found that a better method of making the change from series to parallel, which had been proposed before the first K type of controller was made, was possible with separately actuated switches or contactors. This is what is known as the "bridge method," and consists in keeping the current on both motors during the transition. Each motor is

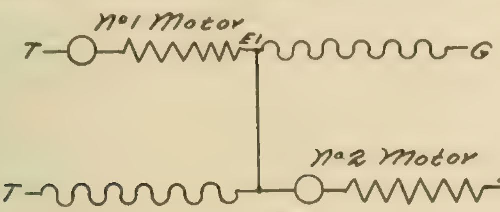


Fig 4

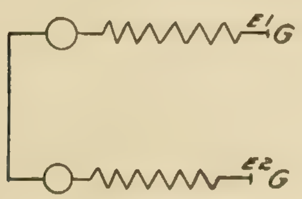


Fig. 5.

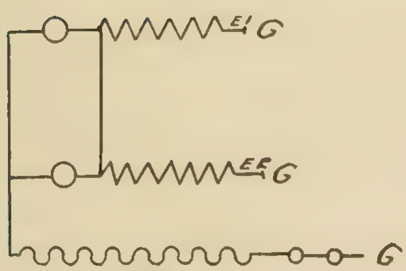


Fig. 6.

provided with a separate resistance, and when full series has been reached the connections are as shown in Fig. 3.

When pasing from series to parallel the first transition step is with resistance for No. 1 motor connected to ground, and resistance for No. 2 motor connected to trolley, as shown in Fig. 4.

It will be seen that this last step has put the two motors in multiple with an equalizing connection between E-1 and the positive side of the armature of No. 2 motor. This equalizer is next open circuited, and the motors are in the first parallel position.

This method of making the series to parallel change permits a somewhat smoother acceleration than with the K type of connections, but it is not essential for light equipments where great smoothness is not such an important consideration as on heavy cars operating with multiple unit control.

Several attempts have been made to produce a control which would be still more economical in use of power than the series-parallel method now in use.

One of these, on which a considerable amount of ingenuity has been expended by different inventors without producing satisfactory results, consisted in providing a "counter electromotive force generator" in series with the motor [illegible] resistance [illegible] plicated and expensive [illegible] consumed in operating [illegible] and full speed, was [illegible] power of consequence.

Another method, [illegible] the excessive complications involved, consisted in the use of shunt field motors with control connections arranged for generating current and returning it to the line when stopping the car or descending grades. A number of patents [illegible] means of accomplishing this result, and various attempts have been made to produce a satisfactory motor and control.

It is very attractive in theory to be able to make the motors on a car generate useful current, but there are a number of obstacles which have thus far prevented practical realization. The motor must be provided with a shunt field with apparatus for varying its strength, dependent upon the speed while braking, and apparatus must also be provided for giving practically a straight series field for starting.

In addition it is necesary to connect the armatures in parallel and series relation for braking, according to the speed of the car. When the armatures are in series, and the field strength is at a maximum, the minimum car speed at which current at line potential may be generated is obtained. It is obvious that when the car is moving at a speed less than this critical speed, the motors will be taking current from the line instead of furnishing it.

On a K-10 controller or similar two-motor equipment, it is a well-known fact that in an emergency the car may be stopped when the trolley is off, or main fuse blown, by throwing the reversing handle to its backward position and turning the controlling handle around to multiple. The connections made are such that the two motors are really connected in series, as shown in Fig. 5, but in such a manner that the voltages of the two armatures oppose each other. If these voltages were exactly the same there would be no flow of current, and consequently no braking. As a matter of fact no two motors are identical, and the slight difference in initial voltage gives one motor predominance over the other and determines the direction of the flow of current, one being obliged to reverse its polarity. This can be readily accomplished as the changing motor is operating as a series generator.

If the car is moving at any more than a very moderate speed the current generated by the two motors will almost instantly reach an amount sufficient to slip the wheels. As the momentum of the car tends to throw more than the normal weight upon the front wheels, and relieve the rear wheels of a corresponding weight, it is to be expected that the rear wheels should slip first.

The instant the wheels slip the motor on the same axle naturally ceases to generate current, but as the current from the other motor is flowing through it, it is rotated in the reverse direction as a motor.

It is well for motormen to know that an effective braking can be accomplished in an emergency by this method.

On four-motor equipments where two motors are permanently connected in multiple, it is only necessary to throw the reverse handle to cause the motors to generate, as the circuits are already made, and it is only necessary to reverse the relation of armature and fields.

With a four-motor equipment, care should be taken that the car is brought to rest before the reversing handle is returned to its forward position, otherwise the contacts are liable to be burned. A recent controller, known as the K-28, has been provided with extra air space in the vicinity of the reversing contacts, while barriers are located between them, so that the chance of injuring the reversing switch when "bucking" the motors has been removed.

When motors have been used with electric brakes the controller made connections somewhat different from the foregoing, as it was necessary to vary the quantity of current taken and divide the load equally. Fig. 6 shows the connections.

Electric brakes have not proved very satisfactory, principally for the reason that their action was too irregular, and they could not always be depended upon. In order to generate current satisfactorily it was essential that the commutator should be in good condition. A comparatively slight increase in the resistance of the circuit caused by a dirty commutator or loose connection would prevent a motor from building up at a certain speed.

Due to this irregular action in the motor it was sometimes difficult to make a smooth stop with electric brakes.

It was also found that the high voltage and additional duty imposed upon the motor was productive of commutator trouble and overheating.

The duty required of a street car controller has gradually increased. Instead of two 30-h. p. motors as formerly, four larger motors are now controlled in the same space. Voltages have been increased and the capacity of the line also raised, so that when an extraordinary arc occurs in a controller from any cause the damage is greater than formerly.

For this reason it is especially necessary to keep fingers properly adjusted, segments renewed and connections tightened to avoid troubles on the road.

There is a growing tendency to place controlling apparatus for large and medium size motors under the car. It removes the heavy capacity parts from the platforms and not only leaves a greater passenger space but also eliminates all possibility of danger from controller "blow-ups."

MULTIPLE UNIT SYSTEMS OF TRAIN CONTROL.

By HUGH HAZELTON,
Electrical Engineer, New York.

Electric motor power found its first application on single motor cars, and when its use was extended to train operation the single motor idea was for a time retained. Placing all the electrical apparatus on one car has the obvious advantage of simplicity and lowest first cost, and the use of a single motor car system was the natural and only feasible thing to do in the early development of the art. The first application of electricity to train operation was made at the World's Fair, in Chicago, in 1893. The trains were made up of one motor car and three trailers. This installation was followed in 1895 by that of the Metropolitan West Side Elevated Ry., in Chicago, where similar equipment was used. The experience of these two roads demonstrated that electric traction was fully as reliable as steam and more economical for this class of service. A single motor car pulling trains of several cars has, however, many of the limitations of the steam locomotive, and some of the pioneers in the art saw that important improvements could be made with electric traction, if the motors were placed on each car in the train and a suitable method devised for their simultaneous operation from the forward car. By such an arrangement the weight of the motive power equipment is distributed, and there is effective for traction as great a percentage of the total train weight as desired. The demand for more rapid acceleration and increased speed had forced steam roads to build successively heavier locomotives, which in turn required stronger bridges, heavier rails and better roadbed.

With an electric locomotive or a single motor car the problem of providing the necessary weight for traction is the same as with a steam locomotive, and an equipment designed for a specific service has the same limitations when increased service is desired. Mr. Frank J. Sprague was the first to point out the advantage made possible by equipping each car with its own motors and providing for their simultaneous control, and in 1885 he made the first concrete suggestion of such a "multiple unit system," with special application to the Manhattan Elevated railway, in New York. The advantages enumerated by Mr. Sprague were as follows:

1. The number of cars in the train may be increased at will, thus increasing the carrying capacity of the road.

2. The speed of the trains may be increased, thus improving the service and also increasing the carrying capacity.

3. Long trains may be run at the same speed as single motor cars and with equal facility.

These claims are now fully established, and all of the elevated and subway lines in this country and Europe, which have been installed within the past five years, have adopted some type of multiple unit control, and the earlier roads which adopted the single motor cars are already replacing them by multiple unit equipments.

Although multiple unit control apparatus found its first application on elevated railways for passenger service, it is now coming into use on interurban roads, and it may be of interest to consider its claims in this more extended field. The necessity for rapid acceleration on interurban roads is not as great as on elevated or subway roads, where the station distances are shorter, and the traffic demands on many interurban roads may be supplied at first by single motor cars, but as the traffic increases it may become desirable to run trains of two or more cars. Unusual local conditions, such as fairs, and ball games, also frequently make it desirable to run a number of cars together in a train. If the motive power equipment is designed for propelling a single car, the addition of trailer cars is sometimes impossible, if the road has steep grades, and it is always unsatisfactory, for it results in overloaded motors, reduced speed and unreliable service. If the cars have been equipped with multiple control apparatus it is possible to couple together as many cars as desired without increasing the load on the motors, or reducing the schedule, and the train of cars has the same ability to climb grades or start on a slippery rail as a single car. By adopting multiple control apparatus, therefore, no limitations are imposed which may restrict future increase of service.

The first operative system of multiple control was installed on the South Side Elevated Ry., in Chicago, and put into operation in 1898. The Boston Elevated Ry. also adopted the Sprague control, of a somewhat modified type, and began the operation of its cars in 1901. The General Electric Co. and the Westinghouse Electric & Manufacturing Co. also developed multiple control apparatus, and sample equipments of the three types were put into competitive operation on the Boston Elevated and on the Brooklyn Elevated railways.

In the original Sprague system a drum-controller placed on each motor car was operated by a pilot motor so attached as to give a step by step motion to the drum. A current limiting relay was provided on each car to regulate the speed at which the drum controller was advanced through the resistance positions. The current operating the pilot motors on the several motor cars throughout the train was supplied through a control cable in circuit with the master controller, which was turned on or off by the motorman.

The early form of Westinghouse control made use of a drum controller operated by an air cylinder with a ratchet arrangement. The air cylinder was provided with electrically operated valves, and these valves were simultaneously operated throughout the train by control wires in the circuit from the master controller. A current limit relay on the forward cars provided automatic acceleration.

In the original type of General Electric control a radical departure from the drum type of controller was made by substituting independent electrically operated switches or "contactors;" each contactor consisting of a main switch with blow-out coil and a solenoid, wound for line potential at 600 volts Similar contactors on the motor cars in the train are simultaneously operated by the control cable in circuit with the master controller. By the successive operation of the different contactors the resistance units are cut out until the motors are in full series; then the multiple connection is made and the resistance units again cut out until the motors are in full multiple. The original type of General Electric control was adopted for the 800 motor cars of the Manhattan Elevated railway, in New York, and put into operation in 1902. The control equipment supplied on this road does not include the current limiting relay which accomplishes automatic acceleration, but this feature was included on the 430 motor cars of the Interborough Rapid Transit Subway, which were put into operation in New York in 1904.

There are at present on the market two types of multiple control apparatus, known respectively as the Sprague-General Electric control and the Westinghouse electric-pneumatic control. By the combination of the Sprague and General Electric companies, the best features of the apparatus of both systems are brought together. The "contactors" of the General Electric Co. have proved greatly superior to the drum type of controller, and the Sprague-General Electric system now has the General Electric type of contactor switch and reverser, and the Sprague current limit relay and master controller.

The Westinghouse company has also adopted in its present electro-pneumatic control a "unit switch," or contactor, in place of the original drum controller, and this switch is operated by means of an air cylinder with electrically controlled valves. It is worthy of note that while the design of the mechanism has been radically changed and materially improved, the fundamental principles of operation, defined by Mr. Sprague and incorporated in his original apparatus, have finally been adopted almost unchanged by all manufacturers of control apparatus today. As a practical uniformity of results is obtained by the control apparatus of both systems now on the market, some attention will be given to the advantages common to both, and a comparison of the more important features of difference in the design of the apparatus supplied by each company.

CONTACTORS.

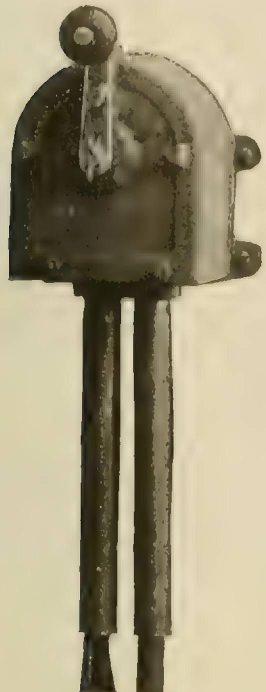
In both systems independent switches, or contactors, are now used for closing and opening the main motor circuits. With these independent switches large current valves may be handled with greater safety and certainty than was possible with the drum type of controller, for a wider air gap and stronger magnetic blow-out is provided, and the contacts of the independent switches open more quickly than was possible with the revolving drum controller.

In the General Electric contactor the contact fingers are closed and opened by a solenoid wound for line potential, which is operative between the limits of 300 and 750 volts. The advantages claimed for this design are simplicity and low cost of maintenance, by reason of the small number of working parts.

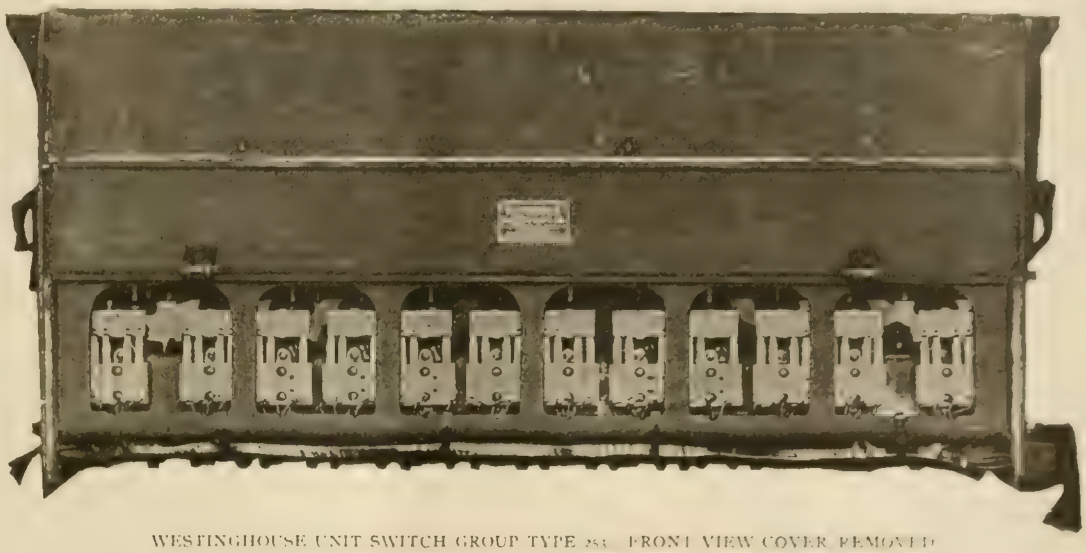
While the use of 14 volts potential for the operating circuit makes it necessary to install and maintain duplicate storage batteries on each motor car, there are compensating advantages, for the operation of the contactors is made independent of line voltage and of interruptions of current on the forward car. Another advantage of the independent operating circuit is the possibility of stopping the train, even in the unusual event of simultaneous failure of brakes and power supply, by reversing the master controller handle to multiple so that the motors are made to act as generators.

CURRENT LIMITING RELAY.

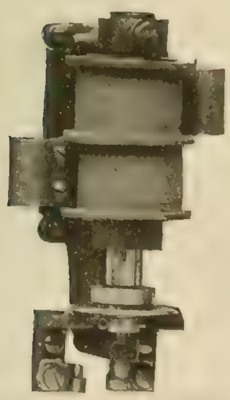
The current limiting relay, common to both systems, consist of a solenoid placed on each motor car through which the current of one motor passes. The armature of the solenoid is attached to a



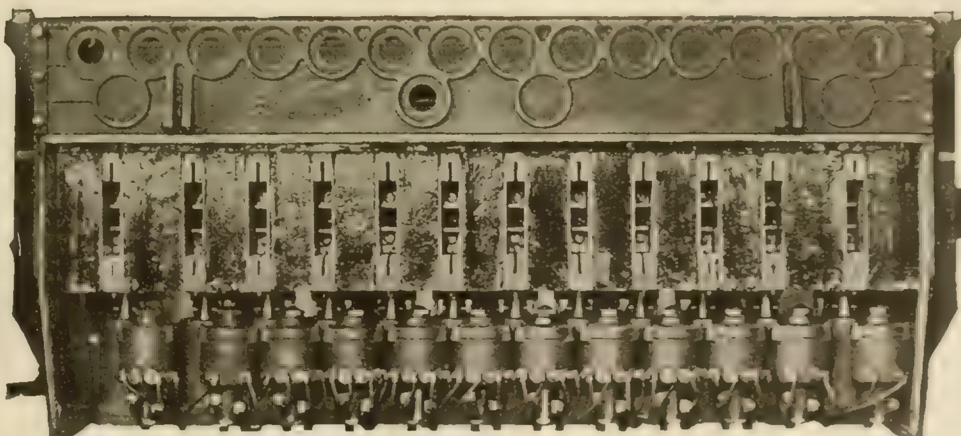
WESTINGHOUSE No. 12 MASTER CONTROLLER



WESTINGHOUSE UNIT SWITCH GROUP TYPE 253. FRONT VIEW COVER REMOVED.



WESTINGHOUSE CURRENT LIMITING RELAY

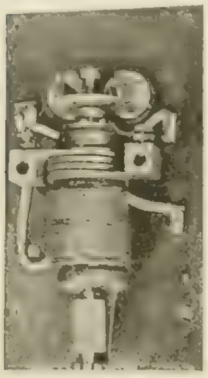


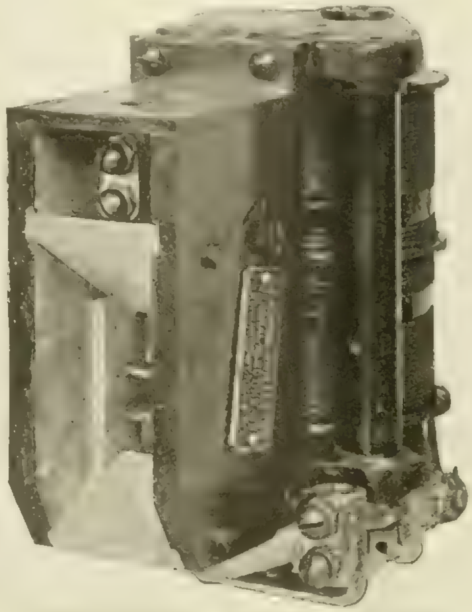
WESTINGHOUSE UNIT SWITCH GROUP TYPE 253. REAR VIEW COVER REMOVED.

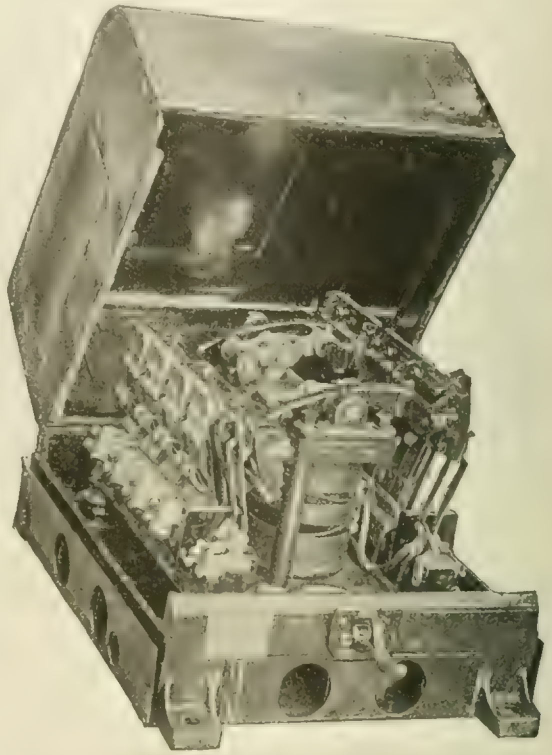
The Westinghouse contactor consists of a similar switch and blow-out coil, but an air cylinder is provided for opening and closing the contact fingers of the switch, and electro-pneumatic valves for controlling the admission of air to the cylinder. The valve magnets are energized by current at 14 volts potential, supplied by a duplicate equipment of storage batteries. In the present design the Westinghouse contactor provides a wider air gap between the contact fingers when open, and greater pressure to the contacts when they are closed, than in the General Electric design. The amount of air gap and pressure necessary for satisfactory operation is, however, capable of definite determination, and with either solenoid or air cylinder operation results equally satisfactory may be secured. The rapidity of closing the contacts is less with air operation, and the wear resulting from the hammer blow correspondingly less.

contact disk which opens and closes the operating circuit for the main contactors. The operation of the current limiting relay may be described as follows: In starting the train the motorman usually turns his master controller to the full multiple position. The current is first completed to the contactors that connect the motors in series with all resistance in circuit. This connection is maintained, and the armature of the current limiting relay is drawn up until the counter e. m. f., due to the increasing speed of the motor armatures, causes the current in the motor circuit to drop to a value which no longer holds up the armature of the current limiting relay. This armature then drops and makes connection to the operating circuit of the next resistance unit. The contactors are thus interrupted in their progression at each successive step, so that a nearly constant amount of current is allowed to the motors during the

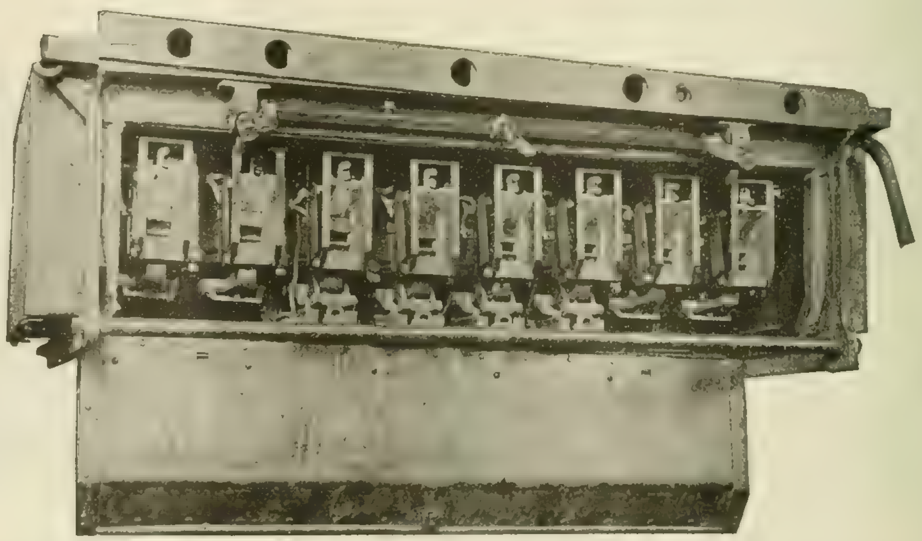
period of acceleration until the motors are in full multiple without resistance. The current limiting relay is now recognized as an important, if not a necessary feature of multiple control system, and its use provides operating advantages which cannot be obtained in any system of hand control. With the hand controller the motorman starts his car as quickly or as slowly as his judgment or caprice may dictate, and the slipping of the driving wheels is the only limitation to the amount of current imposed upon the motors in starting. For heavy electric service it is specially desirable that the current used in starting trains shall be kept within certain well defined limits. Consideration of speed requirements and economical use of power, fix the minimum rate of acceleration and the corresponding minimum starting current, while the maximum allowable acceleration and starting current is defined by the following considerations:


SPRAGUE GENERAL ELECTRIC CURRENT LIMITING RELAY


SPRAGUE GENERAL ELECTRIC CONTACTOR D. B. 4 A.


SPRAGUE GENERAL ELECTRIC REVERSER D. B. 26 WITH COVER OPEN


SPRAGUE-GENERAL ELECTRIC MASTER CONTROLLER


GROUP OF SPRAGUE GENERAL ELECTRIC CO.'S CONTACTORS IN CASE—WITH COVER OPEN

1. Excessive starting current results in violently fluctuating loads at the power house, and in order to meet these demands, the power equipment must be increased in output and the line equipment in carrying capacity. On interurban roads, where the number of trains on the line is small, the fluctuations due to heavy starting currents is especially objectionable.

2. Excessive current applied to the motors results in destructive mechanical strains which materially increase the maintenance charges on gears, pinions, armature shafts and bearings. On an elevated road which has recently discarded hand control for multiple control with automatic current input, the number of motors laid up in the shop for repairs is now only 4, where formerly it was 14. With the current limit relay on each motor car, each motor does its share of the work, irrespective of possible differences in wheel diameter or variation in the electrical characteristics of the different motors.

MASTER CONTROLLER.

The provision made in the motor controller, of both systems of control, for opening the main circuit and applying the air brakes whenever the motorman releases the controller handle, is considered a valuable safety feature, and its application is so simple as to well warrant its use. The master controller on both systems is very small and compact, as it handles only the small currents of the

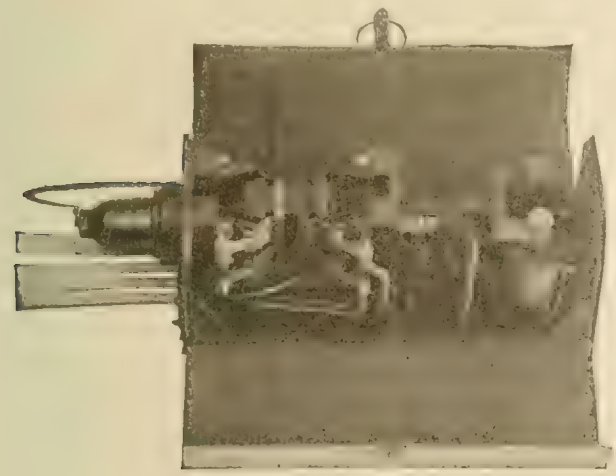
operating wires. In the Sprague-General Electric system the control circuits require not over 2½ amperes at 600 volt , with two 125-h. p. motors, and in the Westinghouse system not over 10 amperes at 14 volts for a 10-car train.

LINE RELAY.

In both systems a potential or line relay is provided which opens the main circuit whenever the supply of current from the line is interrupted. When the current is again restored to the line the contactors are closed through successive resistance steps before returning to their former positions. This device obviates the shock which would otherwise occur in passing over road crossings or turnouts where the continuity of the third rail is broken.

BUS LINE.

In connection with multiple unit systems of control, it is often advisable to install a bus line cable throughout the train connecting the several contact shoes, so that in case the shoes of one car are not in contact with the third rail, the motors of this car may receive current through the bus line from the other cars. The bus line greatly facilitates operation where it is necessary to interrupt the continuity of the third rail at street crossings or yards, and at such points a continuous supply of current for motors and for car lighting is thereby maintained. The bus line also serves to eliminate motor flash-overs, which sometimes occur when the cars are running at high speed, and the supply of current is suddenly interrupted and restored, as is the case when the contact shoes on one car



WESTINGHOUSE REVERSER SWITCH. TYPE 176 C WITH COVERS OPEN

momentarily lose contact by striking a high joint or an approach incline. In the case of snow or sleet on the third rail, the bus line serves to distribute current to all the cars in the train from any car which may secure contact with the third rail.

CIRCUIT BREAKERS AND FUSES.

For the protection of circuits against excessive current, circuit breakers and fuses are used in connection with multiple control apparatus. Fuses are usually placed in the circuit from each contact shoe, and a common form of shoe fuse consists of two copper wires, about No. 9 B. & S., connected in multiple with suitable terminals and placed on the wood beam that supports the contact shoe. Some of the large roads are using enclosed fuses of 400 amperes continuous carrying capacity in place of the copper wire fuses. For protecting the main motor circuit some roads are using fuses and some circuit breakers. The type of fuse most widely used for the purpose consists of a copper ribbon 10 mils in thickness and 1¼ in. wide, placed in a fireproof box with magnetic blow out. A hole ½ in. in diameter is made at the center of the ribbon, so that the fuse will begin to melt at the center. A copper ribbon of this size will carry 400 amperes continuously. For larger capacity the number of copper ribbons is increased. These fuses will open an overload or short circuit with entire safety, and the cost of renewals is small. They do not open a short circuit with as little noise and flash as the enclosed type of fuse, however. When a circuit breaker is placed in the main motor circuit it is arranged with a tripping device, placed in the motorman's cab, and in some cases the circuit breaker may be reset from the cab also. There is some doubt of the advisability of resetting the circuit breaker until an examination of the cause of its opening is made, and the trouble remedied.

In equipping cars with multiple control the practice of placing all the apparatus under the car has now become standard. The main motor circuits are all kept below the car, and the wiring is done in iron conduit pipes, and the bottom of the car is thoroughly protected by fireproof material. These precautions have greatly reduced the risk of fire, and on one of the elevated roads in Chicago which has recently replaced its original hand control by multiple control apparatus, the underwriters have voluntarily reduced the fire insurance rate. The reduced fire risk is also given as the controlling reason for the installation of multiple control apparatus on single motor cars on one of the street railway lines recently opened in Boston.

Before leaving the subject of multiple control, a word should be said concerning the reliability of the apparatus in service,—for this is the final measure of merit.

During the first years of its introduction, the most serious obstacle against the adoption of multiple control was the apparent complication of the system, which suggested a doubt as to whether it could ever be operated with as few failures as the simpler apparatus of hand control. The experimental stage is now past, however, and in the more modern types of multiple control it is safe to say that the apparatus is fully as reliable in operation as hand control, and it has the ability of handling much larger current values. On the Manhattan Elevated railway, in New York, where there are over 800 motor cars in daily service, the number of delays to service, chargeable to failure of control apparatus, averages only about five per month. It is the practice to inspect the control apparatus on this road once every three days, and except for occasional cleaning, little work is necessary.

In conclusion, the writer would express the hope that this paper may serve to emphasize the merits of the multiple control system for many interurban and street railway lines where the limitations of hand control have stood in the way of the best service and most complete development of the property. The ability to run cars in trains of any desired length, without reduction in speed, and without overloading the motors; the advantage of limiting the current during acceleration to a predetermined value, and the decreased fire risk by placing the control apparatus under the car, are features of the multiple control system which warrant the attention of all progressive railway men.

A. & J. M. ANDERSON MANUFACTURING CO.

The exhibit at the A. & J. M. Anderson Manufacturing Co., Boston, consists of a large variety of material for overhead work, some of which is new. Besides the "Ætna" insulators, overhead line material and switches, the company is exhibiting a new third rail insulator which is now being used on the Metropolitan Elevated

Ry., Chicago, and is shown in the accompanying illustration. This third rail support is made up of malleable iron castings and "Ætna" insulation, and is the result of much experimenting as well as practical experience. Mr. Ernst Waltmann, manager of the company's New York office, is in charge of the exhibit.

To accommodate increasing business, the Indiana Union Traction Co. has placed two new freight cars in service between Indianapolis and Muncie, and Indianapolis and Kokomo. Round trips will be made daily, except Sunday, handling freight for all intermediate points.

THIRD REGULAR ANNUAL MEETING

American Railway Mechanical and Electrical Association

Philadelphia, Pa.—Sept. 25-26, 1905.

The first session of the convention was called to order at 11 o'clock a. m. by the president, C. F. Baker, who introduced Hon. John Weaver, mayor of Philadelphia.

Mayor Weaver made a brief address as follows:

Mr. President and delegates of the American Railway Mechanical and Electrical Association: It gives me very great pleasure as mayor of Philadelphia to welcome you here to this convention. It seems to me that a convention of manufacturers and others who are interested in the carrying of the public must be of great interest, of great importance and give great results beneficial to the traveling public. We all know that you get some benefit from it from an economical standpoint, because to use the very best cars that you can get, the very best equipment of every kind is probably the greatest economy that can be practiced. But what you are all interested in and I suppose what every citizen in the United States is interested in, is having their welfare looked after and I am quite sure your meeting year after year in convention and exchanging views, must result in great benefit to the traveling public. I do not know of any other organization that represents interests closer the public of the United States. I suppose at some time or other the majority of all the men, women and children get into a trolley car, so that we can see that the majority of the American citizens are interested in these cars and these roads that are equipped for them. The trolley street car system is rapidly extending. It used to be that we had the old horse cars on the streets. We now have electrical cars, but they are not confined to the city; they go out from the city streets into the suburbs and are extending beyond that; you have the great interurban roads that have been developed in the middle west so successfully and are now being developed so successfully here in the east. I have been told recently that a great many of the trunk steam railroads are thinking of putting in electrical equipment for carrying their local traffic and just what local means is a question, because we find that they are going out and carrying in the local trade for hundreds of miles.

I am very glad as executive of this city to welcome you. I trust you will have an exceedingly profitable time and a pleasant time. I welcome you on behalf of the citizens of Philadelphia. I give to you the freedom of the city; the keys are yours. Use it as you like and after you are through with your convention I trust that you, when you leave here, wherever you go, you will carry away with you some very pleasant recollections of this good old city of Philadelphia.

The president then introduced President Ely, of the American Street Railway Association, who spoke as follows:

I am sure we are all deeply indebted to Mayor Weaver for taking his time to come here this morning, and in behalf of the great city which he represents extending so beautifully as he has done its welcome and its freedom. About the key, of course, Mr. Mayor, we all understand that the key does not open up as much as it did awhile ago—(Laughter), that is from what we read in the outside newspapers.

(Mayor Weaver: It opens the hearts of the citizens.)

That is sufficient if it opened no more. Mayor Weaver is going to stay here, probably out of courtesy, while I deliver my remarks. I must therefore make them very short. In the first place I wish to say as president of the parent organization that there has been a great deal of work done during the past year looking toward your closer affiliation and organization with the parent association and discussion of the methods of work to be pursued by not only the parent organization, but your organization and the others affiliated with the parent organization. What I wish particularly to impress upon your attention today is that there be no misapprehension of the purpose of this move toward organization. It is simply a desire on the part of those who have come to see that there was a multiplication of organizations that was going beyond, perhaps, the limits of proper expenditure and proper effort and that these organizations were not working harmoniously along well thought out and well developed lines. So the idea is in some way, and in the way mapped and laid down, to get things together so that the lines of work to be pursued by the different organizations will be carefully thought out a year in advance and the investigations and the work done devoted to the most important things that are involved in the street railway industry. Each organization should proceed in such a way that it will supplement the work of the others. Particularly do I desire to impress upon you this fact, and it is a fact that may be absolutely relied upon, that there is not one in the parent organization, not one among those who have been ardently engaged in the work of organization, who desires in any way to do anything that will detract from the dignity of this organization of yours. You cannot be prouder of this organization than are the presidents of the companies and those who worked in the ranks of the parent organization. I could not more clearly illustrate my ideas upon the subject than to refer to the remarks Mr. Beggs made last year at St. Louis when he was addressing your convention. Those absolutely are the ideas that animate the minds of those in the parent organization. Your work is of vast importance, as the mayor said, probably at some time or other almost every man, woman and child in the country gets into and out of a trolley car and the safety of that apparatus, and the proper working of that apparatus, and its adaptability for convenience and comfort, is dependent upon the departments which you represent. Nothing could be more important than the apparatus which carries the people that make our business. Therefore with the method of work and the dignity of the organization, that autonomous organization which you have had up to now no one intends to interfere. The only thing is that we shall work together and that the expenses attendant upon the running of the different organizations shall be paid at one time to the end that the work does not fall into confusion, that there may be no misunderstanding as to the value of the work and how much it costs. Upon that is determined what we may be able to do in these lines of work. So much has been said on this subject that probably nothing more is desirable from me at this time, but especially do I desire to emphasize the fact that no one wishes to interfere with the autonomy of your organization nor to put a halter or bridle on it nor curb it nor ride it to death nor compel it to do anything which it does not desire of its own free will and volition to do. This matter will come up for action at these meetings that are to be held and therefore it is greatly to be desired that each one here, each delegate, gives a careful reading to the proposed form of constitution and by-laws and if there are any objections now is the time that they are to be heard. It is to be a square deal, and a fair show for all, nobody is to be subdued, nobody is to be silenced, muffled or gagged, and we want everybody to talk and out of that to come what will be of immense benefit to these organizations, all of which are engaged in one work, although in different branches of it. I am glad to meet you all here again. Each convention is larger than the other; each convention brings some new faces, and I am happy to say many, many old faces. This work that has been done here by the Manufacturers' Association is simply superb. This exhibit as one walks through it reminds one of the finest departments of the largest expositions that have been held in this country. Nothing could be more beautiful, well arranged and adapted to viewing, than the exhibits as they are arranged below.

Where everyone pulls so true, to mention the names of individuals is invidious. All the members of the Manufacturers' Association from the president down have worked unremittingly for months and to some of them has fallen a greater part of the work than to others. I have seen no evidence of shirking, but, on the contrary,

everyone has stood forward to bear his full share. Not only the Manufacturers' Association is to be congratulated by us on the result that has been attained; it seems to me that as it is one of the first accomplished results of the movement toward organization in our lines of work that it speaks well for the success and the desirability of the plan. I thank you, Mr. President, for the opportunity of saying these words and I on your behalf extend to the mayor your thanks and our thanks for his hearty welcome.

Mr. Daniel M. Brady, chairman of the Manufacturers' Association, spoke of his early association with mechanics and mechanical men and of his warm feeling for them. He welcomed the visiting members and spoke of the efforts to run the Manufacturers' Association on an equitable basis.

The president then read his address as follows:

ADDRESS OF PRESIDENT BAKER.

It affords me great pleasure, at this, the third annual convention of our association, to extend to you all a hearty greeting. I note with keen satisfaction the goodly number of our members present; it certainly augurs well for the enthusiasm and success attendant upon our meetings.

Since it seems desirable to dispense with the reading of the papers in order to give us an opportunity for a thorough discussion of them, it hardly behooves me to take up much of your time with a long address.

We have found a cordial welcome extended to us here, and there is an atmosphere surrounding this historical "City of Brotherly Love" which should be conducive to a full attendance and effective work. It is my hope that this meeting will surpass the excellent record of the past and that at its close we can congratulate ourselves upon its having been our best and most valuable convention. Although as an organization we are young it has become a recognized fact that our society has done and is doing much to increase the world's stock of useful knowledge in matters pertaining to electric railway's operation and maintenance. The improvement shown each year may well indeed be a source of pride and pleasure to us, and it is to be hoped that our excellent progress may be continued. This can assuredly be brought about by earnest attention and free participation in the discussion of such subjects as may come before us.

The extension of the bounds of our association to admit of the inclusion of the members of the maintenance of way departments has greatly broadened the scope of this association and will, I am sure be of benefit not only to the association, but also to the individual members, whether they be of the mechanical, electrical or maintenance of way department.

If I may digress for a few moments I would like to say a few words relative to my feelings when elected president of this association. In a society having a so widely extended membership as this it is impossible for the president to know, personally, very many of the members who may be in attendance at our meetings. This is a source of much embarrassment to the presiding officer, but is one which can be greatly lessened if each member, as the opportunity may offer, will present himself to the president. This would apply with equal force to our secretary, whose very efficient work as the only permanent officer of our society and the one on whom the president has to depend in a great many ways, will be greatly enhanced by a large personal acquaintance of our members. It is the duty of each member to do all in his power to make each meeting a success socially, as well as an occasion of making and renewing acquaintances, for promoting good fellowship, and for bringing out and distributing useful knowledge in their various lines and departments.

One of the principal efforts of an executive officer of our railways and through him and his subordinates is to increase the difference between the cost of operation and revenue received. In this effort the departments represented by this association can, above all others, materially assist. There are numerous channels through which this may be accomplished, one of the most important, to my mind, is system and organization properly laid out and applied. Ofttimes desired results may be obtained and success in small matters made possible without the necessity of inaugurating anything that might be dignified with the term "system" as in such matters an officer would be able to so divide his time as to come in personal contact with much of the detail, but this can only be done where the organization is small and where dependence must be placed on but few. In large companies covering considerable territory and employing many men an executive officer is unable to go into much of the detail or have frequent personal contact with his men. In this case success in the management of property is absolutely dependent upon good organization and system. The larger the company the greater is the necessity for a proper and adequate organization since the executive officer must depend to a greater extent upon his subordinates. Any system to be successful must clearly define the duties and measure of responsibility of each individual so that if a failure occurs there will be no doubt as to who is to be looked to for an explanation and no difficulty in placing the responsibility. Lack of good system or absence of a good and reliable organization has caused many an executive officer to carry burdens and worries which might easily have been avoided were the organization such that his subordinates could relieve him and thus enable the chief to devote more time to planning and systematizing his work. The details could then be more readily and satisfactorily carried out by his assistants, as scattered efforts are more often futile and concentration is necessary for success in large matters. An organization and system of this kind is not brought about at a single stroke, but can only be the result of long and patient study of the conditions surrounding the department, the personnel of the men in the department; and the hearty co-operation of the subordinates upon whom the head of the department must depend for attention to the details. We have already taken a step in this direction in the report of the joint committee of the Accountants' and our own associations upon the standardizing of the blanks and forms used in these departments. That this can be continued to a good advantage there is no doubt, but as local conditions vary so much it is extremely difficult, if not impossible, for any general system to be devised which will be applicable to all. We can only strive, by earnest study and hard work, to improve our organization and system of records and accounts in every conceivable way in order that we may approach as closely as possible the ideal. A quotation from "System" occurs to me as being particularly pertinent to this subject:

"No good system ever just happened, it was wrought out by the hammer of concentrated thought on the anvil of hard work."

This to my mind gives us the key note—concentration—and to admit of concentration it is necessary that the organization must be such as to permit of the details to be taken care of by the subordinates, leaving the head of the department free for greater and more important matters, and I bespeak your careful thought and consideraation of this matter, as I believe it well deserves the attention of each and every one of us and to my mind can be easily made the means of a vast stride toward the goal for which we are all striving.

It is with a feeling of deep and sincere sorrow that I have to announce the heavy loss sustained by our association during the past year by the death of one of our most active and able members and officials, Mr. W. O. Mundy. Mr. Mundy was one of the original members of the organization, who, by his strenuous efforts, contributed very largely to the success of this society.

The high character of the papers and reports previously presented has been fully upheld in those to be presented this year. They are a credit to the association and likewise to the writers, and I sincerely trust that the discussion will be free and ample in order that the greatest possible benefit may be derived from our convention.

Mr. E. W. Olds and Mr. Alfred Green paid tributes to the late Mr. W. O. Mundy, whose death was a sad loss to the association. President Baker appointed Messrs. Olds and Green a committee to draft suitable resolutions on Mr. Mundy's decease.

Mr. Mower, secretary of the Association, read the report of the executive committee, giving details of the management of the association during the past year.

His report as secretary and treasurer showed that during the past year there has been added to the membership of the association ten company members, 59 active members and 1 junior member, making at present 38 company members, 134 active members and 31 junior members. The New Orleans Railways Co., on account of passing into the hands of a receiver lost its membership.

The financial report showed cash on hand Oct. 9th, 1904, $403.55. dues received from company members $760, from active members $635, from junior members $18 and from miscellaneous sources $30.98, making a total of $1847.53; expenditures were, printing and stationery, $454; postage, $68; salaries, $500; annual convention, $109.25; expenses executive committee, $191; miscellaneous, $29.48; a total of $1351.73, leaving a balance in bank of $495.80.

There is outstanding on the books quite an amount from active members and junior members, and there is one company member owing the association at the present time. The bills payable amount to $100.04.

The reports were accepted as read.

Mr. Adams, chairman of the Committee on Organization, stated that Mr. Ely had outlined before the convention the principal thought in connection with that subject. In the plan submitted the points that will affect this association are in relation to financial assistance. This organization is going to look to the parent association for support. The financial question in the opinion of Mr. Adams is one of the principal reasons for organizing. He also referred to the matter of the printing of the reports of proceedings which the parent association will take care of, and set forth the desirability of closer relations between the associations.

In answer to a question by Mr. Green as to whether this association will elect its members as usual, President Baker said that is for this association to determine. It would make its own constitution and by-laws and would be left largely the same as now, with possibly a change in the name. Further it had been suggested to call it the American Street and Interurban Railway Engineering Association.

Mr. Green and Mr. Adams believed that the constitution of this association as it now stands should not be changed.

Mr. Olds said that under the proposed plan the membership of this association would not be restricted to the companies which may belong to the parent association, but that the individuality of this association would be retained. He expressed the idea that the wish was to work absolutely in harmony with the parent association.

Mr. Richard McCullough said it was not the intention in the plans suggested to diminish the authority or standing or prestige of the subsidiary organization. In regard to the membership he thought that the members were to be the railway companies themselves and also such associate members as should be elected, and that there was no reason why anyone interested or who had formerly been interested in the street railway business should not become a member of the association and have all the privileges of membership except voting and holding office.

Mr. Simmons commented upon the remarks of Mr. Ely, saying that all members should wipe out all feeling that there is a desire to curb these subsidiary associations in their power to do good.

Mr. Simmons spoke of the amount to be subscribed for the partial support of this organization by the main association which can only be determined as events proceed. He said that the scheme of raising funds is to have each company pay in proportion to its gross receipts as the larger companies are going to derive far greater benefit than the smaller ones, the large company having present a dozen different men representing different departments, while the small company will have but one man present.

On motion of Mr. H. E. Farrington the subject matter under discussion be placed in the hands of the executive committee

A recess was then declared.

MONDAY AFTERNOON SESSION.

President Baker called the convention to order at one o'clock.

Mr. Charles Hewitt, engineer of the Philadelphia Rapid Transit Co., extended an invitation to the delegates to visit the power houses and stations of the company, and mentioned that perhaps the most interesting station, on account of the newness of the installation of turbines and the high-tension alternating current apparatus would be the Second and Wyoming Sts. stations in the lower part of the city.

Mr. C. H. Hile, superintendent of wires. Boston Elevated Railway Co., presented his paper on Power Distribution, which will be found on page 606.

Mr. L. P. Crecelius, of St. Louis, asked Mr. Hile about his experience with lightning trouble at terminal points where the overhead feeders joined on to the underground feeders, and what scheme, if any, he had for protection at that point, as that was one of the weak points in connection with the cable overhead construction; whether he used lightning arresters to avoid electrolysis in the cable.

Mr. Hile replied that his company had installed on every cable two lightning arresters, one at the station end and one at the terminal end, wherever there is a terminal, and where the current comes in on the overhead wire there is installed a lightning arrester. There had been very little trouble. He could only recall three instances in which it was believed that the underground cable was injured due to lightning; whether it was owing to the good fortune or having the lightning arresters in use or not, he could not say. Some extra arresters were installed on terminal poles. On an iron pole an insulated wire was carried right down along the pole to the track system.

Mr. Crecelius said that as there is not much that can be done to render a circuit non-inductive going down a line pole, his company had had some trouble with its cables at that point.

Mr. Hile answering an inquiry said that the circuit breakers acted automatically at the power station only; that the feeder system or section might include one feeder or a half-dozen feeders, depending on the size of the section, and if it happens to be a feeder section, feeding from more than one station, it means more cables in that section and dependence was placed on circuit breakers to cut out the station and protect the section. This the circuit breaker does not always do. At times, if the section is badly disabled, the first thing is to clear the section, which can be quickly cut dead at the power station, and then get the crew on the ground and jump in with the other section, throwing out the feeders which are disabled.

Mr. Crecelius remarked that in order to accomplish that it would be necessary to have a good system of communication and a good record of locations so that the repair crew could know where to cut out.

Mr. Hile answered that the company had complete plans which showed every detail of location, and copies of these plans are kept at the power station, at the headquarters of the operating department and at the headquarters of the department having charge of wires and conduits. Some one is kept constantly at the telephone, and the crews are directed to go to a given place, instructions being to cut out such a cable by number, everything being identified by number so that the company do not depend wholly on the knowledge of the crew, although the crew is supposed to know. The records which are kept show that the crew was called to throw such a switch and cut out such a cable; they report back so that a complete record is kept of everything of that kind.

Mr. H. H. Adams, of Baltimore, asked Mr. Hile what he considered was a good distance for the installation of lightning arresters on a line for general overhead construction.

Mr. Hile replied that he could not answer the question off-hand, as much depended on the location; among the higher hills, he would advocate a lightning arrester about every mile, or every three-quarters of a mile. In certain districts of the country, especially in the west, where lightning is a pretty serious consideration, the use of lightning arresters is very important.

Mr. Adams stated that for the past three years he had kept a record of all the equipment that had been damaged by lightning flashes on a map of the system by inserting a pin at the given point, and had found that at crossings and at corners there is more likelihood of trouble from lightning.

Mr. Crecelius stated that he believed it would be a good thing to put in wooden poles at terminals and take out everything in the way of an iron pole.

Mr. Hile considered the suggestion a good one where there was much trouble with lightning, and believed good results would follow from a good earth ground independent of the system.

Mr. Adams cited a particular case of that kind, where on a line which ran out into the country there had been considerable trouble from lightning on that line. The grounds were gone over and where there were track grounds a good ground plate was put in and the number of arresters doubled and very materially reducing the trouble; in other words, it seemed to be a question of more arresters, but that was on a line of wooden poles.

Mr. E. A. Sturgis, of Worcester, said his company had had a good deal of trouble with lightning, which had been overcome by forming underground connections and putting in more arresters. He asked Mr. Hile in regard to the changing load at the power station. If he understood it, the practice was to vary the voltage and the load swings from the outer stations into the inner stations.

Mr. Hile replied that technically this is the case—the heavier load coming on tends to lower the voltage of the station taking the load and the other stations get all the benefit of the high voltage and eases up the demand on that station, even though having the heavier load.

Replying to a question as to cement lined conduits, Mr. Hile said the company had some 76 miles of cement lined iron pipe duct, although it had not laid any cement-lined iron pipe conduits since 1895 and is not contemplating laying any more. He could not say that it had ever injured the cables and the main objection he always felt was that in case of any cable trouble the cement-lined conduit seemed to distribute the trouble so widely on account of the iron rings and the iron casing of the pipe. It seldom happened in building a large conduit that one pipe was absolutely separated from another; that there was enough cement between the pipes to prevent one pipe grounding on another.

Mr. Hanna said his trouble had been to use cement-lined conduits so as to avoid the burning of the cables. He found that the cement-lined conduit damaged the cable. The company had requested chemists to examine the pipes and cable about two years ago, but had not yet secured a report further than that a cement-lined pipe increases all sorts of electrolytic troubles and that there is also an actual chemical action on the lead from the cement, which is strongly alkaline. He hoped that some way had been found of putting a covering on the lead sheath or something of that nature to keep the cables from coming in contact with the cement. The principal trouble had been in parts of the city where the drainage had not been very good.

Mr. Charles Hewitt, of Philadelphia, said that his company had practically tied its lines with heavy copper cables connecting one-half of the stations together without any reference to the feeder sections. If the tie lines are connected into the bus bars on the two stations one station will cut out inside of 5 minutes unless the tie line is very long and the drop is great. Stations 10 miles apart tied together will work perfectly, as the point of greatest drop will travel up and down the cable depending on the load created by the cars, but with stations near together (a mile or two miles distant from each other), a tie line connecting the bus bars woud probably be impossible.

Mr. Hile said his company had no such trouble except in cases where a bad ground in one station had thrown the other station out.

Replying to an inquiry from Mr. Hazleton, Mr. Hile said that the company had considerable iron pipe used as connections to the poles, ordinary 3-in. pipe, to cross bridges and certain places in the street, and where there had been trouble on the cable, creating electrolytic conditions, ordinarily the lead was cut.

Mr. Hartley Le H. Smith said that with reference to the operation of a station or stations with lines running from one to the other, he thought that whether that operation was successful or not was a question of how the machines operated at the stations, whether they had a series winding strong enough to raise the electromotive force as the load on the machines is raised. If the series winding was strong enough, the station would not operate that way; however, if the series windings helped to hold the electromotive force up, yet not strong enough to actually raise it, as the load becomes heavier the station will operate smoothly and for the same reason that machines can be operated without a series winding. He thought it helped out in station operation to a large extent to avoid having series windings so strong that the electromotive force is raised.

Mr. Paul Winsor, of Boston, said that their machine characteristics are practically flat, the machines being compounded for a rise of potential; with a distance between installations there was no trouble.

Some further discussion on this point followed.

Mr. L. P. Crecelius, chief electrician of the United Railways Co., St. Louis, then read the paper on "The Power Station Load Factor as a Factor in the Cost of Operation," which will be found on page 610.

Mr. H. LeH. Smith said he thought the subject of the load factor at stations had not received sufficient consideration, that it was to a considerable extent neglected absolutely, and yet it was one that was most intimately concerned in the efficiency of the station operation. The load factor before the meeting was the ratio of the average load to the maximum load; he did not think that to be the ratio most significant in showing the efficiency of the station. In his opinion the ratio which shows the actual load which the machine has had to the load they would have had if they operated at the rated load has the greater influence in the station operation, and that it is not realized, either, to what an extent that ratio alters. In that ratio there is the effect of the average steam consumption of the engine, a thing that [illegible] the electrical [illegible] through out the range of [illegible] but on the steam engineering side that is not so.

Mr. Crecelius replied that [illegible] is a point he could not [illegible] of the load factor [illegible]

Mr. Hewitt said that in Philadelphia they had six storage batteries, five of them being [illegible] tating the distribution of the [illegible] battery is connected directly with one of the stations; he could not give the load factor, but thought it was about 70 to 75 per cent., that is the average of the various stations. They maintained a full load on every engine throughout the day by means of the tie lines which has been referred to, but they transpose the load from one station to another to accomplish such results.

Mr. McCulloch called attention to a difference in the two papers. In Mr. Hiles' paper the load factor is based on a period of operation of 18 hours, while in Mr. Crecelius' paper the load faction is figured over a period of 24 hours.

Mr. Hiles stated that in taking the statistics of different companies to comparte the cost of power, ordinarily the cost of coal runs pretty close to two-thirds of the amount of the cost of power produced, and it takes but a small percentage of variation in the price of coal to show a different result in the cost of power given in any statistics of record.

Mr. Crecelius said that in the case of his company the cost of coal was a little over 50 per cent.; a little over half the cost of operation, without maintenance.

Mr. H. LeH. Smith offered some further discussion on the relation between the two load factors which have been mentioned. The one which has been mentioned at the meeting was significant for two reasons. One, the fact that the ratio of the average load to the maximum is a measure of to what extent the machines are standing idly in the stations and also it has a relation to the labor item as the number of men in the station are nearly, if not absolutely, as large in the rush hours as in the light hours, especially in any large railway system which has a load which runs up so much higher in the rush hours than in the average load so that the load factor representing the ratio of average to maximum load is a matter of how the engines are started and stopped, whereas the other load factor is a matter of how economically the engines are working when they are working.

Mr. J. S. Doyle, superintendent of equipment, Interborough Rapid Transit Co., New York, then read the report of the committee on "Controlling Apparatus," which will be found on pages 612 to 617.

Mr. Winsor stated that his company had put on 40 surface cars with multiple control, but that it had been done temporarily because it was found the platform controller was not large enough to handle the cars. They felt that the currents were too heavy to be handled on the platform of the car.

Mr. E. W. Olds said that his company had realized for a number of years it was necessary to do something to take care of the large flow of electricity with four-motor equipments. He believed the controller should be removed from the front platform. His company was having constructed at this time 50 equipments which would to a certain extent remove the fireworks from the front platform. It is planning to use one of the K types of controllers with two contactors in the circuit, the idea being that the controller contacts will be made before the closing of the main contactor system; it would be the reverse from the opening of the arc. By this method the main circuit is opened and closed underneath the car so that in case of short circuit it will not be at the controller. He had found that most of the so-called controller accidents and blow ups are not caused by the failure of the controller, but by some short circuits in the other apparatus and the flow of current being so great that the ordinary cylinder type will not break the arc and the result is a burnt out controller. He had arranged the wiring of this controller so that one side of the armature will be always positive, doing the reversing in the fields. By this method he is able to protect each motor with its individual fuse, so that should a short circuit occur in the motor or in the wiring the individual fuse of that motor would blow, cutting out the motor.

Mr. J. S. Pevear, of the General Electric Co., said that he did not think he could add anything to what Mr. Olds had said; that Mr. Olds had covered the whole matter by saying they are putting in two contactors underneath the car in series to give practically the same effect as with the type M cylinder controller.

Mr. F. E. Case, of the General Electric Co., thought that practically the only thing to add was that this is merely a partial step in the right direction, as he believed the full multiple control, with the apparatus all located under the car, is the proper method, and in the process of getting at it gradually the placing of the principal contactors under the car is the right thing to do, and that ultimately the railway men would look at it in that light.

Mr. Adams thought that the railroads would be glad to take the full step in that matter, but just at the present time he did not think the companies were in position to take the step on account of the question of cost.

Mr. Olds said they had decided to adopt the enclosed fuse, which is on the no-arc principle; they are placed underneath the center of the car in a box by themselves, and he anticipated very little trouble in locating a blown fuse.

Mr. George H. Hill said he thought that it would be realized that the difficulty with a cylinder controller was not the result of the controller not being properly designed for its duty as that existed heretofore, but due to the increase in the severity of the conditions. Heretofore the voltage of most of these systems had very accommodatingly receded and gone down to small amounts when there was a short circuit, which is of great assistance to the controller, but on large systems the voltage has increased, and it is a hard thing to take care of a spark in the limited space of a platform controller, and that is the whole difficulty. These conditions have approached gradually and there was the further objection of the lack of space under the car which has made it difficult to produce a satisfactory small multiple control equipment. The chief necessity, aside from efficiency of apparatus, is a little more room in which to break the arc, and the car equipments in city service have not been of sufficient size to accommodate the multiple unit system which was developed originally for systems employing larger cars. The manufacturing companies are not standing idly in the matter, but are taking steps to take care of the conditions as they exist at the present time; the size of cars for use on city lines is gradually increasing, and that would help matters out.

The multiple unit apparatus has been proven to be the real solution for handling heavy equipments, and not only heavy equipments but equipments on heavy tied-in systems with heavy feeders where the voltage is high and there is no help from the line drop.

Mr. J. S. Doyle, of New York, stated that the maintenance cost was in favor of the multiple unit system.

Mr. R. C. Taylor, of Brooklyn, thought in the discussion of the controller question, one of the principal factors was overlooked—the multiple unit control was being mixed up with the drum control. The multiple unit controller, however, could be the drum controller or contact, or any other, provided it is big enough to do the work. All that was the matter with the controller at the present time is that it is not big enough for the work. He thought the operating men who were in charge of the equipment should create a demand for a good controller and it would be supplied. He thought the controller should be put under the car.

Mr. Edward Taylor, of Brooklyn, stated that they had built and were operating in Brooklyn a multiple unit system of control. The main thing in designing this controller was to make it simple and yet effective; to make it so simple that the ordinary electricians and shop foremen could understand it and maintain it. The main principle of the apparatus was a simple solenoid, which is operated by a rapid switch which notched the controller up a step at a time. The speed of this was affected by a throttling device or limit set at any predetermined point. In connection with the controller the circuit breaker was operated automatically, as was also the air brake equipment, making an automatic air out of the straight air system. The point was borne in mind in designing this to have the normal position safety, so that in case any connections were broken or any of the circuits interrupted the apparatus would go to the stop position. All parts were released by springs or by gravity, not depending on electric circuits. For instance, if the car were running along with the controller up and the brakes off, and the pole came off, the controller would be running off, circuit breaker dropped out, and brakes applied. This feature would save, particularly, a great deal of controller wiring and suspension troubles. An original device was also used in connection with the operation of the magnets. Heavy currents were used at the start to insure a strong pull on the magnets. Later, when the magnets were in operation, high resistance was automatically put in circuit which reduced the running current to as low as one-tenth of an ampere on the entire apparatus. A special feature of a controller of this sort was that cars could be run singly in the city or congested districts and operated together over the suburban lines. By placing a control apparatus on the trailers it would make it possible to operate from the trailer or motor, thereby not necessitating changing the trailer around the motor at the end of the line. The experimental apparatus had cost considerable to construct, nevertheless they estimate if they were building a large quantity, this controller could be built with the money that could be realized by taking off the other apparatus and the lesser amount of wiring which would be used.

Mr. Olds stated that as he understood it, this K-11 controller was placed under the car, a two-motor equipment. He thought that the work was along the right lines. Such a controller must necessarily reduce the number of parts and consequently reduce the expense, and he believed that the apparatus as described had considerable merit.

On motion of Mr. Olds a vote of thanks was passed to the authors of the papers presented at the meeting, after which the meeting adjourned.

AMERICAN STREET RAILWAY ASSOCIATION.

President, W. Caryl Ely, Buffalo, N. Y.

First Vice-President, Elwin C. Foster, President, New Orleans Railway & Lighting Co.

Second Vice-President, John I. Beggs, President, Milwaukee Electric Railway & Light Co. and President United Railways Co., of St. Louis.

Third Vice-President, Richard McCulloch, Assistant General Manager, United Railways Co., of St. Louis.

Secretary and Treasurer, T. C. Penington, Treasurer, Chicago City Railway Co.

Executive Committee: The President, the Vice-Presidents and—

W. G. Ross, President, Street Railway Accountants' Association.

C. F. Baker, President, American Railway Mechanical and Electrical Association.

J. J. Stanley, General Manager, Cleveland Electrical Railway Co.

Howard F. Grant, Manager, Seattle Electric Co.

C. G. Goodrich, Vice-President, Twin City Rapid Transit Co.

Frank G. Jones, Vice-President, Memphis Street Railway Co.

W. E. Harrington, J. G. White & Co., New York.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

President, W. G. Ross, Managing Director, Montreal Street Railway Co.

First Vice-President, Frank R. Henry, Auditor, United Railways Co., St. Louis, Mo.

Second Vice-President, Isaac McQuilkin, Comptroller, Indiana Union Traction Co.

Third Vice-President, J. W. Lester, Treasurer, Worcester Consolidated Street Railway Co.

Secretary-Treasurer, Elmer M. White, Assistant Secetary and Treasurer, Birmingham Railway, Light & Power Co.

Executive Committee: The Officers and—

F. E. Smith, Auditor, Chicago Union Traction Co.

G. B. Willcutt, Secretary, United Railroads of San Francisco.

A. L. Linn, jr., General Manager, Fairmont (W. Va.) & Clarksburg Traction Co.

P. S. Young, Comptroller Public Service Corporation of New Jersey.

AMERICAN RAILWAY MECHANICAL AND ELECTRICAL ASSOCIATION.

President, C. F. Baker, Superintendent, Motive Power and Machinery, Boston Elevated Ry.

First Vice-President, H. H. Adams, Superintendent of Shops, United Railways & Electric Co., Baltimore.

Second Vice-President, John Millar, Chicago.

Third Vice-President, Fred G. Simmons, Superintendent Construction and Maintenance of Way, Milwaukee Electric Railway & Light Co.

Secretary and Treasurer, S. Walter Mower, Detroit United Ry.

Executive Committee: The Officers and—

OFFICERS OF THE AMERICAN ASSOCIATION OF STREET RAILWAY CLAIM AGENTS.

E. W. O'CONNOR,
Vice President

W. A. DIBBS,
President.

[illegible]

W. H. RENAUD, JR

[illegible]

D. F. Carver, Superintendent, Rochester Railway Co.

J. S. Doyle, Superintendent of Car Equipment, Interborough Rapid Transit Co., New York.

E. W. Olds, Milwaukee Electric Railway & Light Co.

W. H. McAloney, Superintendent of Rolling Stock, Denver City Tramway Co.

AMERICAN ASSOCIATION OF STREET RAILWAY CLAIM AGENTS.

President, W. A. Dibbs, Superintendent of Claims, Empire State Surety Co.

Vice-President, E. W. O'Connor, Claim Adjuster, Savannah Electric Co.

Secretary-Treasurer, Benjamin B. Davis, Claim Adjuster, Columbus (O.) Railway & Light Co.

Executive Committee: The Officers and—

W. H. Renaud, jr., Claim Agent, New Orleans Railway & Light Co.

J. P. Feeney, Claim Agent, Public Service Corporation of New Jersey.

AMERICAN STREET RAILWAY MANUFACTURERS' ASSOCIATION.

Chairman, Daniel M. Brady, President, Brady Brass Co., New York.

Secretary, George Keegan, 13-21 Park Row, New York.

Executive Committee: The Chairman and—

John A. Brill, Vice-President, J. G. Brill Co., Philadelphia.

William J. Cooke, Vice-President, McGuire-Cummings Manufacturing Co., Chicago.

Fred S. Kenfield, President, Kenfield Publishing Co., Chicago.

Charles S. King, Secretary, Ohio Brass Co., Mansfield, O.

George J. Kobusch, President, St. Louis Car Co., St. Louis.

Charles C. Pierce, Manager Railway Department, General Electric Co., Boston.

Howard F. Martin, General Manager of Sales, Pennsylvania Steel Co., Philadelphia.

James H. McGraw, President, McGraw Publishing Co., New York.

John W. Nute, President, St. Louis Car Wheel Co., St. Louis.

E. H. Baker, Galena Signal Oil Co.

Frank C. Randall, Manager New York Office, Allis-Chalmers Co.

Newcomb Carlton, Fourth Vice-President, Westinghouse Electric & Manufacturing Co., Pittsburg.

William Wharton, jr., President, Wm. Wharton, Jr., & Co., Inc., Philadelphia.

E. M. Williams, Manager Street Railway Department, Sherwin-Williams Co., Cleveland.

W. A. DIBBS.

Mr. W. A. Dibbs, president of the American Association of Street Railway Claim Agents, is superintendent of the claim department of the Empire State Surety Co., of New York, having resigned the position of claim agent of the Metropolitan Street Railway Co. since his election to the presidency of the association. Mr. Dibbs was born in New York City 31 years ago, received a common school education, and entered the mercantile business, where he was for some time employed as traveling salesman for a wholesale silk house. Having a liking for railroad work, Mr. Dibbbs entered the service of the Long Island Railroad in its legal department, where he continued until its absorption, so far as claims were concerned, by a casualty company. Mr. Dibbs then secured a position with the Metropolitan Street Railway Co., serving as an investigator and adjuster for about three years, when he was appointed claim agent of the company, in which capacity he has served for ten years. Mr. Dibbs was largely instrumental in promoting and organizing the Claim Agents' Association at St. Louis last year and is its first president.

The motive power department of the Philadelphia Rapid Transit Co. announces that it will gladly welcome all delegates who desire to visit the generating and sub-stations of the company throughout the city.

DAILY STREET RAILWAY REVIEW

PUBLISHED DAILY BY THE

KENFIELD PUBLISHING CO.,

1332-1338 Cherry Street, Philadelphia, Pa.

BRANCH OFFICES:

Chicago—45-47 Plymouth Court.

New York 39 Cortlandt Street. Cleveland 302 Electric Building.

London—82 Fleet Street.

SUBSCRIPTION AGENCIES:

Austria, Vienna -Lehmann & Wentzel, Karntnerstrasse.

France, Paris Boyveau & Chevillet, Libraire Etrangere, Rue de la Banque.

Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.

New South Wales, Sydney Turner & Henderson, 16 and 18 Hunter Street.

Queensland (South), Brisbane—Gordon & Cotch.

Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

THE DAILY STREET RAILWAY REVIEW is published each year on the occasion of the meetings of the American Street Railway Association, the Street Railway Accountants' Association of America, and the American Railway Mechanical and Electrical Association, and contains the convention reports. This publication is separate from the *Street Railway Review*, published monthly at Chicago, Ill., but is in its nature supplementary thereto.

SUBSCRIPTION RATES:

In the United States, Canada or Mexico:

DAILY STREET RAILWAY REVIEW, (four or more issues)..$ .40
Street Railway Review (12 monthly issues) 1.75
Combined Subscription (DAILY REVIEW and *Review*) 2.00

In All Other Countries :

DAILY STREET RAILWAY REVIEW (four or more issues) .. .40
Street Railway Review (12 monthly issues) 2.75
Combined Subscription (DAILY REVIEW and *Review*) 3.00

Application made for entry as second class matter.

7TH YEAR No. 1 TUESDAY, SEPT. 26, 1905. SERIAL NO. { VOL. XV. No. 9 A

SAVE THE "DAILY REVIEW."

Special attention is called to the fact that the "Daily Street Railway Review," published at Philadelphia, September 26th to 29th inclusive, this being the seventh successive year, is in its nature supplementary to the "Street Railway Review" published monthly. Notwithstanding the "Daily" is a separate publication it should be bound with the monthly for convenient reference and in order to facilitate this, the pages of the "Daily" are given numbers consecutive with those of the next preceding monthly issue. Reference is again made to this fact for the reason that very frequently the "Daily" is entirely overlooked by subscribers when sending the "Review" to be bound, and as soon as the binder discovers that 150 pages or so are missing we receive a request to furnish the missing numbers, which unfortunately we are not always able to do.

COMPLIMENTARY STENOGRAPHY SERVICE.

Knowing that all the delegates are busy men when at home, and doubtless a great number of them may find it difficult to throw off business cares entirely while at the convention, the Railway Journal Lubricating Co. has arranged to give complimentary stenography service to the members of the three associations. The company has had suitable stationery printed, embodying the names of the three associations; stamped envelopes are provided, with a return card to the booth of the Railway Journal Lubricating Co., and the services of a competent stenographer have been secured. This service is entirely free and all delegates are welcome to the courtesy extended.

DEMONSTRATIONS OF THERMIT WELDING.

The Goldschmidt-Thermit Co., 43 to 49 Exchange Place, New York City, is displaying in space 13, section C, various classes of welds, such as are applied chiefly to street railway work in the form of track welding and rail bonding. The company also has an outside space where actual demonstrations will be made daily at 4 p. m., showing the application of the thermit process for welding street railway rails and also for bonding third rail installations. The company is represented at the convention by E. Stutz, vice-president and treasurer, and R. F. Kelker jr., engineer.

"SOUVENIR FROM NATURE."

Delegates, supplymen and accompanying ladies visiting the convention are very cordially invited to call at space 19, section D, each morning during the convention to receive a "souvenir from nature."

BUCKEYE ENGINE CO.

FORMER CONVENTIONS A. R. M. & E. A.

A list of the meeting places of the American Railway Mechanical & Electrical Association and of the presiding officers is as follows:

Saratoga Springs	Thomas Farmer, President	1903
St. Louis	E. W. Olds, President	1904
Philadelphia	C. F. Baker, President	1905

RULES REGARDING REDUCED RATES TO THE CONVENTION.

For the convention of the American Street Railway Association the railroads have granted rates of fare and one-third on the certificate plan, that is, full fare going and on the presentation of 100 certificates, one-third fare returning. It is necessary that a certificate be secured from the ticket agent when the ticket is purchased; the certificate is then deposited with the clerk at the registration booth immediately on arrival at Philadelphia, where it is signed by the secretary and validated by the special agents of the railroads. A fee of 25 cents is charged on each certificate, which must be paid when the certificate is deposited. Unless the certificate is validated by the special agent not later than September 29th the benefit of one-third fare on the return journey cannot be had. One hundred certificates must be presented to secure the reduction in fare. Tickets to Philadelphia might be secured on September 21st, but not later than September 27th. Certificates for the return trip will be ready September 29th although delegates may remain until October 4th before returning home. No stop-over is allowed on the return journey.

MR. KEEGAN ENTERTAINS.

One of the most enjoyable functions which marked the opening days of the convention was the elaborate breakfast given by Mr. George Keegan, secretary of the Manufacturers' Association, on Sunday morning at the Bellevue-Stratford. Among the guests were Chairman Brady, Chairman Peirce and Chairman Baker. There were also other guests, all of whom greatly enjoyed the occasion.

THE EXHIBITS.

As Mr. Ely so aptly pointed out in his opening remarks before the American Railway Mechanical and Electrical Association, great credit is due Mr. Brady and his colleagues of the Manufacturers' Association for the general and detail arrangements and execution of the placing of the manufacturers' exhibit. Early yesterday afternoon nearly all the booths were decorated and the displays in place. The buildings are well policed and a number of fire guards are on watch about the floors. The general arrangement of the sections and aisles is such that many exhibits may be viewed from two sides. The general arrangement also permits of a visitor desiring to inspect the exhibits starting at the entrance and passing all the booths in turn without doubling on his course. This has its advantages when the aisles are crowded. The buildings are well lighted by arc lights over the aisles, which, with the illuminated signs and decorations in the booths, serve to brightly illuminate all parts of the exhibit space.

Mr. Brady and his associates have completed these and other detail arrangements in a manner which reflects greatest credit to their ability and energy.

CHARLES F. BAKER.

Mr. Charles F. Baker, president of the American Railway Mechanical & Electrical Association, was born in Vermont, in 1855. Mr. Baker's early days were spent in Milwaukee, Wis., where he entered steam railroad service in 1871. His experience in the shops and mechanical department of railroads was quite extensive, and in 1880 he entered the service of the E. P. Allis Co., where he was in charge of special work. In 1884, Mr. Baker left the Allis Co. to go with the Pittsburg Railway Co., resigning in 1893 to become master mechanic of the West End Street Railway Co., of

Boston. At the time of the consolidation of the Boston properties and the organization of the Boston Elevated Railway Co., Mr. Baker was appointed superintendent of motive power and machinery and has since continued in charge of the mechanical and electrical departments, power houses, shops and rolling stock. Mr. Baker has always been a very active member of the mechanical and electrical association.

GENERAL ELECTRIC CO. REPRESENTATIVES.

The General Electric Co. has a large exhibit of its station apparatus in section J, including its latest designed turbines, railway motors, etc. Of special interest are the two GE-69 railway motors (200 h. p. each) loaned by the Interborough Rapid Transit Co. Motor No. 1 has been in regular service since Oct. 2, 1903, and has made a total of 45,248 miles to date, while motor No. 2 has been in regular service since Dec. 10, 1903, and has made a total of 53,005 miles. These motors and their mileage are typical of the performance of 418 GE-69 motors in regular operation on this company's lines. The company also shows a complete alternating current car equipment, ten of which have been ordered for the new Toledo & Chicago interurban railway. These equipments consist of four 75-h. p. single-phase motors, for operation on both alternating and direct current.

The company has a very large representation at the convention and among the early arrivals are included the following gentlemen: Gen. Eugene Giffin, first vice-president; J. R. Lovejoy, manager railway department; E. D. Mullin, manager Philadelphia office: C. C. Peirce and C. E. Sprague, Boston; S. W. Trewick, L. R Pomeroy, F. H. Larken and H. W. Clapp, New York City; R. E. Moore, Philadelphia; J. C. Calisch, Buffalo; M. M. Corbin, Cinnati; E. H. Ginn, Atlanta; George D. Rosenthal, St. Louis; J. H. Livsey, Detroit; H. L. Monroe and J. W. Buell, Chicago, and the following from the Schenectady office: J. G. Barry, W. B. Potter, A. H. Armstrong, E. D. Priest, F. E. Case, F. H. Gale, C. E. Barry, R. B. Beale, G. H. Hill, J. S. Pevear, W. G. Carey and E. M. Kinney. W. J. Clark, B. E. Sunny, and J. J. Mahoney are also here.

BULLARD AUTOMATIC WRENCH CO.

The Bullard Automatic Wrench is attracting considerable attention among master mechanics and tool men. This is an entirely original device manufactured by the Bullard Automatic Wrench Co., of Providence, R. I. The wrench is so designed that the grip that one would use on a pipe to turn it by hand is applied mechanically to this wrench. This grip tends to turn the pipe without any crushing strain, and in its application to the wrench all the pressure on the handle goes to turn the pipe. The wrench is made in several sizes and may be seen at the companies exhibit, space 28, section D. F. C. Thornley, manager, E. C. Watson, superintendent, and W. H. Thornley, are representing the company at the convention.

Among the early arrivals at the convention are the representatives of the Peerless Rubber Co., W. J. Courtney, F. O. Donnell and J. L. McGilvray. The company has a full line of its products on exhibit at space 8, section B.

WHARTON IMPROVED SWITCH.

Outside the southeast door of the convention hall Wm. Wharton, Jr., & Co., Inc., of Philadelphia, has a working exhibit of its "Wharton Improved Switch" for steam and electric railroads with standard M. C. B. or wider wheel treads. This is an unbroken main line switch with a special guard rail for clearing the switch for the main line, should it be left set for the siding and approached by a train from the trailing side. The switch exhibited forms a portion of the freight siding leading from the railway tracks into the convention building. Operating over this switch as a part of the exhibit is a large Pennsylvania R. R. freight locomotive with two blind and two flanged drivers on a side, thus increasing the effectiveness of the exhibit by actual demonstration. In the same track near this switch is a Wharton steam-electric crossing designed with the steam rail and guard all in one casting of this company's special manganese-steel.

GOULD STORAGE BATTERY CO.

The exhibit of the Gould Storage Battery Co. occupies space 4, section I, and besides the large size Gould lead battery, includes a display of various types of plates for stationary and vehicle batteries. A number of photographs of recent installations in the electric railway field add materially to the exhibit while bulletin No. [illegible], describing the recent battery installation at Topeka, Kans., will be found of considerable interest. The company is represented by D. W. W[illegible] and W. S. Gould.

ELMER P. MORRIS CO.

The Elmer P. Morris Co., 15 Cortlandt St., New York City, has an exhibit of electric railway material and supplies at space 9, section N, including commutators, overhead material, trolley poles, etc. The company is introducing a new material called "Delo," (which is manufactured by a secret process) for all kinds of bearings. The metal is much lighter than brass or copper and it is claimed that an experience of four years has proved a much longer life for this metal. Those in atttendance representing the company are Elmer P. Morris, president, E. D. Hinman and W. V. Sweeten.

ELECTRIC WELDING IN CAMDEN, N. J.

H. F. G. Kleinschmidt, supt. track welding department of the Lorain Steel Co., has his force of assistants at work in Camden, N. J., electrically welding the rail joints of the street railway in that city. This work is being done with the latest equipment for this purpose. In order that all delegates to the convention who are interested in electric welding may see this process in operation an automobile has been provided to take such delegates direct from the convention hall to Camden, which is just across the Delaware River, east of Philadelphia.

REGISTRATION.

The work of the Finance and the Entertainment Committees has been executed in a most commendable way under the direction of their chairmen, Mr. E. H. Baker of the Finance Committee, and Mr. C. C. Peirce of the Entertainment Committee. There are always a vast number of details in the preliminary work of these committees which if not taken account of early cause vexing delays at registration time. The ease and rapidity with which the delegates were registered testifies to the completeness of the preliminary arrangements for this work which has been so thoroughly taken in hand and executed by the chairmen and the working members of these two committees.

The badges for members of the different associations and the lady guests are especially neat in design. Each badge has a numbered tag clasped to the ribbon by which number the delegate entitled to the particular badge is registered in the index of delegates. It is announced that these badges, which are of different colors for members of the different associations, and special admission cards will alone admit visitors to the various entertainments and meeting places.

PETER SMITH HEATER CO.

The Peter Smith Heater Co., of Detroit, Mich., is exhibiting a radical improvement in hot water heaters, the invention of Mr. W. P. Cosper, general sales agent for the Garton-Daniels Co., which greatly increases the efficiency of this well-known heater. The demonstration of hot water circulation through a transparent glass pipe is both interesting and instructive to all who witness it. Whether interested or not, members and guests of the association will find the time well spent by a visit to this exhibit, as it represents a remarkable departure from the beaten path.

Mr. Elmer M. White, secretary-treasurer of the Accountants Association is at the Walton. The executive committee of the Accountants Association will meet at the Hotel Walton at 3 o'clock this afternoon.

LUMEN BEARING CO.

Samples of "Lumen" and "Alpha" bronze castings and bearings and "Ideal" trolley wheels are being exhibited by the Lumen Bearing Co., of Buffalo, in space 6, section K, where the company has an attractive booth. A large mounted eagle with American and Canadian flags crossed in the background, representing the company's Buffalo and Toronto factories, adorns the wall of the booth. This eagle is a magnificent bird, measuring nearly seven feet from tip to tip, and is attracting a great deal of attention.

Two articles of especial interest that are being exhibited by this company are its new 6-in. "Ideal" trolley wheel, which weighs fully a pound less than the ordinary cast copper wheel of the same size, and samples of Lumen bronze axle bearings cast in a metal mold. This latter may be placed in service without any finish whatever, and the fact that the cost of finishing is eliminated and a saving in the weight of the casting is effected, recommends this product to the prospective purchaser. The company is represented at the convention by E. P. Sharp, of the Buffalo office, and H. R. Forbes, New York representative.

MODERN PACKINGS.

The United States Metallic Packing Co., 429 North 13th St., Philadelphia, which has been manufacturing metallic rod packings for a quarter of a century and which makes an engineering specialty of packing valve stems and piston rods on steam engines, etc., for all pressures and temperatures of steam, has designed its class No. 1 packing for marine and stationary engines.

This is a double packing, the inner packing being composed of one set of babbitt metal rings, which are separated from the rest of the packing by a dividing piece; outside of this is a second set of packing. Should water or steam leak through the first set of rings it is caught by the second set and can be drained off, and should the first set of rings wear out the second set is on the rod ready at all times. The principle of this packing is that soft metal rings are forced by the steam pressure into a vibrating cup and against the rod or stem. The soft metal packing rings, which come in contact with the rod and do the packing, are cut in halves with a small open space between them when first applied so that they may conform to the surface of the rod. When they have done this the open space will be closed up and in the condition will last four or five times as long as they would if continually cut so as to stand apart. The success of this packing is due to its flexibility and automatic adjustment and to the fact that all packings are designed to suit the work for which they are to be used. The company advises no difficulty has been experienced in packing the highest pressures, in one case air pressure of 2,500 lb. per sq. in. having been successfully packed. Packings are also being furnished for use on double-acting gas engines and also for use with superheated steam.

The company is being represented here by Messrs. Vissering, Butler, King and Curtiss, who are also representing the American Locomotive Sander Co.

THE STAR BRASS WORKS.

The Star Brass Works, Kalamazoo, Mich., manufacturer and jobber of street railway supplies, has on exhibit a complete line of its trolley wheels and harps and street car fenders, including its new "Champion" street car fender, which was described and illustrated in the "Review" for August, page 511. The fittings of this fender are adjustable to accommodate different styles of cars and its construction and operation are so simple that it requires but little attention after being installed, features which appeal to the manager as well as the motormen. F. P. Crockett, O. P. Johnson and H. P Eskelsen are representing the company at the convention.

THE DUFF MANUFACTURING CO.

The Duff Manufacturing Co., of Allegheny, Pa., is occupying space No. 8, section A, of the exhibit hall, where it shows a large number of its products more particularly adapted to electric railway work. The company is the exclusive manufacturer of the well-known Barrett patent compound lever jacks, including track jacks, automatic lowering jacks, differential screw jacks, oil well jacks, pipe forcing jacks and automobile jacks; also motor armature lifts and traversing jack bases. Barrett motor armature lifts are shown in two styles; one having a jack mounted on a truck, the other having the wheel and screw movement and having ball bearing throughout.

The company is showing for the first time at a street railway convention, the Duff roller bearing screw jacks, which it states are displacing hydraulic jacks and other forms of screw jacks for all classes of lifting. This is one of the most important jacks that has been placed on the market for a number of years, the advantages claimed for which are economical operation, reliability and durability. These are shown in a large number of sizes up to capacities of 70 tons, in addition to some 30 sizes of the regular Barrett jacks. The company's representatives at the convention are T. A. McGinley, George A. Edgin and Charles A. Foster.

HALE & KILBURN EXHIBIT.

The Hale & Kilburn Manufacturing Co. has its exhibit immediately adjoining the post office and telephone exchange. The booth has an attractive background, decorated in dark olive and red, with the signs in gold, the whole being illuminated by numerous electric bulbs.

The exhibit proper comprises a full line of the well-known Hale & Kilburn reversible and walkover seats, upholstered in all the various coverings, such as rattan, mohair plush, real leather, imitation leather, etc. There are seats with armrests, and also without; others show the company's patent grip handle and bronze backband features; also the patent single and double automatic footrests, and oval-shape base forming the aisle end support of the seat.

There are shown a number of new things in the car seat line, among them being one or two styles of revolving chairs suitable for parlor car or parlor compartment service on electric lines.

LORD ELECTRIC CO.

Among convention exhibitors is the Lord Electric Co., of Boston and New York, which is not a new company but an old company seeking new business in a new field. In entering the field of railway supply manufacturers and contractors the Lord Electric Co. is well equipped with an able and experienced engineering and business staff and has a factory thoroughly equipped for the manufacture of rail bonds, lightning arresters and other railway specialties.

The company's plan of taking contracts complete to furnish and install rail bonds on a large scale met with instant favor among railway managers as is evidenced by the many large and important contracts it has received during the year. This somewhat novel method of handling rail bond installations relieves the railway companies of a great deal of responsibility and detail work and assures them of the work being done by men who are thoroughly skilled in their particular line.

In taking over the Shaw non-arcing lightning arresters and static dischargers the Lord Electric Co. has made many changes and improvements, completing the entire line of instruments for direct current and alternating current work.

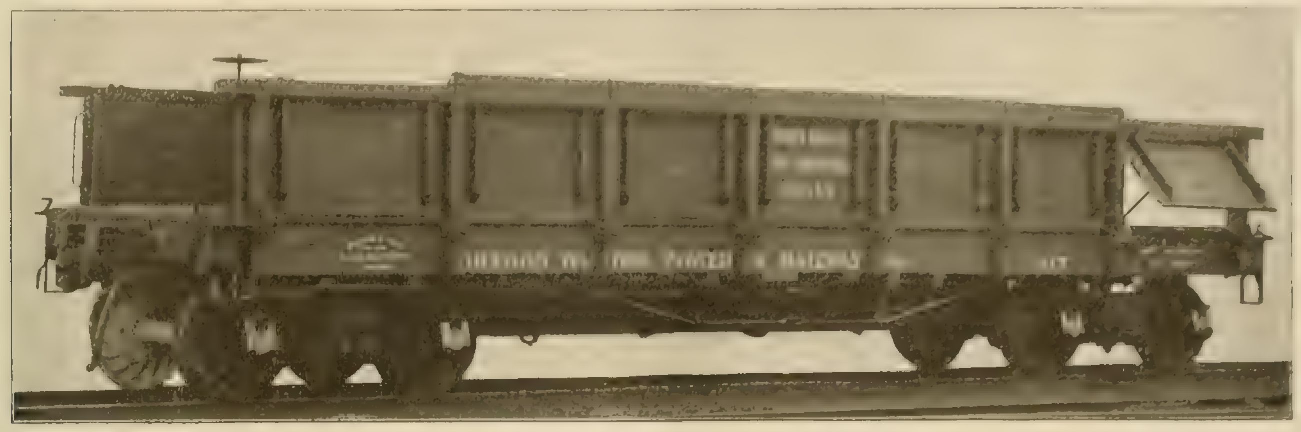
Bulletins C and D which are being distributed at the convention illustrate and describe lightning arresters and rail bonds, giving also much valuable information as to their installation. The Lord Electric Co. is now negotiating for other patented railway specialties with a view of manufacturing and marketing them.

PITTSBURG EMPLOYES ENTERTAINED.

The feeling of good fellowship which exists between the Pittsburg Railways Co. and its employes was demonstrated on the evening of September 14th, when an enjoyable social meeting of the various relief associations of the Railways company was held at Duquesne Garden. Officials of the company together with the inspectors, dispatchers, division superintendents and the officers of the relief associations joined in the festivities and for over three hours forgot the troubles of the trolley. Over 250 persons sat down to the elaborate dinner which opened the entertainment. During the dinner the guests were entertained by orchestral selections, after which followed a vaudeville show by professional talent, during which photographic reproductions of the officers of the company who come into contact with the men were thrown on a screen by a stereopticon. Following this were a number of comical moving pictures. The meeting closed with short addresses on live topics by officials of the company and members of the relief associations. Employer and employe went to their homes feeling that another link in the bond of friendship had been forged and all present looked forward to another opportunity to get together. Mr. A. S. McSwigan, manager of amusements of the company, acted as stage manager, musical director and toastmaster.

RODGER BALLAST CARS.

The Rodger Ballast Car Co. has devoted a great deal of attention to the modifications of the designs of certain of its standard cars with a view to making them especially adapted for use on electric and street railways, where owing to small clearances and sharp curves it is not practicable to operate the standard cars. In this design the features of the standard Rodger car were retained, except that the car is not convertible. The smaller car is 12 ft. long over end sills, 8 ft. 6 in. wide and 7 ft. 1 in. high above the rail, and has a capacity of 9 cu. yd. when level full or with a 9-in. heap, of 11½ cu. yd.



RODGER CONVERTIBLE BALLAST CAR.

The car illustrated is of the standard convertible type and is recommended for use on electric railways where conditions will permit, being capable of more varied uses in regular service. Railway companies contemplating construction work as a rule give too little attention to the saving which can be effected by the use of especially designed apparatus and give too much consideration to the increased first cost which is incidental to equipment designed for a special purpose.

The position of the Rodger Ballast Car Co. is that any railway can well afford to purchase ballast cars because even if there is so little as one mile of track to be ballasted, the use of a properly designed car will effect savings in labor that will more than half pay for the car, which is then available for use as a freight or emergency car. The principal savings effected by the use of the Rodger car are in the unloading of the car and the distribution of the ballasting material. The cost of unloading from a flat car by shoveling is not less than 4 cents per cu. yd. and when the ballast is at the side of the track, as is the case when a flat car is used, to transfer this material where it belongs would cost 10 cents per yd. more, making a total difference in the cost of placing the ballast of 14 cents per yd., which means from $200 to $400 per mile of track, according to the depth of ballast provided, 3,000 yd. per mile being considered high-class. Where a large amount of work is under way and steam shovels are used for loading the cars a minor saving is effected because the rapidity with which a train of Rodger cars can be loaded enables the steam shovel to be kept at work more steadily and its output thereby increased.

H. W. JOHNS-MANVILLE EXHIBIT.

The H. W. Johns-Manville Co. is well represented. Its exhibit is very attractively arranged, and includes a complete line of overhead line material, a number of new devices of high potential design that have recently been got out, a full line of "Noark" standard and National Electric Code standard fuses, blocks, service and sub-way boxes and accessories, and a diversified line of molded insulating materials, consisting of vulcabeston, "Monarch" and molded mica compounds. In addition to this the exhibit includes some of the well known asbestos and magnesia pipe coverings, asbestos roofing, asbestos, vulcabeston and "Kearsarge" gaskets and packings. Among the products which attract particular attention are "Transite" asbestos fire proof lumber and "Electrobestos" fire proof insulation. The two latter materials are coming into very extensive use in the construction of electric railway cars, particularly in New York City where all the details of the present construction of cars have been very carefully worked out. The [illegible] a very complete catalogue devoted to these [illegible]. The [illegible] of high voltage insulators also attracts considerable attention.

The exhibit is in charge of J. W. Perry, manager of the electrical department, New York, and the following gentlemen in addition are in attendance: H. N. Manville, secretary, New York; T. T. Lyman, general sales manager, New York; D. T. Dickson, manager Philadelphia branch; H. M. Voorhis, manager electrical department, Philadelphia office; H. M. Clymer, Philadelphia office; J. E. Meek, general representative, New York, and C. N. Manfred, manager advertising department, New York.

WELFARE WORK.

Mr. H. F. J. Porter has opened an office at No. 1 Madison Ave., New York, thus offering his services in consultation on general manufacturing and mechanical engineering questions relating to industrial betterment, and for promoting "welfare work" which is now recognized as an important adjunct to systems employing large numbers of men. Mr. Porter has had an extended engineering experience with the New Jersey Steel & Iron Co., Columbia University, Cary & Moen Steel & Iron Works, World's Columbian Exposition, Bethlehem Iron Co. and the Westinghouse companies. He is a member of the American Society of Mechanical Engineers, the American Society for Testing Materials, the American Institute of Social Service, the Institute of Political and Social Science, the Franklin Institute, etc.

WESTERN ELECTRIC AND D. & W. FUSE COS.

The Western Electric Co., of New York, and the D. & W. Fuse Co., of Providence, R. I., have united in exhibiting their products at spaces 15 and 16, section F. The former is displaying a full line of railway overhead material, and the latter a full line of fuses of various types, cut-out boxes, transformer cut-outs, service switches, etc. Special demonstrations of the usefulness and advantages of "Deltabeston" magnet wire will be made at the booth daily and all purchasing agents and master mechanics are cordially invited to witness these demonstrations. The Western Electric Co. is represented by R. H. Harper, of the New York house; F. D. Killon, of the Chicago house, and F. C. Jaeger, of Philadelphia. The D. & W. Fuse Co. representatives are W. S. Sisson and C. F. Harmon.

REINFORCED CONCRETE POWER HOUSE.

J. G. White & Co., New York, have secured the contract for constructing the new reinforced concrete power house of the Waltham Gas Light Co., of Waltham, Mass. The entire building is to be of reinforced concrete construction, no exposed steel frame work being used. The design calls for very large windows, thus insuring ample light and ventilation. Steam will be supplied by four 350-h.p. Stirling boilers, set in batteries of two each, an 8 ft. 6 in. by 180 ft. reinforced concrete stack furnishing natural draft. Suspended coal bunkers will occupy the upper half of the boiler room, and will be served by coal conveyors. Chutes from the bunkers, operated by valves from the boiler room floor, will feed the coal to the boilers. Two 500-kw. Parsons turbo-generators direct connected to Westinghouse dynamos will form the main engine equipment.

Exhibitors at the Convention

American Railway Supply Co. 7, C.
Allis-Chalmers Co. 23-28, C.
American Brake Shoe & Foundry Co. 19-20, I.
Atlas Railway Supply Co. 30, D.
American Locomotive Sander Co. 23, I.
American Steel & Wire Co. 5-6, E.
Adams & Westlake Co. 11, I.
American Car & Foundry Co. Track.
Albert & J. M. Anderson Co. 17, L.
American Automatic Switch & Frog Co. 29, L.
American Book Bracket Co. 31, L.
Acme Automatic Street Indicating Co. 7, N.
Brady Brass Co. 29-32, C.
Baldwin Locomotive Works, 12-13, I.
Blake Signal Co. 22, I.
Carnegie Steel Co. 7-8, E.
Continuous Rail Joint Co. 12-14-16, C.
Crouse-Hinds & Co. 1-3, C.
Creaghead Engineering Co. 10, L.
Coe. (W. H.) Manufacturing Co. 26b, I.
Columbia Machine Works & M. I. Co. 24, I.
Consolidated Car Fender Co. 9-10, B.
Cook's Sons, Adam. 28a, I.
Clark Electric & Manufacturing Co. 30b, I.
Coin Counting Machine Co. 11, L.
Duff Manufacturing Co. 8, A.
Durkin Controller Handler Co. 14-16, K.
Dearborn Drug Co. 13, F.
Dossert & Co. 8, N.
De Ronde, Frank L. 17, C.
Dilworth-Porter Co. 1, C.
DeWitt Sand Box Co. 10, K

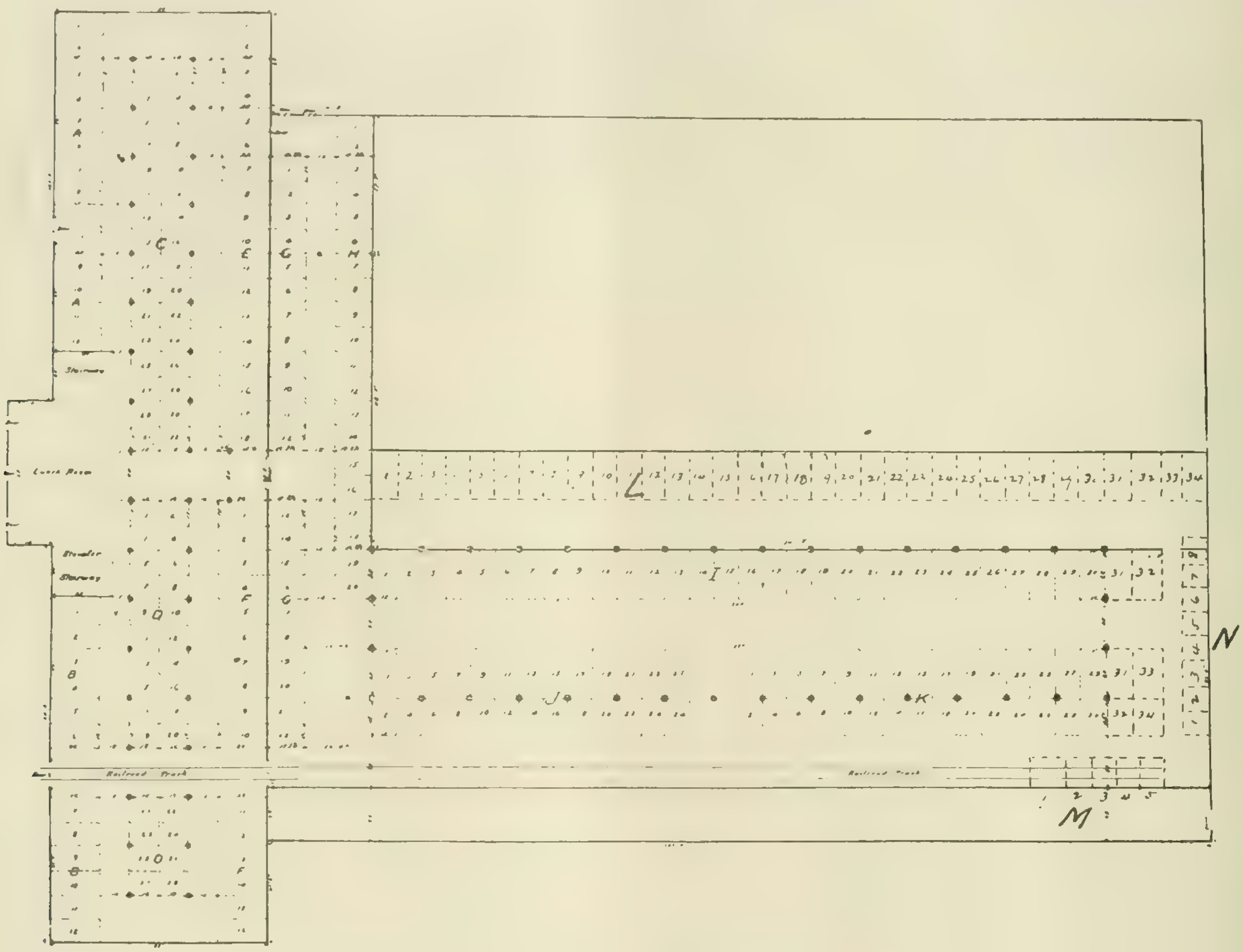


DIAGRAM OF EXHIBIT HALL.

Brown, Harold P. 6-7, L.
Buda Foundry & Manufacturing Co. 4, E.
Brill (J. G.) Company. 4-20 H and Track.
Bullard Automatic Wrench Co. 28, D.
Bliss (E. W.) Co. 23, K.
Benjamin Electric Mfg. Co. 26a, I.
Brown, Irving B & Son. 26, K.
Baldwin & Rowland Switch & Signal Co. 29b, I.
Blanchard Ry. Switch & Signal Co. 31b, I.
Berry Bros., 12, B.
Borgner, Cyrus. 3, M.
Baltimore Waste. 2 C.
Curtain Supply Co. 9-10, A.
Chicago Pneumatic Tool Co. 9-13, K.
Consolidated Car Heating Co. 2-3, E.
Dressel Railway Lamp Co. 1a, C.
Duquesne Steel Foundry Co. 13, L.
Duplicate Transfer & Rebate Co. 4, G.
D. & W. Fuse Co. 15, F.
Dixon Crucible Co. 32, L.
Empire Safety Tread. 10, C.
Edwards Co., O. M. 12, A.
Electric Railway Equipment Co. 22, J.
Electro-Dynamic Co. 26, D.
Eureka Automatic Signal Co. 27, D.
Electric Storage Battery Co. 29-34, K.
Egry Autographic Register Co. 25, D.
Eclipse Railway Supply Co. 20-21, L.
Earl, Charles. 1, M.
Franklin Railway Supply Co. 18, K.

ALLIS-CHALMERS CO.

The Allis-Chalmers Co., Milwaukee, has a very spacious booth in section C, which is fitted up as a reception room. The company is making no exhibit other than a set of handsome photographs of various departments of its works. Many of this company's representatives are among the early arrivals at the convention and include the following:

F. C. Randall, manager New York office; G. B. Foster, manager Chicago office; George H. Berg, manager Boston office; J. W. Murray, manager Pittsburg office; A. H. Whiteside, manager Philadelphia office; G. W. Pulver, manager Buffalo office; W. S. Durand, manager power department; C. L. Marburg, manager railway department, Cincinnati; B. A. Behrend, chief electrical engineer, Cincinnati; David Hall, assistant chief electrical engineer, Cincinnati; Charles E. Lord, patent counsel, Cincinnati; O. C. Buttenfield, sales agent, Philadelphia, and Arthur Warren, manager publicity. The company is distributing a very attractive and appropriate souvenir, the design being that of the Liberty Bell.

WESTINGHOUSE RAILWAY APPARATUS.

The Westinghouse Companies' publishing department has recently published an attractive pamphlet descriptive of Westinghouse railway apparatus, which is being distributed by the Westinghouse Electric & Manufacturing Co. at the convention. The publication consists of some twenty pages and includes descriptions and numerous illustrations of the following products of the company: Westinghouse direct-current railway motors, single-phase alternating-current motors, generators, systems of control, Baldwin-Westinghouse electric locomotives, and various details and repair parts. An attractive half-tone engraving of the main works of the Westinghouse Electric & Manufacturing Co. and the Westinghouse Machine Co. adorns the frontispiece. The publication is issued especially for distribution at the convention.

In the list of the heads of departments of the Philadelphia Rapid Transit Co. as included in the history of that company published in the September issue of the "Review" should have appeared the name of Mr. George B. Taylor, assistant engineer of way. Mr. C. B. Voynow, to whom this title was given, has the title of assistant engineer.

INSULATING COMPOUNDS.

Three standard kinds of insulating compounds are now offered to the trade by the Macon-Evans Varnish Co., Pittsburg, Pa., which is a specialist in the manufacture of insulating materials. Particular attention of the street railway trade is called to these compounds, which are: Macon insulating varnish, a clear liquid; Macon "Electrolac", a black baking insulating compound and paraffine insulating compound, an air drying material for coil insulation. These compounds have been subjected to rigid tests and found to possess the essential properties necessary in such materials. The black paraffine insulating compound is a new material that requires but a short time for air drying. It is stated that this compound retains indefinitely the plastic properties so desirable for street railway work where it is desirable to replace short circuited coils without injuring the insulation of the coils "lifted".

EXHIBIT OF "PEACOCK" BRAKES.

The National Brake Co., manufacturer of the "Peacock" brake, is occupying space 12, section K, in the convention hall, where types A, B and C of "Peacock" brakes are shown.

The "Peacock" brake has met with no small degree of success, due to its low cost of installation and maintenance. The frame is cast into one piece and secured to the car platform with three bolts. The ratio between the gears and between the gear and the drum are such as to give great power at the instant it is required, while the slack is taken up very quickly by means of an eccentrically geared cam when power is not required. The frame and gears are made of malleable iron.

The company is represented at the convention by the following gentlemen, whose headquarters are suites 533, 534 and 535, Bellevue-Stratford Hotel: G. S. Ackley, president and general manager; W. D. Brewster, secretary; F. D. Miller, sales representative; E. C. Rutherford, Canadian representative; J. E. Edwards, New York City office, and W. W. Miller, southwestern representative, with headquarters at Houston, Texas.

SYMINGTON PRODUCTS.

The products of the T. H. Symington Co., Baltimore, Md., which are being exhibited at space 25, section I, are the Symington journal box and Baltimore ball bearings, the latter being manufactured by the Baltimore Railway Specialty Co., but for which the Symington Co. is selling agent.

The principal features of the Symington journal box are the arrangement of the ribbing on the inside to hold the packing in place, and the dust proof lid, both of which attend to eliminate the possibility of a hot box, and also reduces the cost of lubrication and brass wear at least 25 per cent, as shown by actual test. The prime feature of the ball bearings, center and side bearings, is to eliminate friction between truck and car body, thus reducing the motive power necessary to carry cars around curves with consequent wear and tear of flanges and rails, which in many instances causes the rails to spread with expensive results. It has also been found possible in many cases to start a heavy interurban electric car on a sharp curve with the controller in the first notch when the car was equipped with our bearings, where it took full power to start a car equipped with the ordinary center and side bearings.

The company advises it is furnishing its improved bearings for the highest grade car equipment of steam, interurban and street railways that are now being constructed in this country and abroad. It has recently equipped all of the London Underground Railway Co's new railway cars with center and side bearings, and the railway company advises that the bearings absolutely paid for themselves in 60 days, the railway company having made a wattmeter test at its central power station.

THE OHIO BRASS CO. EXHIBIT.

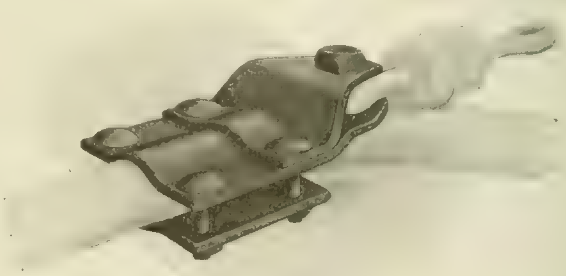
The exhibit of the Ohio Brass Co., Mansfield, O., occupies the larger portion of section D, and is 60 x 24 ft. in size; the space is almost immediately opposite the lunch room in the main exhibition hall and convenient to the stairways and elevators leading to the meeting room of the convention proper on the second floor.

Here the company has a complete and elaborate display of its general line of overhead material, including all styles of pole brackets; in connection with single phase line material, three styles of single phase bracket construction are shown, as well as a full line of Locke Manufacturing Co's. high tension insulators especially suited for single phase work; a number of types of third rail insulators are shown mounted on blocks. The Nichols-Lintern pneumatic air sander is shown in full operation, the Haycox car signal, and the Monarch track cleaner mounted as in operation. The company's steel hose bridges are also shown. Practical demonstrations of installing soldered rail bonds will be given at frequent intervals, as well as having a complete display of bonds already installed in rails.

In addition to its very interesting and instructive exhibit of its products, the Ohio Brass Co. has provided accommodations for visitors, and heartily urges all street railway men and their friends and families to make free use of its space, utilizing it as a meeting place and to deposit wraps and parcels. The following representatives of the company are in attendance: C. K. King, vice-president; A. L. Wilkinson, secretary; A. L. Price, foreign agent; G. A. Mead, electrical engineer; N. M. Garland, F. H. Jameson and R. M. Campbell, of the New York sales office; and E. F. Wickwire, J. E. Slimp and M. P. Wolcott, of the general sales office.

THE KEARNEY CABLE CLAMP.

The Kearney cable clamp, an illustration of which is shown, is designed to supplant the extra joints and fastenings necessary in the ordinary methods of cable suspension at angle poles and dead-ends. Two wrought steel plates with four clamping bolts constitute the device. The two parts of the clamp are designed to fit the surface of the cable and when the nuts on the four bolts joining the two parts are tightened the clamp grips the cable so that the pull is transmitted through the upper plate to a globe strain or similar insulator fastened to the pole at the curve. By the use of two of



KEARNEY CABLE CLAMP.

these clamps, one holding the cable in either direction from an angle pole, the curved portion of the cable between the two clamps may be made short and relieved of any great amount of strain. This method of construction does away with the necessity for serving the heavy cable about an insulator at an angle pole, and then making a joint to continue the cable after it has turned the angle.

The Kearney cable clamp is made in but one size, suitable for cables from No. 0000 to 1,000,000 c. m. cross-section. The manufacturers, W. M. Matthews & Bro., St. Louis, state that a substantial saving in first cost, as well as a more perfect type of line construction can be had by the use of this device. In order to place this clamp upon the market this company offers to prepay the freight on trial orders of 25 or more clamps on condition that they will be paid for if satisfactory, otherwise they are to be returned at the expense of the manufacturer.

THE ATLAS RAILWAY SUPPLY CO.

The Atlas Railway Supply Co., 1523 Manhattan Building, Chicago, is represented at the convention by its president, Mr. J. G. McMichael, and Mr. G. M. Huber. The company has an attractively furnished space, 10x20 ft., where are exhibited samples of its many well-known products, among which may be mentioned "Atlas" rail joints, for T or girder rails, suspended or supported; rail braces of various design, including "Atlas" standard girder brace, used with or without bolts, and the "Atlas" plain brace with and without tie plates; the "Atlas" supported girder rail joint No. 5; "Atlas" primer and "Atlas" surfacer, will take the places of oil or paste wood fillers and lead and oil surfaces; and "Atlas I X L" paints for wood and iron work.

THE STERLING VARNISH CO.

The space in the convention hall occupied by the exhibit of the Sterling Varnish Co., Pittsburg, Pa., is No. 1 of section A. The company is exhibiting street railway motor armature and field coils insulated with "Sterling" extra insulating varnish and "Sterling" black plastic insulator, and finished with "Sterling" black air drying varnish and extra black finishing varnish. Some of these coils are cut into sections to show the penetrating power of the compounds as well as their exceptional elasticity and mechanical strength, oil proofing, etc. Samples of cotton cloth coated with Sterling black plastic insulator and "Sterling" elastic insulating varnish are shown to demonstrate to master mechanics and superintendents what results can be secured from cloth coated with these compounds. These cloths are such as are used for insulating and taping coils, canvas for armature heads, etc.

The company is distributing for the first time among street railway men strips of copper coated with "Sterling" black iron enamel. This material is an exceptional protective coating for iron and steel structures such as bridges, cars, trucks, tanks, iron poles, hand rails, etc. The company also has on hand for distribution a supply of the Sterling Varnish Co's. hand books relating to insulating compounds, their care and manipulation; small samples of the cloths coated with black plastic insulator and elastic insulating varnish, etc.

The exhibit will be in charge of Mr. A. S. King, who is in charge of the company's eastern territory, and Mr. C. L. Cool, in charge of the western territory. Mr. James Todd, president, Dr. Walther Riddle, vice-president, and Mr. Arthur Hartwell, general manager, are in attendance at the convention.

MAYER & ENGLUND AND ALLIES.

The Mayer & Englund Co. and some of the leading manufacturers which it represents, have grouped their exhibits in one section, and for this purpose secured spaces 1 to 8, inclusive, of section A, South Pavilion, having a total of 1600 sq. ft. The exhibitors in this group are the following:

The Sterling Varnish Co., Pittsburg, occupying space No. 1. It exhibits the full line of "Sterling" insulating compounds, insulated cloths and papers.

The Garton-Daniels Co., Keokuk, Ia., has space No. 2, and exhibits a full line of the Garton lightning arresters for direct and alternating current circuits, as well as the automotoneer.

The R. D. Nuttall Co., Pittsburg, is in space No. 3, and shows a full line of standard gears and pinions for railway motors, and "Union" standard trolleys; also special gearing.

The Mayer & Englund Co., Philadelphia, is at space No. 6, where is displayed a full line of general railway supplies, such as overhead line material, pole brackets and pole fittings of every description, car fittings of various kinds, such as registers, register fixtures, headlights, fenders, tail lights, shades, trolley catchers, and numerous other detail supplies which the company regularly handles.

The Protected Rail Bond Co., Philadelphia, has space No. 7, with a complete line of well-known "Protected" rail bonds and tools for applying them.

The Duff Manufacturing Co., Allegheny, is in space No. 8, with a display of Barrett automatic jacks, and the Duff motor armature lift.

In the middle of this group of booths is a reception pavilion where no material is exhibited. This is to be fitted up with desks, chairs, tables, local and long distance telephone, stenographer and typewriter, and other office conveniences. This central space is at the joint disposal of all the exhibitors in the group. The booths are handsomely decorated, the prevailing colors being gold, green and maroon.

The representatives of the Mayer & Englund Co. and the Protected Rail Bond Co. present at the convention are:

Charles J. Mayer, president of both companies; A. H. Englund, secretary and treasurer of the Mayer & Englund Co., and treasurer of the Protected Rail Bond Co.; Edwin B. Ross, secretary of the Protected Rail Bond Co.; H. G. Lewis, Wm. A. Armstrong, jr., Benjamin Haylar, jr., John McSorley, and H. J. Mayer, of the Philadelphia office; H. E. Beach, New York office; Edward Hammett, jr., Pittsburg office; J. M. Gallagher, Chicago office; F. M. Laxton, Atlanta representative.

"RING" FIXTURE CURTAINS.

The Curtain Supply Co., Chicago, [illegible] position to supply the trade not only with its standard Forsyth No. 86 fixtures for closed cars and with "Climax", "Acme" and Forsyth cable fixtures for open cars, but also with the new open car "Ring" fixture curtains for open cars, which are giving such excellent satisfaction to the Brooklyn Rapid Transit system on the 300 cars now in service, and which have just been specified for a new lot of cars by that company. This fixture obviates the necessity of the use of the cable, the tips being prevented from escaping from the grooves by means of metal plates placed in front of each groove. The head is a long one, thrust out against the bottom of the groove by means of very heavy springs located in the tube, and the friction surfaces hold against the upward pull of the spring roller, but are released from contact by pulling the curtain down. At either end of each head anti-friction rollers keep the curtains level at all times. At the bottom of each groove are projections which hold the curtain firmly and prevent the least creeping up, so that there is no danger whatever of the passenger being subjected to rain or sun, should the curtain be pulled down to the extreme bottom. This new fixture is on exhibit at the company's booth, spaces 9 and 10, section A.

R. D. NUTTALL CO. EXHIBIT.

A complete line of gears, pinions and trolleys is being exhibited by the R. D. Nuttall Co., of Pittsburg, at space 3, section A, of the exhibition hall. The large axles for the heavy cars now used in high speed and interurban service have made the gearing one of the most important parts of an electric car and the economical life of an equipment is to a great extent dependent on the design, material and workmanship of gears and pinions. To meet conditions now obtaining the company is manufacturing both solid and split gears of standard and heavy weight designs, as well as special designs and ratios from specifications. The new ball bearing trolleys manufactured by the company are also shown. The company is reprecented by its president and treasurer, Mr. F. A. Estep; also George Provost, John P. Provost and a number of other regular representatives from the sales department.

TICKETS.

"A Few Illustrated Remarks Pertaining to Tickets" is the subject of a very complete and extensive catalog published by the Globe Ticket Co., 112-114 North 12th St., Philadelphia, manufacturer of tickets used by steam and electric railways, theaters, summer parks and all places of amusement. The publication includes 72 pages descriptive of the many designed tickets, which are profusely illustrated in colors. While it is the purpose of the catalog to present a variety of tickets of the company's manufacture to guide its customers in their selection, the styles may be changed to meet the ideas of patrons, although by conforming to the company's standard, with which the styles are original, it saves time and expense. Samples of any styles of tickets are sent on request, together with samples of quality and colors of paper and cards, when desired, and those contemplating the purchase and installation of a system of tickets will find this catalog both interesting and valuable. The facilities of the company for supplying its goods at the shortest possible notice are superior, it having branch offices at 358 Dearborn St., Chicago; 27 Market St., San Francisco; and New Amsterdam Theater Building, New York.

W. T. VAN DORN CO.

The exhibit of the W. T. Van Dorn Co., 1074 South Paulina St., Chicago, manufacturer of Van Dorn automatic couplers, occupies space No. 8-C. The company is represented by Mr. W. T. Van Dorn, president and manager, who will be pleased to show delegates the operation of the company's latest couplings and draft riggings. The exhibit consists of a number of models showing the workings of the various styles of couplers manufactured by the company, as well as one full size coupler.

The Consolidated Car Heating Co. reports the sale of 31,220 electric heaters for use in 2774 cars for four months ended July 1, 1905.

ALL-STEEL CAR IN THE BRILL EXHIBIT.

The J. G. Brill Co. has on hand an order for 75 standard 28-ft. closed cars for the New York City Railway Co. and is also building an all-steel car of the same dimensions. This steel car is included in the company's exhibit and is particularly interesting on account of its light weight. Another feature of this car is in the fact that no pressed steel is used. The bottom framing is entirely composed of rolled channels and angles, and the posts are channels shaped in a bulldozer. It is claimed that there are distinct advantages in using structural material on account of its being straighter, and also because the channels and angles are filleted at the bends, while pressed steel has no reenforcement at these points and is weakened by bending. The rivets which secure the side plates to the posts are countersunk and ground flush with the plates. Wood is employed in the car only for ventilator sash frames, upper and lower parts of window sashes (the window sash stiles are brass) and the doors. This car should be examined by all who are watching the progress of steel car building and marks a large advance in structural methods.

BOTTOM FRAMING AND POSTS OF BRILL ALL-STEEL CAR FOR NEW YORK CITY.

LORAIN STEEL CO. REPRESENTATIVES.

The Lorain Steel Co., Philadelphia, which has its exhibit in section E, spaces 9 to 18 inclusive, has quite a large representation at the convention. Those in attendance are:

Daniel Coolidge, president; P. M. Boyd, secretary and treasurer; Randolph Cliz, Cleveland agent; F. J. Drake, Philadelphia agent; S. P. S. Ellis, Pittsburg agent; E. B. Entwisle, chief engineer; H. C. Evans, New York agent; William W. Kingston, Atlanta agent; H. F. A. Kleinschmidt, superintendent of track welding department; A. S. Littlefield, Chicago agent; S. P. McGough and Carroll Burton, assistant to the president.

EUKEKA AUTOMATIC ELECTRIC SIGNAL CO.

The exhibit of the Eureka Automatic Electric Signal Co., Lansford, Pa., which occupies space 27, section D, in the exhibit hall in charge of Mr. John Earley, superintendent of the company's factory, and Mr. Walter Drumheller, traveling representative. Here the company is showing the "Eureka" single-wire system of block signals for single track electric railways; the "Eureka" single-wire system, adapted to ring bells on bridges and at road crossings, and to operate semaphores to show danger or safety at steam tracks crossed at grade; the "Eureka" two-wire system of block signals, showing both track and trolley operation. The company is also showing a new signal stand, made entirely of metal, and designed for high-speed trolley or third rail lines. The base of this stand consists of three compartments in which are contained the signal operating apparatus, separate compartments being used for batteries, controllers and resistances, switches, etc. The base is surmounted by a tower constructed of 4½-in. tubes converging from the corners of the base and meeting in a hollow cone, on which are supported either "Eureka" semaphores or lanterns. The whole device is 14 ft. in height.

GALENA SIGNAL OIL CO.

The products of the Galena Signal Oil Co., Franklin, Pa., are very attractively displayed at spaces 1, 2, 3 and 4 at section D, where the following representatives of the company will make their headquarters during convention hours:

S. A. Megeath, first vice-president, Franklin, Pa.
C. C. Steinbrenner, Franklin, Pa.
E. H. Baker, New York, N. Y.
E. G. Beatty, Franklin, Pa.
L. J. Drake, jr., Indianapolis, Ind.
Alfred Green, Brooklyn, N. Y.
W. H. Pape, Franklin, Pa.
C. A. Record, Boston, Mass.
J. V. Smith, Franklin, Pa.
C. E. Sedgwick, Franklin, Pa.
C. H. Thomas, Franklin, Pa.
W. A. Trubee, Bridgeport, Conn.
C. H. Mason, Boston, Mass.
Edward Wilson, Franklin, Pa.
LeRoy G. Miller, manager street railway department.
George A. Barnes, assistant manager street railway department.

THE NATIONAL CURTAIN FIXTURE.

The exhibit of the National Lock Washer Co., Newark, N. J., manufacturer of nut locks, curtain fixtures, car curtains, sash locks and sash balances, occupies space 15, section C, where the company has an exhibit of its products, including the "National" curtain fixture. It is claimed that this fixture positively locks the curtain against upward tension and that the heads being stationary will not come out of the grooves in the casing, two advantages to be considered in selecting a curtain fixture. It automatically locks against the tension of the spring roller by means of an eccentric on each side of the window, which are pivoted within the guides. The locking cams are drawn within the heads or guides when the handles are compressed, the guides remain stationary, and the curtain is entirely free to be raised or lowered without danger of the heads coming out of the grooves in the casing. Each fixture is provided with two non-friction rollers, which bear lightly on the casing and make a smooth running curtain. The fixture is adjusted to variations of wood work by simply screwing or unscrewing the heads, and the locking cams are self-adjusting to swelling and shrinking of wood.

STOMBAUGH GUY ANCHORS.

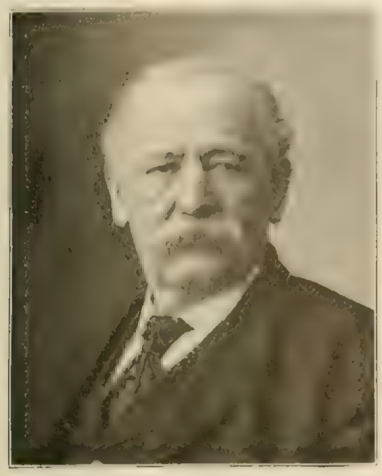
W. N. Matthews & Bro., 225 North Second St., St. Louis, report a large increase in the sales of Stombaugh guy anchors to the street railway, electric light and telephone trade for anchoring poles, fences and smoke stacks. Persistent efforts have been made by this firm in placing these anchors before the trade and convincing managers and purchasing agents of their merits, the most effective of which is the opportunity given for ordering any quantity of Stombaugh guy anchors over one dozen on 30 days' trial, freight prepaid. After they have tried them for this length of time if they prove satisfactory they are to be paid for, otherwise they may be returned freight collect. This proposition is very liberal indeed and offers an opportunity to investigate and be convinced of the merits of the product, without the risk of entailing any obligation or unnecessary expense should the anchors prove otherwise than represented. W. N. Matthews & Bro. state that they never have return shipments except in cases when it is found that the soil is too rocky to permit the installation of Stombaugh guy anchors.

Upon the occasion of the recent visit of the Secretary of War and his party to the Philippines, an excursion on electric cars through the city of Manila was given in his honor, Tuesday, August 8th, from 3.30 to 6 p. m., by the Manila Electric Railroad & Light Co.

THE OFFICERS OF THE J. G. BRILL CO.

The concern which is now the J. G. Brill Co. was founded in 1868 by John George Brill and his eldest son, G. Martin Brill. Previous to that time both were in the employ of Murphy & Allison, one of the largest car building concerns in the business. Mr. J. G. Brill learned the trade of cabinet making in Bremen, Germany, and in 1847, at the age of 30, came to Philadelphia and soon obtained a position with the car builders which he retained until the opportunity arrived to commence business with his son. During those years Murphy & Allison built street and steam railway cars and Mr. Brill obtained a broad experience in every branch of the art which in later years was invaluable to him. His early training as a cabinet maker gave him an insight into the methods of strong, light and perfect wood-working, essential to the construction of durable street cars; and his knowledge of the best timber and materials to be used, without which fine workmanship is of little avail, was also largely due to his thorough schooling in Bremen. He was an extremely energetic and conscientious mechanic and required of his employes the very highest class of work. He was not so earnest in the matter of making money as he was that every production of his shops should be perfect in every respect, and when in 1883 the Exposition of Railway Appliances in Chicago awarded the firm the gold medal for the best street car, he was more satisfied than with the largest order ever taken. Before his death, in 1888, Mr. Brill saw the business, which he and his son had establishd, grow from the humble beginning in a small shop at 31st and Chestnut Sts. to a large plant covering all the available adjoining ground, about four and one-half acres, and the firm incorporated under the name J. G. Brill Co., with himself as president. Eighteen and one-half acres of land in a desirable location had been purchased and the buildings planned for a modern and commodious plant.

Mr. G. Martin Brill has been president of the company since the death of his father. He was [illegible] delphia, learned the trade of car building with Murphy & Allison, and was foreman of their [illegible] of years. His [illegible] truck building has been constantly developed by the closest application to the building up of his [illegible] the best organized and equipped concerns in the country, and whose products have made the name of its founders known in all lands. Mr. Brill's capacity and energy together with his impressive and genial personality and powerful physique are familiar to the leaders in industrial matters the world over. Although much sought on account of his conservative judgment, keen foresight, sturdy integrity, and his prominence as one of the country's largest manufacturers, he has confined his connections to a few concerns. Nearly every day of the year Mr. Brill is in his office at the Brill works, ever alert to direct improvements, and as ready to encourage earnest efforts towards betterment in equipment and workmanship as he is to condemn indifference and carelessness. In consequence, he has brought together at the Brill works and the other concerns with which he has to do, not only mechanical facilities of the highest order, but what is even of greater importance, forces of men deeply interested in turning out the best character of work, loyal to their company, by the appreciation and confidence which is always accorded them. Besides being president of the J. G. Brill Co., Mr. Brill is a director in the American Car Co., the G. C. Kuhlman Car Co., and the John Stephenson Co.; is president of the Halifax & Yarmouth Railway Co., vice-president of the Nova Scotia Development Co., and a director in the Merchants' National Bank, of Philadelphia.


G. MARTIN BRILL


JOHN GEORGE BRILL


JOHN A. BRILL


S. M. CURWEN


JAMES RAWLE


W. H. HE[illegible]

Mr. John A. Brill, vice-president, is the member of the concern best known in railway circles, as the larger part of his time, until the last few years, has been given to traveling in every part of the world where street railways are operated. The immense business of the company is largely due to his untiring energy and straight-

forward business methods. His broad knowledge of the operating conditions of all kinds of railroads is evidenced by nearly 200 patents which have been issued to him on cars and trucks and parts of their equipment. He has a master mind for discerning operating conditions and meeting them in the most practical manner. The fundamental principle of electric truck construction—an independent frame for the support of the motor—was conceived by him and the first truck to be constructed on that principle was of his design. Many of his designs were at first considered extremely radical, but in every instance his aim to completely meet requirements has been realized by persistent, clearsighted effort. The impress of his genius is indelibly stamped on nearly every type of car and truck which has come into general use in the field of electric traction. Mr. Brill is also president of the American Car Co., vice president of the G. C. Kuhlman Car Co., and a director of the John Stephenson Co.

Mr. James Rawle, secretary and treasurer, purchased a third interest in the business of J. G. Brill & Son in 1872, the firm then becoming J. G. Brill & Co. After his graduation at the University of Pennsylvania, Mr. Rawle took up civil engineering and was a member of the corps which laid out the lines of the Philadelphia & Erie Railroad Co. Frank Thomson and A. J. Cassatt were also in this engineering corps. At the time he joined the Brill company a number of costly buildings had been recently added to the plant. A general depreciation in railroad stocks and an insecure condition of business throughout the country occurring at that time, the situation was critical for the firm and called for exceedingly skilful management. Mr. Rawle assumed control of the finances in a manner which at once convinced all with whom he had to do that the utmost reliance could be placed in his methods. The wisdom and equity with which he has directed the handling of accounts has given the company the reputation for highly satisfactory dealings and has done much to build up its immense business on a firm basis. Always an unprejudiced student of men and affairs, with a calm and judicial mind, clear and forceful speech, a master of business economics, he commands every situation from beginning to end, leaving no one dissatisfied with the results. Mr. Rawle is also treasurer of the American Car Co., the G. C. Kuhlman Car Co. and the John Stephenson Co.

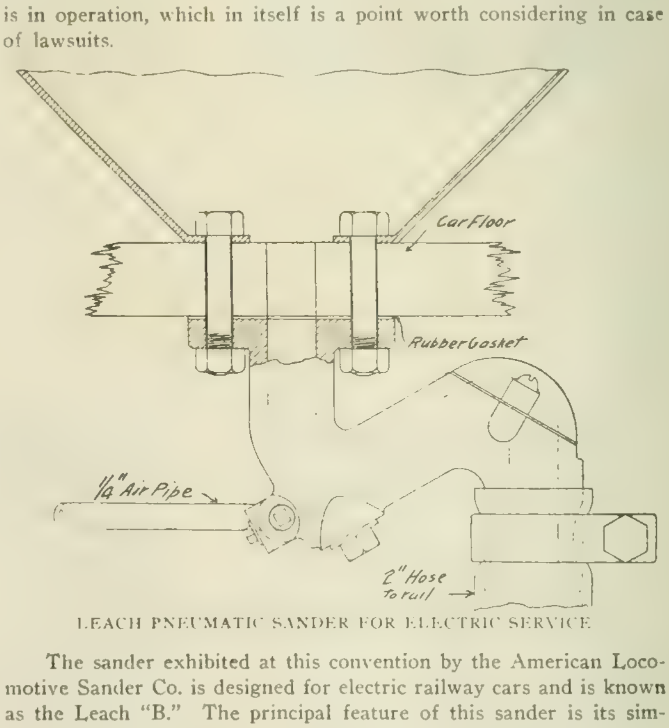
Mr. Samuel M. Curwen, general manager, served his apprenticeship as car builder in the company's shops on Chestnut St. and became head of the drafting department. He left this place to spend several years on his ranch in the west to regain health which had suffered from close application to his work. Returning in 1894, he became a general salesman and the following year was made assistant general manager of the plant. Two years ago the president relinquished the duties of general manager and Mr. Curwen was elected to fill the office. Besides being a practical car builder he is a self-taught mechanical engineer with a broad experience in the large variety of machines and engines employed in a plant of this kind. Many of the valuable patents owned by the company are for inventions of Mr. Curwen. Besides attending to the immense variety of important details which devolve upon his office, he makes time for trips to any point where his engineering skill as a salesman is needed to turn the tide in favor of his company's tender for a large order. His wide acquaintance among railway officials and his profound knowledge of everything pertaining to the manufacture of cars and trucks and their equipment, a keen discernment of the conditions under which they operate, coupled with a convincing address and sincere dealing, fits him singularly for successfully handling difficult situations. Mr. Curwen is also president of the G. C. Kuhlman Car Co., vice-president of the American Car Co., and vice-president of the John Stephenson Co.

Mr. William H. Heulings, jr., assistant secretary, entered the employ of the company at the age of 14 as a stenographer. His energetic manner, quick mind and unusual memory were soon recognized and responsibilities, which he was eager to assume, followed each other in rapid succession. In the office and in the shops nothing escaped his keen eyes nor was forgotten. Before he was 20 he was the right-hand man of Mr. John A. Brill, and from this association has gained much of the knowledge and experience in salesmanship for which he is so eminently fitted by native qualities. At 25 he was on the road as often as he could be spared from his office, sometimes accompanying Mr. Brill but oftener alone. One of his first important orders was secured in the face of difficult circumstances when the chances of getting even a part seemed small, but while the company was wiring instructions, a characteristic message was received which read simply "Got everything." He has a host of friends in the railway world, all of whom have a deep respect for him. He possesses the happy faculty of combining strenuous endeavor for business with genuine good fellowship, and in nature and practice is frank and conscientious to the last degree. Mr. Heulings is also president of the John Stephenson Co.

PNEUMATIC TRACK SANDERS FOR STREET RAILWAY SERVICE.

Pneumatic track sanding is not by any means new; it has been used altogether on all steam railways thoughout the United States, Canada and Mexico for many years, and indeed quite a few foreign railways are calling upon the manufacturers for this equipment. It is believed that wherever the pneumatic sander has been given a careful trial under fair conditions, it has been found efficient and in every way satisfactory.

While the pneumatic track sander has long since passed the experimental stage and is giving wherever used with ordinary care the best of service, still it must be remembered that there are some things it will not do. First of all the sand must be thoroughly dried and screened through a piece of 4 x 4 gauze netting and afterward kept clean; because damp sand and stones will surely prevent the sanders working properly. If this is done and pipe joints looked after a little, pneumatic sanders will save you 70 per cent. of the amount of sand used by giving an instantaneous delivery of sand at the point of contact even on the shortest curves (sanding the rail instead of the right of way), and at the same time allow the motorman's attention to be given to other duties while the sander is in operation, which in itself is a point worth considering in case of lawsuits.



LEACH PNEUMATIC SANDER FOR ELECTRIC SERVICE.

The sander exhibited at this convention by the American Locomotive Sander Co. is designed for electric railway cars and is known as the Leach "B." The principal feature of this sander is its simplicity; it requires little or no attention after being properly applied any further than having the sand properly prepared.

The only wearing part of the device is the blast cap which can be renewed at a very small cost and by any kind of labor. There is used in connection with this sander a motorman's valve with a warning port so arranged that when the sander is being used there is a continual warning being sounded, so the motorman cannot forget and leave the sander working until the sand box is entirely empty.

The New York, New Haven & Hartford Railroad Co. has been trying out the pneumatic sanders on its electric equipment and we understand that it is getting good results, the secret of its success being in the proper preparation of the sand.

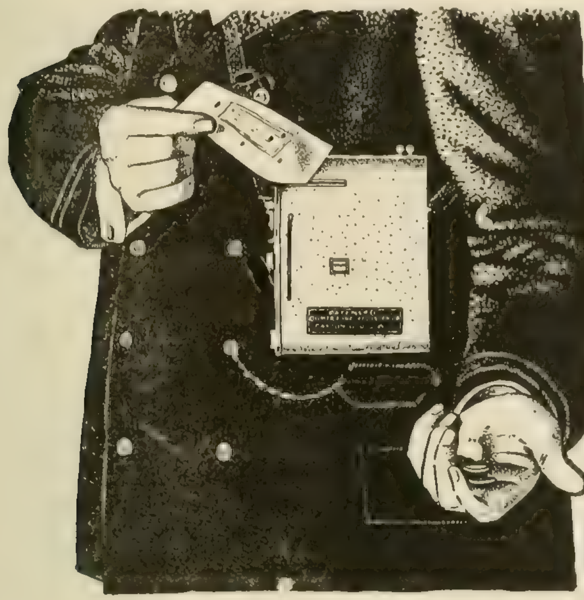
The American Locomotive Sander Co.'s exhibit is an interesting one. The company is the leading manufacturer of pneumatic sanders for all kinds of service, and its representatives will be glad of an opportunity to talk with delegates who are interested in pneumatic sanders and to furnish equipment for one car for trial, not to be paid for unless satisfactory.

Solution of the Transfer Problem—The Ohmergraph.

The general demand and necessary adoption of the transfer system has grown beyond all calculation. The growth has been so widespread and to such enormous proportions that it is to be reckoned with by every street railway manager in the country. The value of a transfer and its necessity are too well known for comment, and the abuses following its introduction have more than kept pace with its good features.

The substitution of transfers for cash fares; the illegitimate traffic in transfers; the system which is almost universal of making the transfer a stop-over privilege instead of its use for a continuous ride are so common that the average manager justly attributes to them some of his gray hairs.

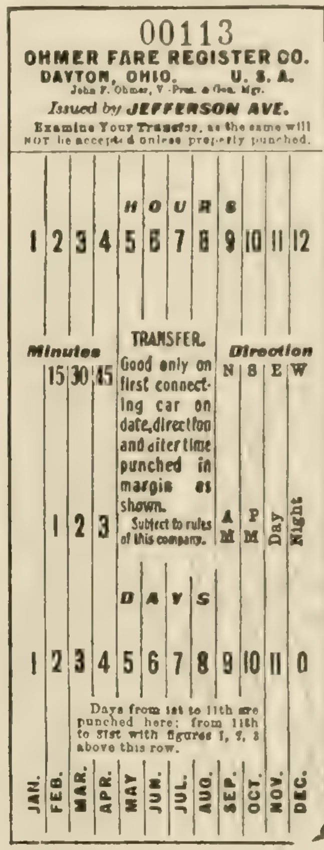
At the time of its issue the transfer should be accurately punched to fix the date, the time by hours and minutes, and when the traffic is more or less congested, it has been found an impossibility for the conductor to collect his fares and issue transfers with the proper limitations. He must either collect his cash fares and issue transfers with the limitations punched as best he can, or properly punch the transfers at the expense of not getting some of the cash fares.



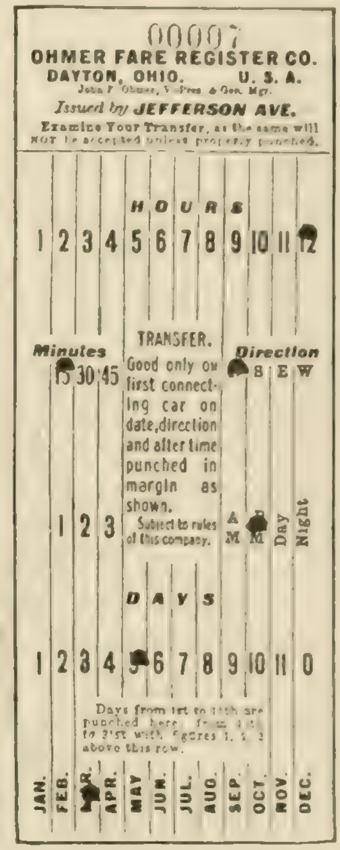
THE OHMERGRAPH.

Mr. John F. Ohmer, of Dayton, O., within the month has presented the "Ohmergraph" as a solution for this most perplexing problem. The "Ohmergraph" is a small machine worn on the side or chest of the conductor, and is so light that its weight is scarcely perceptible. This machine will perforate the month, the day, the direction, the hour, the minute (by tens or fifteens) and it issues and records each transfer in less time than the conductor could place his hand in his pocket for a pad of transfers. The machine is enclosed within an aluminum case and contains transfers put up in rolls of 200 and 300 each. The transfers are consecutively numbered in the usual way and checked out to the conductor by the consecutive numbers and also by the register record. The operation requires one hand only of the conductor and the transfer is properly punched, issued and recorded in one operation by the movement of a single lever. The illustrations show transfers before and after issue. It will be observed that the matter is printed transversely across the paper and can be read without turning. The first perforation is shown in the top column at 12, the next under minutes at 15, the next on the same transverse parallel, punches out the direction, "N"; the next perforation, "P. M." Under the word "Days" are figures from 1 to 11 and then a cipher. It will be observed that 5 is punched for the 5th day, and the last perforation on the transfer as shown indicates March. The figures 1, 2 and 3 on the 3rd transverse column are used for indicating the days in excess of the 11th. For the 12th day, for instance, the figure 1 would be punched with the figure 2 directly below the 1. On the 22nd day of the month, the next figure 2 would be perforated, and on the 30th the next figure 3 and the cipher in the next column below would be perforated. It is impossible to punch and issue transfers without recording them in the machine, and from a sanitary standpoint the innovation should be highly commendable and popular with the public. There is no chance to contaminate the transfer with mutilated money, tobacco, etc., carried by the conductor.

The transfers will be printed in different colors denoting special lines or streets from which they are issued. An audible indication (bell ring) is the accompaniment to each transfer issued and the number of bell rings must indicate the number issued. Under these circumstances the conductor would not dare issue surreptitiously more transfers than are legitimately required by passengers. The



TRANSFER BLANK.



TRANSFER PUNCHED.

perforators for the month and day are concealed and are not accessible to the conductor. The punches controlling the hours, the minutes and the direction are set by the conductor and can be set in an instant to the required time. In operation it will only be necessary for him to move the hour punch once an hour, the minute punch once in fifteen minutes, and the direction punch is moved simultaneously with the issuing of the transfer.

Mr. Ohmer has sold his "Ohmergraph" patents to the Ohmer Fare Register Co., of which he is founder and in active management, and this company has for the past 18 months been preparing to manufacture the "Ohmergraph" on a large scale. The first machines are on exhibition at the convention.

Indiana Union Traction Appointments.

In addition to the appointment of Mr. P. J. Mitten as superintendent of motive power, the Indiana Union Traction Co. has announced the following appointments: Guy H. Kelsay, formerly master mechanic of the Western Ohio Railway Co. at Wapakonita, O., has been appointed superintendent of power; W. C. Sparks has been promoted to the position of superintendent of roadway; Calvin H. Allen has been promoted to the position of real estate and tax agent, succeeding H. C. Stillwell, resigned to become general manager of the Muncie & Portland line.

ELECTRIC STORAGE BATTERY CO.

The Electric Storage Battery Co., of Philadelphia, was organized in 1888, its factory was located in Gloucester, N. J., until the year 1894.

In 1892 the company made its first installation of the "Chloride Accumulator," these words characterizing the special construction of the plates then made. From that time the term has been utilized as the registered trademark of the company, applied generally to all the batteries made by it, excepting those used for vehicle work, which bear the trademark "Exide Battery."

In 1894 the development of the industry was so hampered by patent litigation between the various storage battery companies then in the field that the Electric Storage Battery Co. secured a controlling interest in its various competitors and purchased all outstanding patent rights covering storage batteries and accessories, thus consolidating all conflicting interests and combining all the experience and engineering talent then available in this particular branch of electrical industry.

About this time an alliance was formed with the Chloride Electrical Storage Co., Ltd., England, the Accumulatoren-Fabrik Aktien-Gesellschaft, Germany, and the Société Anonyme pour le Travail Electrique des Metaux, France, which secured to the Electric Storage Battery Co. the control of these companies' patents for the United States, and the benefit of all future improvements made by them. By means of periodical conferences between its own engineers and those of the foreign companies, the Electric Storage Battery Company keeps in close touch with every advance made in the art. In 1902 the company acquired a controlling interest in the Chloride Electrical Storage Syndicate, Ltd. of England.

The successful operation of the plants installed for lighting and power and railway work created a demand for storage batteries in excess of the capacity of the Gloucester factory, so that in 1894 the company secured additional quarters in the large Warden Power Building, located at 19th St. and Allegheny Ave., Philadelphia, at which place, with greater shipping facilities and enlarged space, the manufacture of the "Chloride Accumulator" has continued on an increasing scale, until the company, on account of the magnitude of its business and increase of its working force, found it advisable to purchase not only the entire Power Building, but also all the buildings contained on the large triangular plot of ground bounded by Allegheny Ave. on the north, the Pennsylvania R. R. on the west, and the Philadelphia & Reading Ry. on the east. This entire plant which the company now owns consists of the main building and twenty separate structures devoted to the different processes of storage battery manufacture.

The accompanying illustration gives a general view of the works from the western and southern sides. The executive offices, and the office of the sales department are located on the seventh floor of the main building, and the offices of the engineering, construction, operating, accounting, purchasing, order and superintendent's departments occupy the front portion of the central pavilion on the floors beneath. In the auxiliary buildings on the ground floor are located the lumber sheds, the stock room for pig lead and alloy, the lead foundry and lead rolling mill and other machinery and apparatus for the manufacture of the various types of battery plates; also the extensive forming rooms where the electro-chemical formation of the plates is completed, as well as the power plant which furnishes current for electrolytic and power purposes. In the main building in addition to the offices mentioned, are the machine shop for the manufacture of storage battery auxiliaries, such as end cell switches, copper work, etc.; the carpenter shop where tanks, battery racks, and other accessories of a similar nature are constructed; the tank lining department where the tanks are lined with sheet lead; the switchboard department where switchboard panels for the various storage battery installations are laid out and assem-

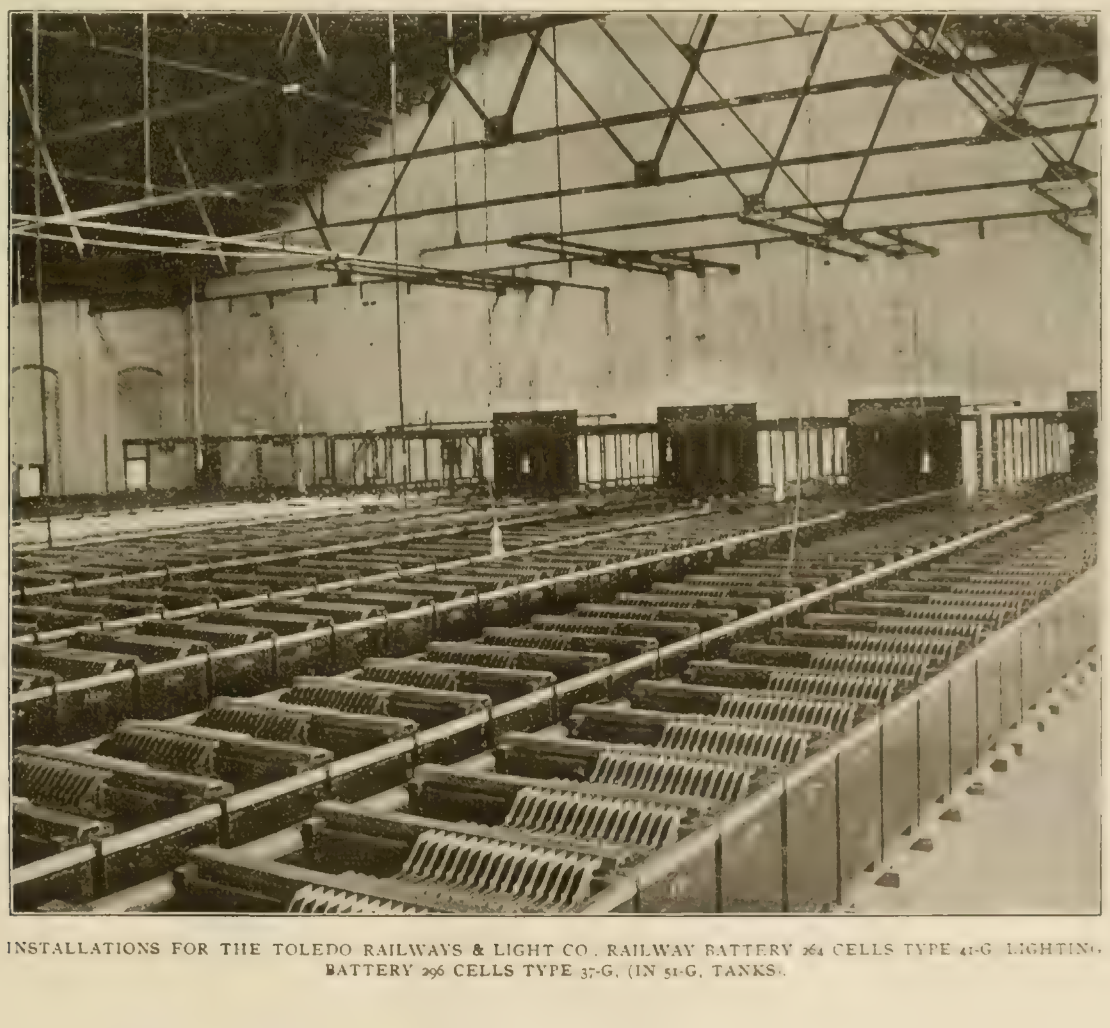
STAFF OF ELECTRIC STORAGE BATTERY CO.

FACTORY AND OFFICES OF THE ELECTRIC STORAGE BATTERY CO.

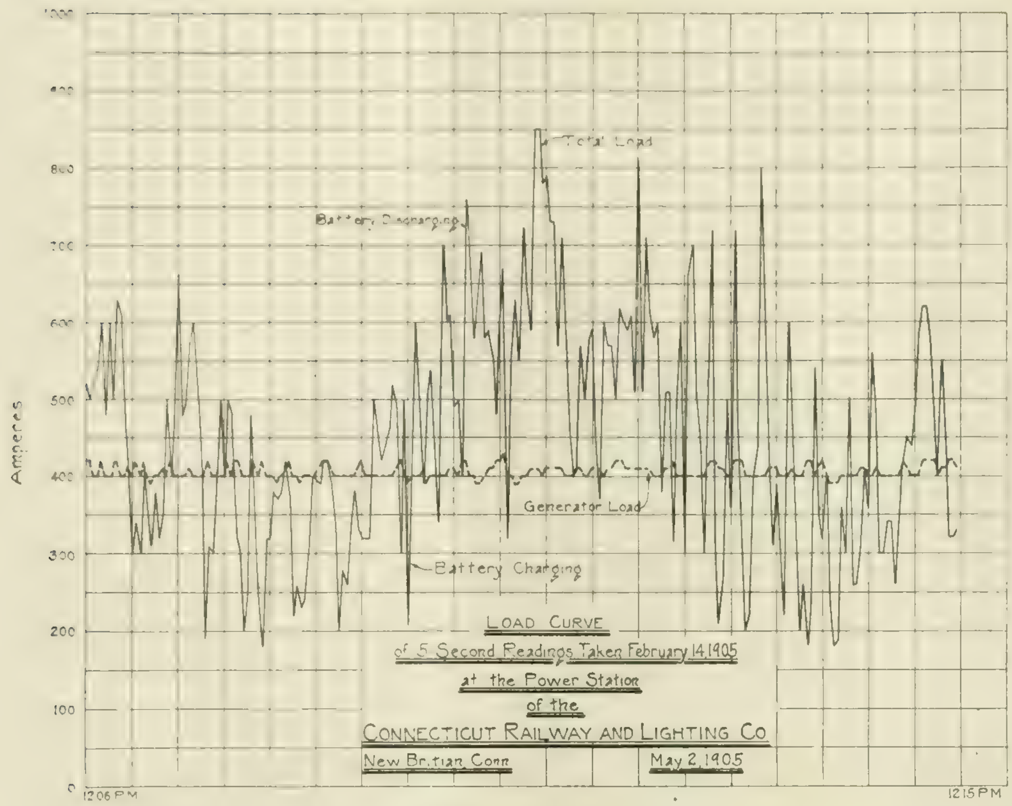
bled; the drafting room; the experimental and commercial laboratories; the general store room and the packing and shipping department. In the basement are located the plate stock-room and the assembling room for small cells, vehicle batteries, etc.

Among the varied applications of the "Chloride Accumulator" in the electrical field one of the most important is its use in connection with electric railway systems. The advantages of a storage battery in railway work in removing momentary fluctuations and handling sustained peaks of load, relieving the power house and transmission lines at times of maximum demand, improving the load factor and, therefore, the economy of generation and transmission, and supplying at all times an instantly available reserve source of energy are now too well known to railway engineers to require more than a brief enumeration.

Among the recent improvements which have been introduced by the Electric Storage Battery Co. are the box negative plate,

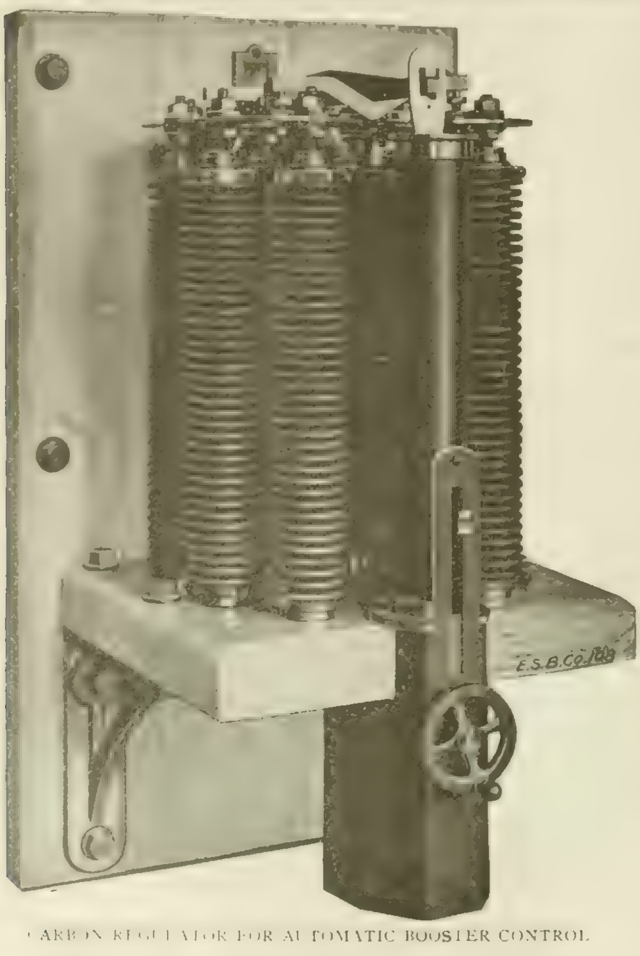


INSTALLATIONS FOR THE TOLEDO RAILWAYS & LIGHT CO. RAILWAY BATTERY 264 CELLS TYPE 41-G. LIGHTING BATTERY 296 CELLS TYPE 37-G. (IN 51-G. TANKS).



CURVE SHOWING RAILWAY REGULATION.

which has been adopted as standard for all heavy electric work; the carbon regulator for the automatic control and regulation of boosters in connection with batteries installed for fluctuating work; and various pieces of apparatus such as the compensating hydrometer, the automatic pilot cell filler, the signaling hydrometer, etc. for improving and simplifying the record and control of storage battery operation.



CARBON REGULATOR FOR AUTOMATIC BOOSTER CONTROL.

The recognition which is now accorded to the "Chloride Accumulator" in heavy electrical railway work is evidenced by some of the recent contracts which have been awarded to the Electric Storage Battery Co., among which may be mentioned the 2000-kw. h. battery installation at the Hammil sub-station of the Long Island Division of the Pennsylvania R. R., which has recently been put into operation; the eight installations aggregating 15,000 kw. h. in the rotary sub-stations for the electrification of the Hudson River and the Harlem Divisions of the New York Central & Hudson River R. R.; the 1000-kw. h. battery recently contracted for by the South-side Elevated Railroad Co., of Chicago, (in which contract was included also an increase for the two large batteries of "Chloride Accumulators" purchased by this road in 1898); a battery of 1500-kw. h. capacity now being installed for the Metropolitan West Side Elevated Ry., Chicago, this being the third battery purchased by that road; a battery of 1,450-kw. h. (second installation) for the Northwestern Elevated Railway Co., of Chicago; the second battery of nearly 2,000-kw. h. capacity recently purchased by the Toronto Railway Co., Toronto, Ont.; the 720-kw. h. battery just installed for the Toledo Railways & Light Co., Toledo, Ohio, and now being increased to 1,200-kw. h. capacity; and numerous smaller plants.

The Peckham Manufacturing Co. is distributing a number of interesting circulars at the convention, descriptive of its products. These are 9½ x 12½ in. in size and are printed on heavy colored paper, four pages to each circular. Among these is a circular describing and illustrating the Ruggle's patent single and double truck electric rotary snow plows, together with a large list of purchasers of these snow plows. The circular describing Peckham's system of double trucks, includes besides illustrations of these products, a view of the works of the company at Kingston, N. Y., and a list of roads using Peckham M. C. B. trucks.

The George W. Lord Co., Philadelphia, advises that the cessation of hostilities in the far East has already been emphasized by the fact that export orders are being received in America for large quantities of supplies and equipment. The company has resumed shipment of Lord's boiler compounds to Japan and Russia, having, since the signing of the peace treaty, in addition to filling standing orders, received from its Vladivostok agent an order for a carload of compound.

THE W. R. GARTON CO.

The W. R. Garton Co., 118-132 West Jackson Boulevard, Chicago is not making an exhibit at the convention hall, but is represented by the various members of the company and its sales department, who will be found at the booths of the various manufacturers for which the Garton company is western selling agent. At the organization of the company in 1898 it acted as manufacturers' agent only, but as the trade developed it was found necessary to carry a stock and handle many articles in addition to the earlier lines, as well as to manufacture several articles of its own design.

The principal manufactures which this company now represents include the Electric Railway Equipment Co., of Cincinnati, railway construction material; the Massachusetts Chemical Co., of Boston, "Armalac", "Enamelac", and a full line of friction and rubber tapes and other insulating compounds; the Eureka Tempered Copper Works, of North East, Pa., brass and copper products, motor bearings, trolley wheels, rail bonds, etc.; the Van Dorn & Dutton Co., of Cleveland, gears and pinions, track scrapers and armature lifts, C. S. Knowles, Boston, glass and porcelain insulators; the Lea Electric Manufacturing Co., the Northall arc lamp; the Trolley Supply Co., Canton, O., Knutson trolley retriever; the Condit Electrical Manufacturing Co., Boston, Elden circuit breakers. Specialties of this company include the "America" incandescent lamp, "Columbia" friction tape and "Velva Para" rubber tape; trolley poles, wheels, harps, bushing, tools, carbon brushes, tape, brakes, switches, paint, etc. The company also controls the output of the Brubaker knife switch.

GOLDEN-ANDERSON VALVES.

The Golden-Anderson Valve Specialty Co., 105 Pike St., Pittsburg, Pa., manufactures the following valve specialties: Anderson cushioned non-return valves, combination cushioned non-return valves, cushioned triple-acting non-return valves, patented pressure reducing valves, automatic and counter-balanced valves, automatic valve and water column, float valves, altitude valves and Golden patented automatic tilting steam traps, [illegible] and illustrated in its pamphlet No. 4, 1905.

Among the [illegible] specialties [illegible] men are the Anderson cushioned non-return valve, the combination cushioned non-return valve and the cushioned triple-acting non-return valve. These valves supply a very vital part of the general piping system of power plants. The valve, when placed between the boiler and header, will equalize the pressure between the different units of a battery of boilers [illegible] the boiler pressure is lower than that of the header. When the boiler pressure equals the header pressure, they open and will remain in that position without chattering or hammering. They will automatically cut off a boiler in case of accident to the boiler, such as the bursting of a tube, and will also act as a safety stop to prevent steam being turned into a cold boiler while men are working inside.

THE WHEEL TRUING BRAKE SHOE CO.

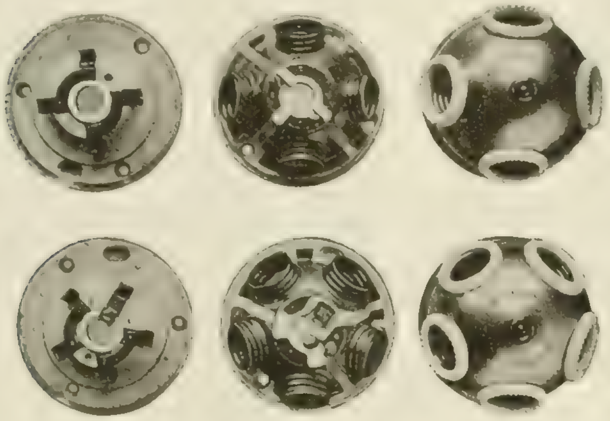
The Wheel Truing Brake Shoe Co., of [illegible] represented at the convention by its president and general manager, Dr. J. M. Griffin, has its exhibit in space 11, section C. The exhibit consists of various styles of abrasive brake shoes manufactured by the company. The company claims for these products, wheel truing brake shoes, that their use prevents the necessity of sending rolling stock having untrue and flat wheels to the repair shop because they perform their work while the car is in service.

THE FALK CO.

While the Falk Co., Milwaukee, Wis., is not exhibiting its products at the convention it is ably represented by the following members of the company: Gen. Otto H. Falk, vice-president; E. A. Wurster, secretary and treasurer, and W. Frank Carr, chief engineer. Besides contracting and building electric railways, the company manufactures switches, frogs and crossings, motor gears and pinions and steel castings, and is the originator and patentee of the cast welded rail joint.

BENJAMIN WIRELESS CLUSTERS.

The accompanying illustrations show the construction of Benjamin wireless car-lighting clusters, manufactured by the Benjamin Electric Manufacturing Co., 42 W. Jackson Boulevard, Chicago. These clusters consist of a porcelain base upon which are securely mounted the necessary contacts formed in sections. Each section, except the



BENJAMIN WIRELESS CLUSTERS.

first and last, serves two lamps and overlaps so as to connect the lamps in series without wires—there being only two binding screws except where two circuits are represented in a single cluster. These clusters have been used very extensively by the larger street railway systems throughout the country, including those of Detroit, New York, Chicago, St. Louis and Los Angeles.

The company has also designed and is manufacturing weather-proof clusters. This type of cluster is specially suited for out door lighting and for mines, subways, etc., wherever the atmospheric conditions are detrimental to the ordinary type or form of cluster. The

BENJAMIN WIRELESS CLUSTERS.

socket-shells are of copper, the casings of polished aluminum, and the cluster-back sealed by a flange tapped for ½-in. pipe and screwed directly on end of support, thus making a weather-proof joint. The shades are heavy, well calculated to withstand hard usage and tapped for ½-in. pipe only.

ST. LOUIS CAR WHEEL CO.

The St. Louis Car Wheel Co., 510-512 Bank of Commerce Building, St. Louis, manufacturer of all kinds of chilled wheels and castings, is occupying space 14, section I. Here the company has an exhibit of street car wheels, its 20th century pattern, the sales for which in the last ten years have increased from 600 a year to over 30,000. The reinforced channel spoke street car wheels manufactured by this company for city and interurban service received the highest award at the Louisiana Purchase Exposition. The results obtained from wheels of this design, of which the company is the original manufacturer, have been very satisfactory and show stronger spokes and flange, more uniform chill and greater mileage. John L. Butterfield, general sales agent, and W. W. Talman, western sales agent, are representing the company at the convention.

THE STANDARD STEEL WORKS.

The Standard Steel Works, Harrison Building, 15th and Market Sts., Philadelphia, is displaying its forged and rolled steel wheels, built up wheels, axles and springs in space 11, section I, 10 x 20 ft. in size. Wheel matters are of no small importance to managers of electric railways and interesting data on the life and cost of the products of this company may be had at its exhibit, where Mr. E. Sidney Lewis, general traveling representative of the company, will be in charge. While the exhibit includes those products of interest to electric railway men, the company manufactures steel tires, steel tired wheels, steel rolled wheels, steel and iron castings and forgings, steel railway springs, steel pipe flanges and steel crusher rings for both electric and heavy steam railroad service.

KALAMAZOO RAILWAY SUPPLY CO.

The Kalamazoo Railway Supply Co., Kalamazoo, Mich., manufacturer of railway and contractors' supplies, is exhibiting its products of especial interest to electric railway men. These include a full line of jacks and track tools and three or four different styles of Root railway spring scrapers, the company having recently arranged for the exclusive manufacture and sale of these scrapers. Two types of Root scrapers were described in recent issues of the "Street Railway Review", the general design and construction of which are similar. They may be seen in operation at the company's booth. Mr. Fred N. Root, manager of the scraper department, represents the company.

FRANK RIDLON CO.

The exhibit of Frank Ridlon Co., 200 Summer St., Boston, occupies space 11, section A, in the convention hall. The principal apparatus shown by this company are trolley catchers, babbitting devices, winding machines for field and armature coils, taping and banding machines, armature trucks and winding stands, sand boxes, trolley harps, automatic locks for vestibule doors, etc. The representatives of the company in attendance at the convention are Henry F. Kellogg, manager of railway department, Jerry M. Hayes and George C. Dana.

LYON SHEET STEEL GEAR CASES.

Lyon sheet steel gear cases, which are manufactured by the Lyon Metallic Manufacturing Co., 16 South Ann St., Chicago, are exhibited at the booth of the Mayer & Englund Co., exclusive eastern agent for the sale of Lyon cases, where individual exhibits of the various manufacturers represented by the latter company will be found in one general group.

LYON GEAR CASES.

Lyon gear cases are made entirely of sheet steel, each section properly riveted and seamed, so as to give strength where needed. They are reinforced at both ends by heavy plates, both inside and outside, and all brackets are triple reinforced, making it impossible to work loose from vibration. The claims for superiority of Lyon sheet steel cases are based on the fact that they are from 75 to 100 lb. lighter than cast iron or malleable cases; in case of accident they become bent or dented, not broken, and can be hammered into shape without injury; the first cost, as well as maintenance, is less.

The company carries in stock a large assortment of cases for Lorain, Walker, General Electric and Westinghouse standard motors for immediate shipment. The present stock is being added to as fast as possible and any styles of cases can be furnished on short notice. The company also ships cases for trial to be returned at its expense at any time within 90 days after receipt, if they do not prove satisfactory in every way.

SCHOEN STEEL WHEEL CO.

The Schoen Steel Wheel Co., of Philadelphia, has erected its exhibit in spaces 15, 16, 17 and 18 of section I, where are shown the progressive steps in the process of making a solid pressed and rolled steel car wheel for steam and electric roads. The starting point for the formation of the wheel proper is a slab, taken from the slabbing mill of the steel works where it was rolled direct from the ingot The progress of the work on the wheel is from center to circumference, so that the first step is the formation of the hub and bore. The round form is then obtained by cutting with a punch under press, after which the blank is reheated and taken to the rolling, where the rolling draws the metal and increases the diameter of the forming wheel. After leaving the rolling mill, and while it is still hot, the wheel is taken to another hydraulic press and dished into its final form. The wheels are shown in these various stages of manufacture, and photographs showing the interior of the company's works at McKee's Rocks, Pa., add materially to the interest of the exhibit. The Schoen wheel is covered by patents on the machinery, process and finished product, issued in Germany, France, Belgium, England and the United States. The company is represented at the convention by Charles T. Schoen, president; W. Martin Johnson, vice-president; and N. B. Trist, sales representative.

DAILY STREET RAILWAY REVIEW

7TH YEAR, NO. 2 | SEPTEMBER 27, 1905. | SERIAL NO. VOL. XV. NO. 9 B

THE TREATMENT OF RAIL JOINTS,

AS PRACTICED BY THE ELECTRIC STREET AND INTERURBAN RAILWAYS OF AMERICA.*

ASSEMBLED AND EDITED BY FRED G. SIMMONS.

Superintendent of Construction and Maintenance of Way, Milwaukee Electric Railway & Light Company; Third Vice President of the American Railway Mechanical & Electrical Association and Chairman of Committee on Way Matters.

The treatment of rail joints is undoubtedly one of the most important matters concerning both construction and maintenance which obtrudes itself upon the consideration of the way engineer, and its more or less successful solution interests in an almost if not quite equal degree the superintendent of transportation and superintendent of rolling stock, who are responsible for the cars operating over the joints; and the power house man and electrician, whose current efficiency depends largely upon their condition. Allowing the unquestioned interest of the financial and managerial representatives, we find the subject to be one in which practically the entire staff are vitally concerned. It is, therefore, impressed upon us that a fairly successful method of treatment constitutes information which it becomes the duty of this association to place before the electric railway world.

It would probably be a hopeless task to ask any body of men to establish a standard or uniform method of treating the rail joints, as several methods may approximate in point of efficiency and the local conditions influence each particular individual in forming a preference for his own method, provided that method has rendered a fair degree of satisfaction in the past.

The idea of the writer, however, in taking up this broad subject has been to set before the electric railway interests as nearly as possible exact data as to the most successful methods now employed in bringing about the maximum of efficiency in the treatment of rail joints with regard to both electrical conductivity and surface and alignment.

It is undoubtedly a fact that many roads, particularly the smaller ones, are continuing to use some inferior and inefficient type of joint, solely because they have been unable to obtain comprehensive information as to some more reliable and more satisfactory type. The failure of one person or system to obtain proper results has often unjustly condemned some type of joint in the minds of many persons, when the reason for such failure may have been, absolutely, a lack of proper knowledge and proper workmanship in the application thereof.

The present most accepted methods are divided into two exact types: 1. The mechanical joint, bolted, riveted or wedged, and connected by means of a metal bond for the passage of electricity with the least possible resistance. 2. The various kinds of welded joints (thermit, zinc, electrical or cast).

The first type applies more particularly to interurban or exposed track, the second type to urban or buried track.

In Milwaukee the Weber joint has been in use nearly eight years, the first joints applied have been entirely undisturbed up to the present time, no work has been done on them, and not one low or battered joint has developed.

With constant use on a double track for a period approaching eight years the writer considers this a first-class showing. The joints are used on a 56-lb. section of ordinary T-rail, and the summer traffic particularly is very heavy.

Accompanying engravings show the latest improved type of both the Weber and the "Continuous" joints.

Information received through correspondence would indicate that many consider the "Continuous" joint a very satisfactory one. The following letter, received from H. S. Cooper, general manager of the Galveston City Railway Co., of Galveston, Tex., is an interesting one, and is a fair presentation of the [illegible] country in the matter as nearly as the writer has been able to ascertain:

"We are in receipt of your letter of March 3rd, enclosing By-laws, etc., of the A. R. M. & E. A., and note your inquiries in regard to "Continuous" rail joints. In our work here we absolutely could not do without a "Continuous" rail joint or one fully as good. We have in use quite a number of miles of 40-lb. and 45-lb. T-rail, left over from the horse car days; also our standard for unpaved work—60-lb. A. S. C. E. T, and in our paved portions a 6-in., 60-lb. T-rail, on all of which we use the "Continuous" rail joint. Owing to the saltness and dampness of the atmosphere and soil of this place, exposed rails rust very rapidly, and, with the ordinary fish plate or angle bar, we find it impossible to get a suitable joint after the rail has started thoroughly rusting, whereas, by using a "Continuous" rail joint, we are able to maintain our joints in nearly as good condition as the rest of the rail.

"Of course we have to use great care in the application of the joint, making positive that we get a good fit by cleaning the roughness from the rail, by seeing that the joint is thoroughly in contact its whole length and well driven up, and by making certain that the bolts are completely and permanently tightened. On new rail, especially where it is put in paving, we keep on tightening the bolts and slowly driving up the joint as long as it is possible to do so, and until the paving is put in, as we find that, similarly to any joint we have tried, no matter how tight the bolts and plate are made when first put on, there are a number of small lumps or inequalities in both joint and rail which prevent it being made absolutely tight, and with the running of the cars over the joints for a few days, it seems to cause a motion between the plate and joint that rubs down these inequalities to a certain extent and allows both joints and bolts to be tightened a little more. In practice we clean both rail and joint thoroughly and swab the rail surface with some cheap oil, apply the joints with the bolts, driving up the joints all that is possible, hammering up the bolts and tightening with from an 18-in. to 24-in. wrench, one man. After a few days, we send a man over with a light hammer and wrench, and have him tighten up every bolt, by hammering the head lightly while he puts his weight on the nut and, if there is an opportunity to repeat this operation before the track is closed up by paving or otherwise, we do so.

"We have quite an amount of 6-in. rail laid in brick, on all of which these joints have been used and have had but very little trouble from loose joints in this rail, some of which has been down two or three years. In all, I do not believe that we have had to take up or re-tighten more than fifteen or twenty joints out of quite a number of hundreds. As stated, we think it is very largely on account of proper and thorough application of the joint, and the writer personally knows, from a large experience in other places, that where complaints have been made as to "Continuous" joints, or of the Weber or "Atlas" types, the trouble has been largely due to imperfect application in the beginning and to lack of proper inspection afterwards.

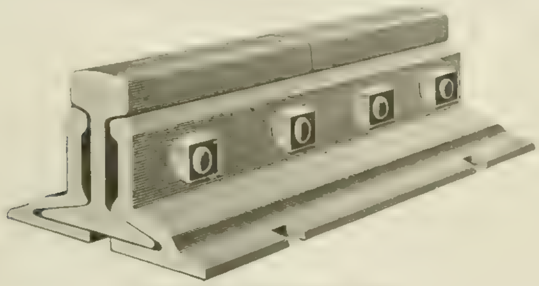
"Properly applied and in proper location, I think there is very little choice between the three types of joints above mentioned, so far as the practical results of keeping joints in good shape are concerned."

The question of electrical conductivity in relation to the mechanical joint affects them all in relatively the same proportion. The method of bonding the rail ends so as to secure the necessary degree of effectiveness is a subject of such importance that we have decided to assign it for consideration in a paper by itself. The writer believes,

* Presented before the American Railway Mechanical and Electrical Association, Sept. 26, 1905.

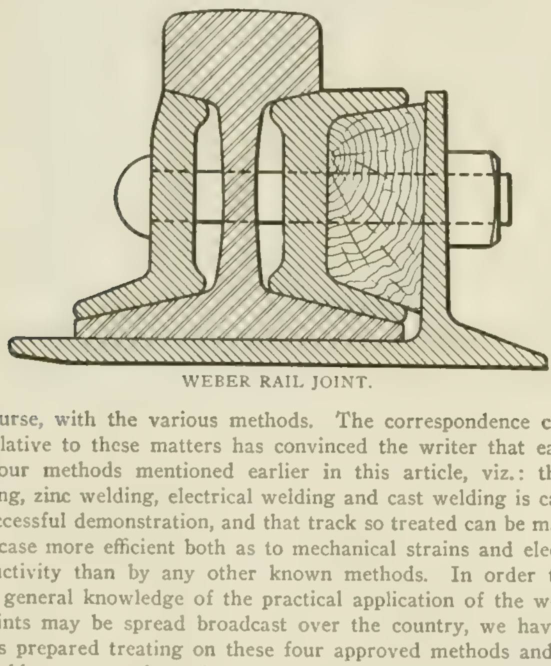
however, that either of the two types of joint mentioned heretofore lends itself equally to any of the more approved methods of bonding.

The study of the various methods of welding the rail ends is, we believe, more particularly interesting to all those roads which have a large proportion of urban trackage, the rail which is buried in the dirt, macadam or paving of a public road or street, accommodating itself more thoroughly to the somewhat unusual conditions imposed by the formation of a practically continuous and unbroken stretch of steel.



"CONTINUOUS" RAIL JOINT

The writer is aware that the officials of many roads are outspoken in their opposition to any rail welding process, and in numerous cases claim a more or less disastrous experience either on their own part or within the range of their observation as sufficient reason to warrant their adverse opinion. We believe that all these unsuccessful experiments in rail welding are due either to unusual local conditions, which in no way affect the general proposition or to a failure to thoroughly appreciate the requirements necessary to a proper and efficient handling of the work; these requirements vary,



WEBER RAIL JOINT.

of course, with the various methods. The correspondence carried on relative to these matters has convinced the writer that each of the four methods mentioned earlier in this article, viz.: thermit welding, zinc welding, electrical welding and cast welding is capable of successful demonstration, and that track so treated can be made in each case more efficient both as to mechanical strains and electrical conductivity than by any other known methods. In order that a more general knowledge of the practical application of the welding of joints may be spread broadcast over the country, we have had papers prepared treating on these four approved methods and have been able to secure in each case an engineer whose experience has been such as to insure an article prepared from certain knowledge. These papers follow:

THERMIT RAIL WELDING.

BY G. E. PELLISIER,
Civil Engineer, Holyoke Street Railway Co.

The "Thermit" process of welding steel rails dates from the year 1899, and is the discovery of Dr. Hans Goldschmidt, of Essen, Germany.

Thermit, as described by the discoverer, consists of a mixture of powdered aluminum and iron oxide, and its application to welding depends upon the following fact. If the mixture is ignited at a single point by means of a special ignition powder, peroxide of barium and aluminum, combustion proceeds without further supply of external heat and without any combination with the oxygen of the air, at the same time developing a temperature estimated at 3,000° C.

By the reaction the iron oxide is reduced to nearly chemically pure iron, the oxygen of the iron oxide combining with the aluminum to form aluminum oxide or artificial corundum, the reaction being chemically expressed by the equation $Fe_2O_3+2Al=Al_2O_3+2Fe$. The aluminum oxide having the lower specific gravity separates from the iron, rising to the top where it may be decanted off or the pure iron drawn from beneath.

COMPLETE WELDING OUTFIT.

This iron, when poured upon metals to be repaired or welded, has the property of uniting intimately with them, due to the very high temperature to which it is raised. When used for welding steel other ingredients, such as carbon, manganese, etc., are added to the thermit mixture to give the resultant metal more or less the properties of the steel with which it unites.

The reaction is carried on in a special crucible made of sheet iron lined with some very refractory material, usually magnesia or aluminum oxide, the by-product of the reaction itself.

RAIL WELDING.

The complete outfit for welding steel rails consists of the crucible just described, a pair of molds made to fit the section of rail to be welded, a pair of clamps to hold the molds in place, a wire brush to clean off the dirt from the ends of the rails, a small gasoline torch to dry off any moisture which may be present on the parts to be welded and to take the chill out of the metal, and a portion of thermit weighing from 15 to 25 lb., depending on the section of rail to be welded. If an absolute butt weld of the ball of the rail

PATTERNS AND MOLDS

is desired, a pair of heavy clamps for upsetting the rails while hot is also necessary. The whole outfit is easily transportable in an ordinary wheelbarrow.

The molds are easily made, being simply sheet iron flasks filled with a mixture of clay and sand, or any other material suitable for steel casting. The only precaution necessary in making the molds is that they should be well vented and thoroughly dried. The flasks may be used repeatedly, of course, but have to be refilled each time after using. One man can fill from 15 to 20 pairs per day.

In making a weld the ends of the rails are first cleaned with the wire brush (this is simply to get the dirt off, as rust makes no difference), and heated to dispel the moisture. The rails are then brought into exact alignment and the molds put on and fastened with clamps. All contact lines between the mold parts and the rail are then luted with moist clay. The top of the rail is also painted with a thin paste of clay and water, which, when dry, prevents the

slag and iron from adhering to the top of the rail. (When a butt weld is desired, a pair of clamps is next adjusted to the ends of the rail so that they may be upset while hot. These are not deemed necessary, however, and are not generally used, as it has been found sufficient to simply weld the base and web of the rail.) The mold are then backed up with sand. The crucible, which is set on a tripod, is next placed over the molds, with the tapping hole directly over

TAPPING CRUCIBLE

the gate in the mold. A tapping rod is then placed in the hole, which is then stopped up by means of a couple of asbestos washers, a small iron disk, and finally a little refractory sand. The charge of thermit is then added and a little of the ignition powder placed on top, which is set off with an ordinary storm match. The reaction when once started proceeds rapidly, usually taking about ten seconds, the molten mass boiling furiously. At the end of about twenty seconds more the boiling has ceased and the iron is separated from the slag. The crucible is then tapped and the metal flows into the molds, followed by the slag, and in less than a minute the joint is made. The joint is then allowed to cool about fifteen minutes before the molds are taken off. (This can be done three or four min-

POURING JOINT

utes after pouring, if necessary, as when welding while the cars are running.) Two or three taps of a hammer will separate the slag from the joint and the work is completed, no chipping or grinding being necessary except when welding old rails where the joints are battered, when of course the rails have to be ground down to an even surface. In case the two rails do not come together closely, a shim of steel may be inserted and welded in, completely filling the gap. (The writer has made many joints in this manner with perfect success.)

Four men constitute a welding gang, and 18 or 20 joints can be made in a day of ten hours. No skilled labor is necessary.

The first place to experiment with this process was Essen, Germany, the home of the inventor. Owing to the importance of the

JOINT ON 7-IN. RAIL BEFORE REMOVING SLAG

rail joint question, however, other European cities were not slow in investigating its merits. In 1900 about 1,200 joints were made in various cities on the continent. The results obtained from these were considered so satisfactory that the use of this method of welding increased very rapidly, some cities introducing it on an extensive scale, notably Leeds, England; Dresden, Austria, and Singapore, India. Twenty-six hundred joints were made in 1902, and 20,000 in 1903. In 1904 a company was formed in the United States to introduce the process here, and at the suggestion of the writer, who had followed the development of the process with considerable interest, the Holyoke Street Railway Co. decided to use it on a mile of track about to be reconstructed.

WORK DONE AT HOLYOKE.

The rail welded was new 9-in. 107-lb. grooved Sec. P. S. Co. 228. known as Trilby section, the rails averaging about 55 ft. in length. The total number of joints made was 170. All joints were welded except those at the special work. (Three joints were also made on the special work as an expeiment, two being at the p. c. of a curve of 40-ft. radius, the other at the end of a frog.) The longest piece welded continuously was about 2,500 ft., both ends being bolted tightly to the special work. The welding was done when the temperature was between 80 and 90° F. in the shade. Of the total number of joints made but two were imperfect, and these were immediately repoured. The cost per joint was about $6.23, divided as follows:

Thermit	$4.98
Molds per pair	.35
Labor and supervision	.60
Crucibles per joint	.25
Incidentals (shims, gasoline, etc.)	.05
Total	$6.23

This work has been down nearly a year now, and not a break has occurred, although the temperature has been as low as 10 degrees below zero. Many of the joints can hardly be detected at the present time, and the wear throughout the rail is perfectly uniform, showing that the rail at the joint has not been softened or injured in any way by the heat to which it was subjected. The alignment of the track has remained perfect both on tangent and on a curve of 300 feet radius, which was also welded. (A prominent street railway official, who has been connected with street railway work for many years, made the remark in the hearing of the writer that there was not a better piece of track in the United States.)

As this work proved thoroughly successful, the company decided to weld about 1,000 joints this summer. Of these, 400 are on 9-in. 107-lb. grooved rail which has been down about four years, 150 on 7-in. 70-lb. T rail which has been down about six years, 100 on 6-in. 60-lb. T rail which has been down about five years, and 350 on new 7-in. 90-lb. grooved rail. As nearly all of the rails to be welded are about 60 ft. in length, this will represent about five miles of track, all of which is in paved streets.

The work on the 9-in. rail has already been completed. Owing to the heavy traffic over some of the lines, about [illegible] joints had to be made at night between the hours of twelve and five in the morning, three men being able to weld from twelve to fourteen joints in this length of time. Where the time between cars was ten minutes or

SAME JOINT, SLAG REMOVED

over the work was done in the daytime, as the joints can easily be made while the cars are running without interfering with traffic. Of the total number of joints made, three (or less than one per cent) were imperfect and had to be repoured. No breaks have yet occurred. The cost of joints on 9-in. rail made this year has been \$5.25, divided as follows:

Thermit	\$4.25
Labor	.50
Molds	.20
Crucibles, per joint	.25
Incidentals	.05
Total	\$5.25

Data on the other sections of rails are not yet available, as the work is not yet completed, but as the charges for labor, molds, etc., remain practically constant, irrespective of the section of rail, it will be safe to say that the cost of joints will lay between \$3.50 for 4¼-in. 60-lb. T rail, and \$5.25 for 9-in. 107-lb. grooved rail, these figures being based on present quotations for thermit. To this must be added \$1.25 per joint for removing and replacing pavement when welding rails already laid.

Tests of the joint with a Conant bond tester which compares the resistance of three feet of rail with a joint with that of three feet of rail without a joint, shows the conductivity of the joint to be practically equal to that of an equal length of rail. Tests of individual joints by determining the drop in voltage at the joints

TRACK AFTER WELDING

confirm these results. Tests of the joints made last year show no deterioration in conductivity. Mechanically the joint seems to be perfect. The following test will give an idea of the strength of the joint: A section of 9-in. 107-lb. rail 13 ft. in length, with the joint in the middle, was placed in the track on two ties, distance center to center of bearing 12 ft. 6 in., and loaded double truck cars weighing about 20 tons allowed to pass over it. The rail cracked through the bolt holes, but no harm was done to the joint.

The fact that we did not have a single break during the past winter shows pretty conclusively that the joint is, when properly made, sufficiently strong to withstand all stresses due to changes in temperature and those due to traffic. Joints sawed through the middle show that perfect amalgamation of the metals has taken place.

GRINDER FOR SMOOTHING JOINT

From what experience the writer has had with this process of welding, it seems to him to possess the following advantages: Simplicity, no skilled labor being necessary, lack of expensive apparatus, the whole outfit costing less than \$100, adaptability to repairs and construction on moderate sized systems where the amount of work done at one time does not warrant the expense of maintaining an extensive apparatus and retention of skilled laborers, the possibility of welding on track already laid without interfering with traffic where the headway is ten minutes or over, and last, but not least, the excellent results obtained both mechanically and electrically. Another point which has not been mentioned is the ease with which compromise joints of almost any description may be made by simply changing the form of molds.

JOINTS AND TRACK CONSTRUCTION IN PHILADELPHIA.

By H. B. Nichols,
Engineer of Way, Philadelphia Rapid Transit Co.
and
C. B. Voynow,
Assistant Engineer, Philadelphia Rapid Transit Co.

Rail joints, especially those used in street railway tracks, may be divided into two distinct classes—those which I will call ordinary joints, where the parts comprising them may be assembled and taken apart with ease and comparatively small expense; and those which I will call permanent joints, where the parts are permanently embodied in the joint and cannot be taken apart. The first class comprises practically all of the joints at present in use, and are those that consist of fish or joint-plates of various forms held by bolts or keys. The permanent joints represent a very small percentage of those in use, as they have been introduced comparatively recently, and consist of so-called cast-welded and the electrically-welded joints.

The different kinds of fish or joint-plates used for connecting ends of rails are well known. The principle involved in all of them is two wedge-shaped plates, that are, by means of bolts or keys, forced on to the rails, the latter having a similar outline: and upon the thorough, continuous and tight contact of these inclined surfaces the solidity and permanence of the joint depends. In any form of rolled steel exact uniformity of section is never obtained; one end is invariably larger in cross-section than the other, even when new rolls are used. This is due largely to the difference of temperature between the ends of the steel when on its final pass through the finishing rolls; and, further, as the rolls wear down, the rolled sec-

tion becomes larger. This is true even with the simplest section, as a square or round bar, and it is considerably more pronounced in the deep rail sections that are used in street railway construction. In consequence, when joint plates and rails are assembled, while theoretically true and exact in their complementary design, in practice they vary greatly, sometimes as much as 1-16 in. But, assuming that the section of plates and rail are correct, as per design, rolled surfaces of steel are not continuous or perfectly smooth planes, but consist of minute elevations and depressions. Therefore, when the two joint-plates are forced by the bolts into the fishing sections of the rail, continuous contact is not obtained, but only an intermittent or point contact. In other words, only the protuberances of the surface of the joint plate come in contact with those in the surface of the rail. The object of a rail-joint is to bridge over the ends of the rails and hold them against vertical and lateral movements under the load. Were it only for those movements, I believe, joint-plates would be effective for a considerably longer period than they are in practice, for the protuberances mentioned above would hold out considerably longer against flattening under the weight of the load. But besides the vertical and lateral movement, there is a longitudinal or bodily movement of the rails, due, principally, to contraction and expansion, and also on account of the wave motion of the rail under traffic. This movement acts like a file on the minute irregularities of the surfaces. Although the linear movement is small, maximum $\frac{1}{4}$ in. to $\frac{3}{8}$ in. in severe changes of temperature, yet those point contacts are so small as compared with the extent of the movement of the rails, that this movement acts upon them like a long-drawn file. The result is that, no matter how tightly the plates were adjusted originally, in a very short time they become loose, and the ends of the rails begin to hammer under the passing wheels. Moisture percolating between the contact surfaces, due to capilary attraction, or otherwise, oxydizes those surfaces and greatly facilitates this filing effect. In steam roads this necessitates constant, almost daily, tightening of the bolts.

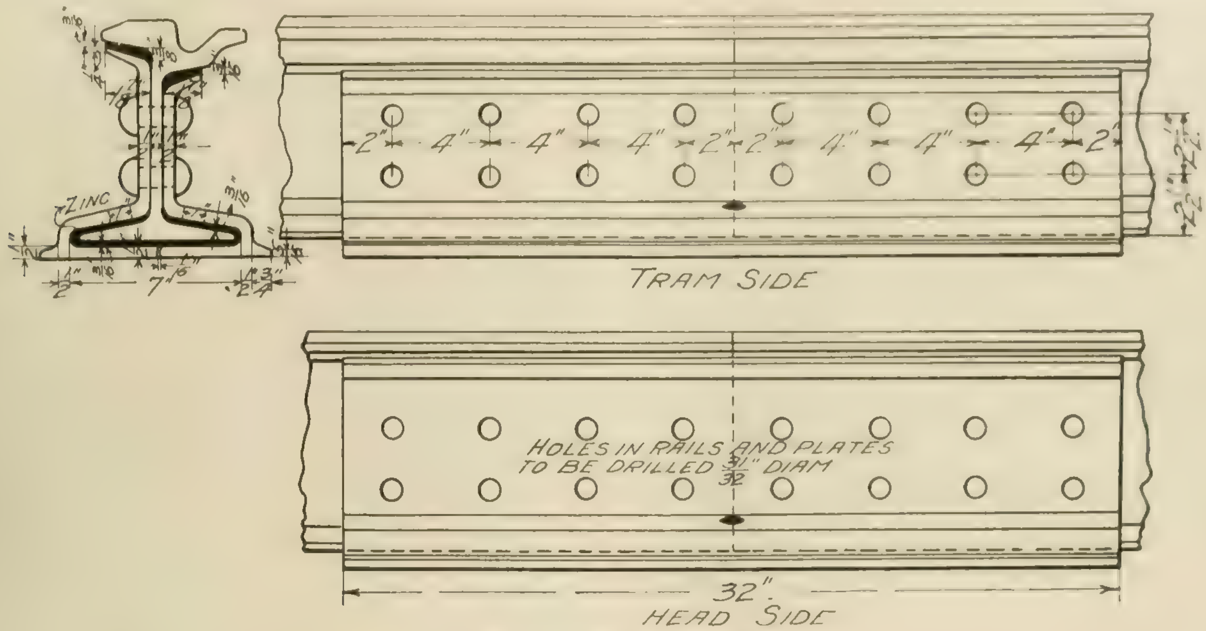


FIG. 1. COMPOSITE JOINT.

FIG. 3. PORTABLE SAND BLAST.

I have not mentioned here the loosening of the plates caused by the nuts being jarred loose from vibration; the reason is that I wish to present the fact to you that a joint, even under ideal

conditions of fit and construction, could not be maintained in perfect condition very long. In street railway track construction the movement of the rails, due to changes of temperature, is not as great as in steam tracks, because the rails are buried in the pavement; yet it is large enough to cause the same filing effect. On the other hand, this burying of the rails in the pavement entirely precludes the constant tightening of the bolts, for the expense of the constant digging up and replacing of pavements would be prohibitive. The consequence is that the joints are allowed to remain

FIG. . JOINT AFTER BEING CLEANED

loose a considerable length of time before they are uncovered and bolts tightened. Moreover, the constant hammering of the loose ends of the rails on the plates causes a depression on the surface of the plate and rail to such an extent that the tightening of the bolts does not avail; and the plates first, and very soon the rails themselves, are in such a condition that a renewal is the only remedy. Even before the ends of the rails and the plates have become damaged, the loose joints cause the ends of the rails to droop, and in connection with the rolling action of traffic, which elongates the upper surface of tread, bend the entire rail in a vertical curve by forcing up the spikes or ties in the middle of the rail. This makes the track a continuous succession of waves, which necessitates, at intervals, the digging up of the entire pavement for the purpose of

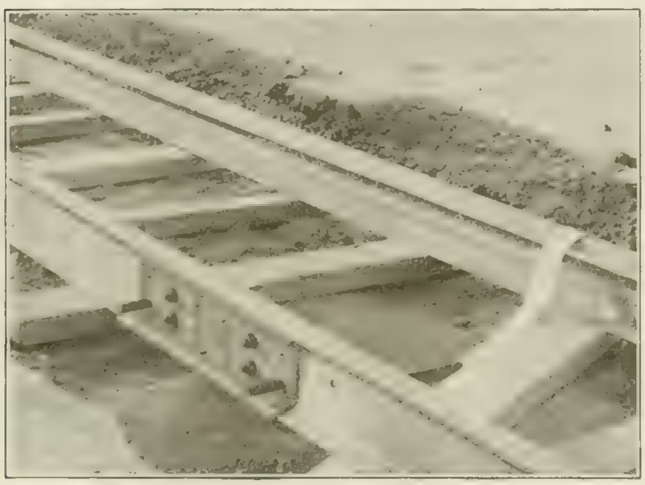


FIG. 4. PLATES IN POSITION

retamping and respiking it. When once these vertical curves are formed the track can never be restored to good condition. As a matter of fact, rails, after they have been removed for renewal, could in many cases have been used for several years more, as far as the middle part is concerned, were it not for the battered ends. In other words, the life of the track is mainly dependent upon the life of its joints. I shall not discuss here the loss involved in the maintenance of the rolling stock and pavement, but anyone taking a ride on old track will feel the effect on himself of low joints.

Street railway track construction being a development of that of the steam roads, the idea prevalent in that branch was necessarily embodied in it, although there are radical differences between the two. The steam railroads, consisting of vast stretches in the open country, naturally do not require paving. The rails being entirely exposed on all sides, and therefore directly influenced by changes of temperature, great care must be taken that the expansion in the rails does not distort the alignment of the track. To prevent this, the rails are laid in short lengths, the joint holes in the rails are made considerably larger than the bolts, and spaces are left between the ends of the rails to allow free movement. This was also embodied in street track construction. But it has been gradually acknowledged that in street railways, where the rails are buried in paving, the changes of temperature in the atmosphere do not affect the rail proportionately; the friction between the paving and the rail exerts upon the latter such a force as to a great extent counteract the force of the stress due to expansion. Again, the material of the paving enclosing the rail on both sides helps to keep the rail in permanent alignment and surface. This has involved what I have called permanent joints, viz., the cast-welded joint, which is formed by pouring a mass of molten cast-iron around the abutting ends of the rails and the electrically-welded joints, which are made by electrically welding two strips of steel plates to the sides of the webs at three or more points. While these joints have seemingly given better results, they also embody either defects or disadvantages which are quite important. In the cast-welded joint the comparatively large mass of molten metal anneals or otherwise affects, whether physically or chemically I do not know, the texture of the rail ends. This makes the track of an intermittent hardness, which is very soon shown in the difference in wear between the middle of the rail and at the joint. Moreover, on account of the sudden high temperature the rail ends expand vertically, and in cooling do not come back to their original cross-section. This causes either elevations or depressions at the joints. The elevations can be overcome by grinding or filing, but the depressions cannot be remedied, and they remain as permanent defects in the track. I am not as familiar with the electrically-welded joints, and therefore cannot give you the resuts that have been obtained with them. But

FIG. . REAMING TOOL

the disadvantage that I know of is the fact that the transportation of the machinery and other expenses involved in placing them is considerable. The cast-welded joint does not give a perfect electrical connection, and I know of a railway in the neighborhood of this city where the management is judiciously using large copper plates in connection with this joint. Both of these joints have the further disadvantages that in case of changes in the track lay-out the joints can only be cut out and thrown in the scrap pile.

The joints that are at present used in Philadelphia are supposed to remedy the above-mentioned defects and disadvantages. This will be seen from the following descriptions. The joint consists of what may be called two Z or special bars, Fig. 1, which are riveted on to the webs of the rail. These plates are not made to fit the fishing section of the rail; on the contrary, spaces are left under the

head, tram and around the foot of the rail. These spaces are filled with molten zinc, which enters into and fills out all the irregularities of the rolled surfaces, thus giving an absolutely continuous and perfect bearing throughout the whole length and width of the flanges of the plates. It is obvious that such a continuous contact could not be

FIG. 6. PORTABLE PNEUMATIC REAMER

obtained by the most laborious machining or milling of those surfaces. The adhesion of the molten zinc to the rails and plates, together with the body-bound rivets, hold the joint permanently tight, and at the same time prevent expansion, thus making the rails continuous.

The method of constructing the joint is as follows: After the material has been distributed and the rails placed on ties, but before the latter are spiked, both plates and rails are thoroughly cleaned (Fig. 2) by a portable sand blast (Fig. 3). The plates are next placed on the rail ends and held in place by steel drift-pins, placed one in each end of the plate (Fig. 4). A steel straight-edge is laid on the head of the rail, and the tread brought to a uniform surface by inserting wedges between the [illegible] or the plates and the head of the rail. The wedges are then driven in with a light hammer until the straight-edge has a continuous bearing.

While the plates are held in place by four temporary bolts (Fig. [illegible]), the rivet holes are reamed to [illegible] (Fig. [illegible]) by a portable pneumatic reamer (Fig. 6). The 12 1-in. steel rivets are then driven by a portable pneumatic riveter (Fig. 7). This insures the filling up of the holes by the rivets. The next step is to put in place the iron clamps for holding the asbestos cloth pads and clay on the bottom and at the ends of plate and above the base of rail. The spaces between the head and tram and plate

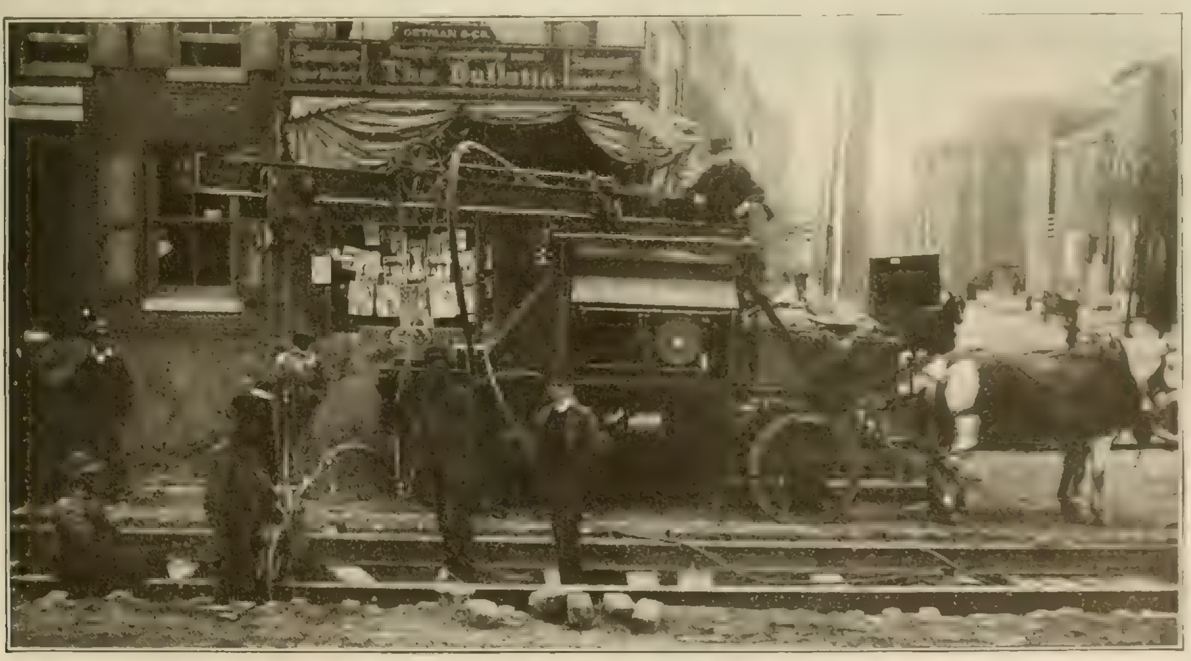


FIG. 7. PORTABLE PNEUMATIC RIVETER

are temporarily caulked with asbestos cloth. The plates are then warmed by fuel oil burners (Fig. 8), operated by a portable compressor, to a temperature of about 300 degrees to 400 degrees, after which the molten zinc is immediately introduced through a 1-in. hole located in the center of the lower portion of plate, the remaining space underneath head and tram of rail being filled by the aid of

dams. These dams consist of aluminum castings padded with asbestos cloth.

From the above description it will be seen that this joint combines the characteristics and advantages of both classes of joints mentioned above, obviating their defects. While it is a permanent joint, in that it holds the ends of the rails permanently together, it can be easily taken apart and the parts replaced at a comparatively small expense. It does not distort the original cross-section of the rail, nor does it affect the physical or chemical nature of the metal. It not only obviates the initial defects in the fit of the rolled section, but also the aggravating cause—that of linear movement, due to expansion. As the plates and rails are thoroughly cleaned and heated before the molten zinc is poured in, the latter galvanizes on to the steel (this was proved on joints that were purposely opened for investigation after having been in the ground for over two years), and, therefore, gives a thorough and continuous electrical connection. I know of very interesting data about the electrical bonding quality of this joint, but as this data is the property of the Franklin Institute, I am not at liberty to divulge it at present. I will only say that, after a thorough test by an electrical expert of this city of joints that had been in the ground over two years, and under the heaviest traffic, the resistance was found to be less than the rails themselves. Another, and I think a very important, feature of this joint is the fact that its initial cost is practically a permanent investment. From the nature of its construction, having an intermediate soft metal between the surfaces of the steel, the plates cannot be affected by wear, and, therefore, practically the entire material that enters into the construction of the joint—that is, the plates and zinc—can be used over again after the rails have been worn out, only necessitating new rivets.

Before describing the other improvements in track construction, I think that it will be interesting to mention the novel idea involved in the construction of this joint. It seems, at first glance, rather an anomaly that malleable iron, cast-iron and even rolled steel plates or a high percentage of carbon have been used, or, in other words, different hard metal substances have been used as a support or foundation for certain vibrating loads, and they all proved more or less a failure. Yet, in face of these known failures, it was proposed to support the same loads by means of a comparatively soft metal, zinc. The fact is that this metal does form a better support. There is a well-known engineering principle which has a similar and close relation to this, and which will explain the seeming ambiguity. Foundations of large and important structures are known to have been built on sand and even quicksand. It is only necessary to dam around the loose material under the foundations and make the area of the latter large enough. The configuration of the plates forming wedge shaped spaces under the head and tram of the rail, and the enclosed space around the foot is the damming, and the filling in under the entire width of base of rail, and of all the irregularities of the rolled surfaces, is the enlarged area of the foundation.

ELECTRICAL RAIL WELDING.

Extracts from an article upon Track Construction, by T. W. Wilson, International Ry., Buffalo. Published in the "Street Railway Review" for March and April, 1903. (Used by special permission.)

The electrically-welded joint was adopted as a standard in 1899, and since that time 30,216 joints (representing 106½ miles of track) have been welded. Numerous descriptions of the process have been published, so all that is necessary here is to give a statement of results obtained and the number and cause of breakages. In this connection the question is still asked as to "what we do with expansion." Probably the best answer is that we "forget it," the same as we do the joint after it is welded.

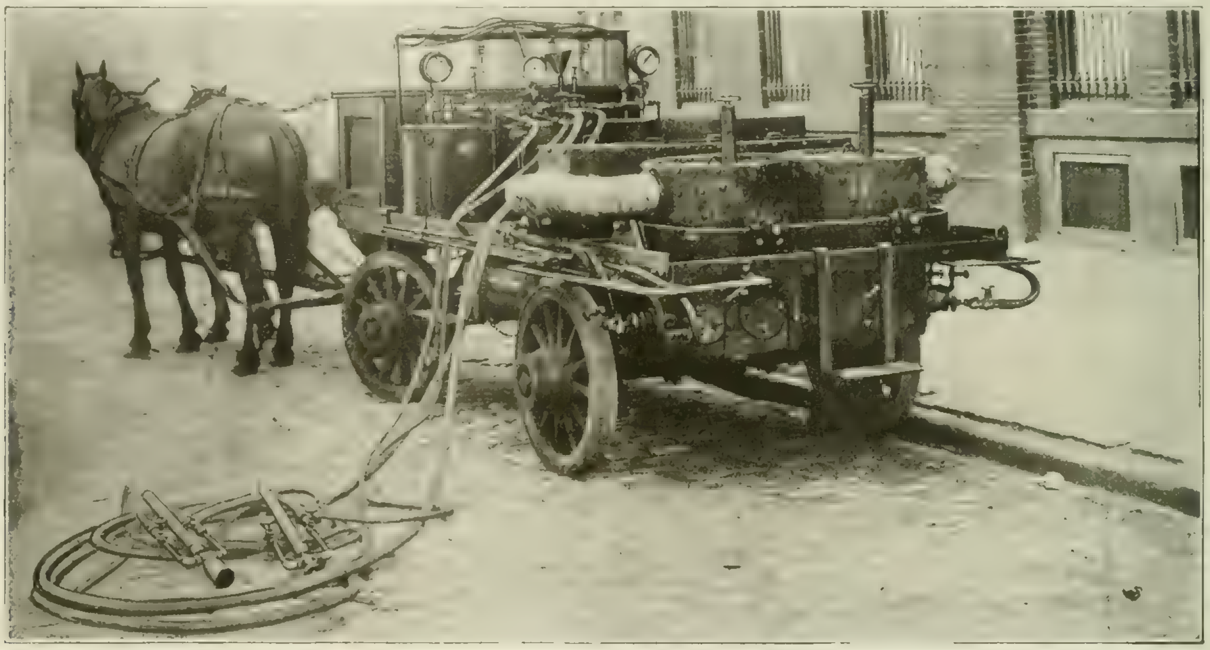


FIG. — PORTABLE FUEL OIL BURNER

Scientifically it may be said that the rail is held in every infinitesimal part of its length by the concrete base, which covers about one inch of the base of the rail, and by the paving, and the track cannot expand or contract. The force is taken up in internal strain in the metal of the rail. When the strain becomes greater than the ultimate tensile strength, the rail breaks.

A tabulated statement follows which explains itself:

FIRST YEAR.

Kind of Rail.	Joints Welded in 1899.	No. Broken.
Old, 6-in.	4,787	18
Old, 7-in.	8	0
Old, Johnson Co., 9-in.	2,658	49
Old, Pennsylvania Steel Co., 9-in.	74	3
New, 6-in.	0	0
New, 9-in.	3,882	45
	11,349	115

SECOND YEAR.

Kind of Rail.	Joints Welded in 1900	Joints Welded in 1899-1900.	No. Broken,
Old, 6-in	11,073	16,760	127
Old, 7-in.	566	574	7
Old, Johnson Co., 9-in.	1,894	4,552	25
Old, Pennsylvania Steel Co., 9 in	140	220	6

New, 6 in.	619	619	2
New, 9 in.	2,234	6,056	16
	17,432	28,781	183

THIRD YEAR.

Kind of Rail.	Joints Welded in 1901.	1899-1900-1901.	No. Broken.
Old, 6 in.	482	17,242	8
Old, 7 in.	0	574	1
Old, Johnson Co., 9-in.	356	4,908	7
Old, Pennsylvania Steel Co., 9 in.	0	220	1
New, 6-in.	0	619	0
New, 9 in.	597	6,653	3
	1,435	30,216	20

Of the 183 broken joints, winter of 1900-01, 23 were on welding done in 1899 and 160 were on welding done in 1900 (17,432 joints were welded in 1900).

The joints which broke have all been carefully inspected, and in no case did the break occur through the weld, nor did the weld pull off. The break almost invariably occurred at the end of a welding bar, the rail breaking usually through old bolt or bond holes beyond the bar.

By welding with bars long enough to cover and reach over all such holes, this source of breakage has been eliminated since 1900. The 49 breaks in 1899 and the 25 in 1900 in old Johnson Co. 9-in., as shown above, were directly due to this cause. The large number of breaks in 1900 old 6-in. (127) we could only account for by attributing them to some quality in the chemical composition of the rail which did not lend itself readily to the weld. They nearly all occurred in the same street—viz., East Ferry St.—and this would seem to help that hypothesis.

Referring again to the table, we note 183 broken joints at the end of 1901 winter. These were all rewelded in the summer of 1901, so that today the number of broken joints is 20. These have been cut out and a piece of rail 10 ft. long inserted, full bolted and bonded. Next summer these plates will be taken off and the rails rewelded.

It has been found that it is not always necessary to cut in a piece of rail in place of a broken joint, as a very neat patch can be welded in a great many cases which gives very satisfactory results.

As an average, therefore, on all welding done in Buffalo, the breakage has been about 1 per cent.

The welding done in 1901 and 1902 in Rochester and other cities shows even better results, and of 5,308 joints welded in Rochester in 1901, there were but 6 broken rails in the spring of 1902. When it is considered that the quality of each weld depends entirely upon the personal equation of the welder (since it is by a cherry red color alone that the proper point of fusion is known), it seems wonderful that such remarkable results are achieved.

In addition to welding our joints, the ground return around special work has been taken care of by welding or electrically brazing copper ground cables to the rails. For this purpose a copper block 1½ in. thick, with a suitable groove across one face to pass over the cable, is provided. The cable is placed against the rail web and the copper block over the cable.

The welder is then brought into position, a Bessemer steel plate about ⅜ in. thick is interposed between the copper block and the contact of the welder. This acts as a heat insulation and enables the copper block to be brought up to proper heat for brazing. Hard spelter is used. By this means a 500,000-c. m. cable can be attached to a rail so that the full carrying capacity of the cable is realized, the area of union between the copper and the steel being ample to allow for the difference in carrying capacity of the two metals.

ELECTRIC WELDING OF RAIL JOINTS.

(From the Iron Age.)

The process of electrically welding rail joints, as applied by the track welding department of the Lorain Steel Co., Lorain, Ohio, comprises three distinct operations. The machinery is mounted on trolley cars of suitable design, the running gear of which is provided with threaded axles so that the machines can be used to weld track of different gages. New rail is welded either before or after the paving is in place, space being left at the joints to permit the entrance of the welder. In old rail the paving is removed around the joint and the old plates and bond wires are removed. The rail ends are then brought up to the proper grade.

In the welding process the first operation is that of sand blasting, by means of which all dirt, rust and foreign matter is removed from the rails at the points where the welds are to be made and from the bars used in making the joint. The apparatus for this work consists of a 10-h. p. motor driving an air compressor, a tank for the storage of air and a bin for holding a supply of sand. A sand mixer of the Tilghman type is also provided. By means of a hose and nozzle the operator directs the blast of air carrying the sand against the rail until all foreign matter has been removed. The bars are similarly treated and the joint is ready for the actual operation of welding.

The apparatus for welding is carried in two cars coupled together by a special form of slip coupling, which permits of sufficient range of movement for the car carrying the welder proper to be moved from one weld to another of the three welds necessary in making a joint without the necessity of moving the second car. The welder itself is hung from a bail on a crane extending out beyond the end of the car. This crane permits of lowering and raising so that the jaws of the welder can engage the sides of the rail and also to shift the welder from one side to the other to engage both rails of the track. The crane is operated by friction clutches from a shaft in the car, which is kept running continuously by a 5-h. p. motor. This motor also drives a small rotary pump for circulating water through the welding transformer and the faces of the contacts to keep them cool. After the water has passed through the welder it goes to a cooling tank on top of the car, is forced under the false bottom and made to blow in from the middle and passes around and around until the outer circumference of the tank is reached. A false bottom is provided, and air, from a blower in the car, is forced under the false bottom and made to blow up through numerous holes. The hot water from the welder passes into the outer portion of the serpentine and gradually finds its way to the center. From there it is conducted to one of the tanks in the car. In its passage along the serpentine path the air is forced up through the water and forms a most efficient method of cooling, depending somewhat on the humidity of the atmosphere, being most efficient when the atmosphere is dryest.

The welder itself is an alternating current transformer, the primary winding of which consists of two coils in parallel of 44 turns each. The secondary coil is a single loop of copper of large cross-section, the terminals of which form the contacts, or jaws, which engage each side of the rail and between which the weld is made. The secondary winding is so made as to entirely inclose the primary coils, which are insulated in oil. On each side of this transformer and supporting it, but insulated from it, are the two large levers, hinged together at about two-thirds the distance from the top, for transmitting the necessary pressure to the weld.

These levers are connected at the top by an hydraulic jack. A hand pump for forcing water into the jack is bolted to one of the levers. A pressure of 4,100 lbs. per sq. in. is obtained on the 3⅞-in. diameter rams of the jack, the leverage on the arms increasing this so that about 37 tons pressure is developed at the weld.

In making a joint, flat rolled steel bars are used, having at each end a boss, or projection, on one side, which form the contact points between the bars and the web of the rail and confine the welded area to these sections. A flat strip of steel ⅛ in. thick by 1 in. wide is placed across the middle of the bars on the same side with the bosses. The bars are supported on small blocks and placed across the joint so that the middle strip engages the web of both rails. The middle weld is a vertical one and made the full width of the bar; the end welds are horizontal.

The welding train of two cars is moved up to a joint. The welder is swung into place and the jaws made to press against the bars on each side of the rail. The current is then turned on and flows from contact to contact through the bars and the rail web. By altering the pressure on the jaws the resistance of the several junctures is increased and the whole is soon brought up to a welding heat. As soon as this point is reached the current is cut off and simultaneously the pressure is brought up to the full amount. The pressure is then loosened and the welder car moved back to

bring the jaws opposite the extremity of the b[illegible] process is again followed here, except that when the final pressure has been applied it is held there and the weld permitted to cool under pressure until the metal has cooled sufficiently not to show any glow. The welder is then moved forward to the other end of the bar and the process repeated, after which the welder is raised and moved to the other side of the car to engage the opposite joint.

By holding the pressure after the weld is made a remarkably tough weld is secured. It will be noted that only the end welds are thus treated. As the center weld is not subjected to any strain, it is not essential to have toughness there. It has been found desirable to weld the ends of the bars while the bars are in an expanded state. By making the center weld first and not stopping to cool it under pressure, the greatest elongation of the bars is secured. After the ends are welded and the bars cool off they shrink and exert a powerful pull to bring the abutting rail ends together, thus closing the slightest opening and leaving practically no joint at all. This is an important point in the manufacture of a continuous rail, for if the abutting rail ends are not brought firmly together, the metal in the head of the rail will have a chance to flow into the opening between the rails, and this in time will cause a low spot in the head of the rail. As the bars are always in a state of tension, it follows that the rail itself, inclosed between the bars, is in a state of compression. Any contraction of the rail itself between the joints will be transmitted to the end welds, and it is therefore necessary to have these welds exceedingly tough to withstand the strain. The object of the center weld is simply for vertical stiffness and to prevent any movement of the rail ends. The actual current used in welding is about seven volts and from 25,000 to 30,000 amperes.

In the car coupled to the welder is carried a rotary converter for changing the direct current from the trolley to an alternating current. The current in the primary coils of the welder is 300 alternating, 40 cycles. The direct current side of the rotary will take current from 325 to 600 volts from the trolley, and by means of suitable regulating apparatus the output on the alternating side, to the welder, is kept practically constant at 300 volts, without regard to the fluctuations on the line. On a line voltage of 500 about 225 amperes are required, or it takes about 125 kw. to make a weld, the current being on about two and a half minutes to each weld.

The third and last operation in the process consists in grinding the head of the rail to a true surface. In welding new rail there is little need for this tool. In old track, where the rail ends have been battered, the receiving rail is purposely welded higher than the other. The grinder is then used to grind out the inequalities in the rail head and bring it back to a true surface. The grinder consists of an emery wheel mounted on a carriage having two rollers, which are about 4 ft. apart. This carriage is let down on the rail so that the rollers roll along the head of the rail, the emery wheel being over the uneven portion at the joint. The carriage is connected with a motor on the car by a swing frame, thus enabling the operator to move the emery wheel back and forth over the joint while the car remains stationary. By means of a hand wheel the emery wheel is gradually fed down, and as it is moved forward and back grinds off the high places until the whole joint is brought to a true surface. The principle is very much the same as a carpenter's plane. With the final operation of grinding the joint is left complete.

Carried on as a continuous process, it takes from 12 to 15 minutes to complete a joint. The work is carried on day and night, about 80 joints in 24 hours being a fair average. The bars used are 1x3½ in. and 1⅛x3 in., the length varying with the form of joint previously used. On new rail, where the ends are left blank especially for welding, the length is 18 in. On old rail the bars must be long enough to reach back of the old bolt and bond holes, in some cases requiring bars as long as 48 in.

In addition to welding joints the same apparatus is made use of in welding or electrically brazing copper ground cables to the rails. For this purpose a copper block, about 4 in. square and about 1½ in. thick, with a suitable groove across one face to pass over the cable, is provided. The cable is placed against the rail web and the copper block over the cable. The welder is then brought into position. A bessemer steel plate, about ⅜-in. thick, is interposed between the copper block and the contact of the welder. This acts as a "heat insulator," and enables the copper block to be brought up to a proper heat for brazing. Hard spelter is used. By this means a 500,000-c. m. cable can be attached to the rail so that the full carrying capacity of the cable is realized, the area of union between the copper and the steel being ample to allow for the difference in carrying capacity of the two metals.

The improved process of electrically welding rail joints and bonds has been in use since 1897. Further improvements were made in the winter of 1900, and the welding done the following season amply demonstrated the value of these improvements. While the breakage on all welding done had not exceeded 1 per cent the breakage on welding done in 1901 was hardly one-tenth as great as before. Of 5,308 joints welded in Rochester, N. Y., in 1901, there were but six broken rails in the spring of 1902. In no case has a joint broken through the bars or a weld pulled off; nearly all breaks have occurred through old bolt or bond holes beyond the bars. By welding bars long enough to reach over the holes this source of breakage has been avoided since 1900. The excellent showing made at Rochester, N. Y., on last year's welding proves to what a remarkable state of perfection the process has finally been brought. When it is considered that each weld depends on the judgment of the man making it, and that every bad weld must necessarily remain in the track, to be subsequently revealed when the strain of winter comes on it, and that but about one out of a thousand is a bad weld, it proves that by no other method of welding can such uniformity of results be attained. In the last three years the Lorain Steel Co. have welded at Buffalo, N. Y., alone over 100 miles of track.

THE CAST-WELDING OF RAIL JOINTS.

BY FRED G. SIMMONS,

Superintendent of Construction and Maintenance of Way, The Milwaukee Electric Railway & Light Co.

Among the first joints cast-welded under contract were those on Chippewa St., St. Louis, on the lines of the Southwestern Ry., during the months of October and November, 1894. The first 744 joints applied at this time were very satisfactory, less than one-half of one per cent breaking. During the following year the work of cast-welding joints on the street railway lines of Milwaukee was commenced, and some of the track welded at that time, consisting of a 5-in. 58-lb. tram-girder rail, is still in place and in first class condition after continual service for 10 years. It is not the intention of the writer to claim superiority in point of efficiency for the cast-welded joints, as compared with several other methods of accomplishing the same result.

We do, however, believe that many engineers and managers have avoided the use of the cast-welding process on account of the numerous erroneous arguments advanced against it, and it is the purpose of this article to lay before the public a simple description of the results obtained in the cast-welding of rail joints by the Milwaukee Electric Railway & Light Co., within the personal experience of the writer and under his supervision.

This description and the results obtained, we believe, conclusively show the possibility of cast-welding the rail joints in a manner absolutely satisfactory both as to efficiency and economy.

It is claimed that the mass of molten iron poured around the rail ends effects either a chemical or molecular change in the metal of the ball of the rail which makes this section of the rail softer than the remainder, the inference being that the carbon is burned out. With over 150 miles of cast-welded track, some of which has been in service 10 years, and with many miles replaced on account of the entire wearing out of the rail, no instance of a low cast-welded joint has been encountered; in fact when the work was properly and thoroughly handled, absolutely reversing this claim we have found that as our old girder rail wore out the cast-welded joint became the highest point in the rail, the thin metal on each side of it ironing down into depressions, leaving the rigidly supported metal of the joint high. Fig. 11 is reproduced from a photograph of such a joint, clearly showing the conditions as stated.

The entire process of pouring a cast-welded joint is illustrated in the accompanying cuts, made from photographs taken during the actual progress of the work.

Fig. 1 shows the utility motor car used in transporting the apparatus and material, and the cupola with the molten iron flowing is attached behind this car. The thin stream of white hot iron may be plainly seen on close inspection of the picture.

Fig. 2 is an enlarged view of the cupola [illegible] apparatus in greater detail.

Fig. 3 gives a very comprehensive view of the car containing the sand blast apparatus used to clean the rail ends.

Fig. 4 shows a joint after it has been cleaned by this process, the steel having assumed an almost silver whiteness.

[illegible]

Fig. 5 shows the molds, car and clamps used in preparing the joint for the pouring of the metal. Attention is called to the strength of this apparatus and especially to the bar. The purpose of this bar is to prevent "cocking" or "kinking" of the joint while cooling, and it has been found entirely efficient. Fig. 6 shows two joints prepared

FIG. [illegible]

for the pouring operation, the gate on one side and the vent on the other being very clearly discernible.

Fig. 7 clearly shows the actual pouring of the joint. Figs. 8 and 9 are views of a completed joint, showing particularly the ease with which paving of any kind may be abutted thereto. Fig. 10 is a section of a joint showing clearly the perfect bond of the metals.

The process is so fully outlined in the illustrations that I will pre- [illegible]. The heating of the iron in the cupola is in no sense different from the operations of any ordinary cupola, and the mixture used is the only point requiring special mention, [illegible] per cent soft scrap.

[illegible] and requires no particular mention. The importance of thoroughly cleaning six or eight inches of each rail end to be welded cannot, however, be overestimated, as it is necessary to remove all scale as well as dirt, and the sand blast process is, of course, the most economical as well as the most efficient.

The heavy clamp-bar already referred to is also a very essential feature, as this weight of metal not only prevents "cocking" and "kinking" of the joint, but helps prevent an overheating of the ball of the rail. This bar is kept in place until all semblance of red heat has left the joint.

An absolute fusion of a portion of the ball and stem of the rail is necessary in achieving a successful cast-welded joint (a sleeve

joint is of no value), and this is not a difficult result. During the last three years we have welded our own joints, having purchased the apparatus shown above from the contracting company, which had previously done the work, and during that time, although we have welded six to eight thousand joints, we have not had one pull or break.

Account No. 183	Supplies	$3,041.30	per joint	$1.260
" " 184	Injuries & damages, 5 %	362.10	" "	.150
" " 185	Interest, taxes, insurance	288.00	" "	.119
" " 186	Miscellaneous	653.35	" "	.271
		$6,680.46		$2.767

FIG. [illegible]—SAND BLAST CAR

Our electrical tests show the conductivity through these joints to be from 100 to 140 per cent of the conductivity of the abutting rail, and in no case of a proper weld does this conductivity fall below 90 per cent. This applies with equal force to track just welded, and track that was welded six to ten years ago, and is borne out by regular periodical tests.

The latest rail adopted as a standard by the Milwaukee Electric Railway & Light Co. is a 7-in. "Shanghai" section of T-rail weighing 95 lb. to the yard. The work shown and the joints illustrated in Figs. 8 and 9 are upon a section of track built of this rail. The weight of cast-iron used in this joint is 200 lb. The total cost of the joint approximates $3.50 for the joint proper and $1.00 for the opening and closing of the street; upon new track this last item is almost eliminated.

Our cast-welding work is treated as a business by itself, and the fairest method of showing the cost of these joints to us is to quote from our yearly report for the calendar year 1904:

CAST WELDING.

Output 2,414 Cast-welded Joints.

Account No. 180	Operating wages.......$1,590.78		per joint $	.659
" " 181	Repairs	704.83	" "	.292
" " 182	Power & light'g expense	40.10	" "	.01[illegible]

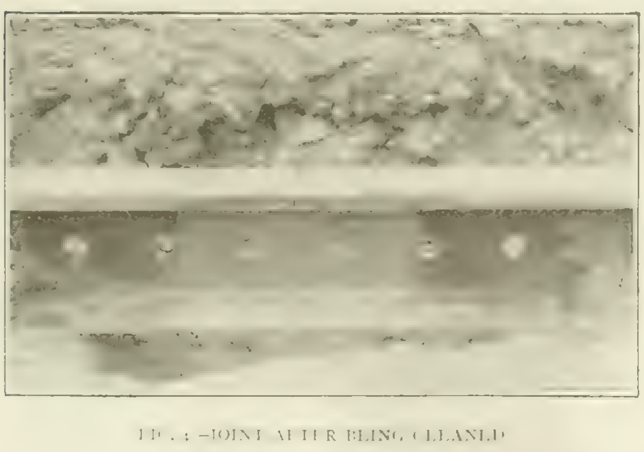


FIG. [illegible]—JOINT AFTER BEING CLEANED

The operating wages, repairs and supplies above contain a certain percentage of increase over actual amounts to cover general depreciation. The 2,414 joints were applied to rail ranging from 5 in. to 7 in. in height. In addition to the above an average of $1.00 per joint must be added as expense in opening and closing the street. A large proportion of the joints were scattered over a wide area and were really welded under adverse conditions.

The foregoing is given as being an exact statement of fact, and is the reason for our belief that in the present development of any of the methods of welding rail joints, the cast-welding process comes most nearly striking the true average between economy and efficiency.

FIG. [illegible]—MOLDS AND CLAMPS

To provide a summary of the foregoing papers is necessarily an undertaking which can result in little definite.

A few correlated ideas asembled and arrayed for purposes of comparison is more exactly what we may hope to accomplish; and in so arraying this correlated data, the fact that the information upon which it is based may not in all cases be complete, or the deduction drawn may not be the true one, serves only to accomplish the end desired, namely, a discussion of the entire subject matter.

Of the four methods of forming permanent joints illustrated above: three are properly designated as "welded," while the other (the zinc joint) cannot be classed exactly in this category. The

deduction which the writer draws from the four papers, however, is, primarily, that it is possible, with the best knowledge, and by the use of sufficient and correct apparatus, to produce an almost absolutely satisfactory joint (as to efficiency) by any one of the four methods.

Thus narrowing down the field of speculation, the question of amount and availability of apparatus becomes a vital one, which seems clearly outlined as follows:

The electrical welding operation appears undoubtedly to require the most cumbersome and very much the most expensive equipment, to such an extent, indeed, that, except in case of the very largest systems, private ownership would be virtually impossible, and all work would necessarily have to be done through contractors.

The zinc joint appears to rank next in point of expensive apparatus, but is followed very closely in this respect by the cast-welded joint.

The thermit welding process certainly requires very much the least expensive apparatus, and from this viewpoint stands in a class by itself. The relation of the joint to the abutting pavement in city streets is a much agitated question, but it has been shown beyond dispute that this agitation is needless, as the shape of the joint can be regulated to meet the condition.

FIG. [illegible].—JOINT READY FOR POURING.

There are many minor points which might be taken up, and which can be brought out in discussion, but in the opinion of the writer the meat of the entire subject, as it affects the great majority of the electric railway interests, is in the relative cost of an efficient

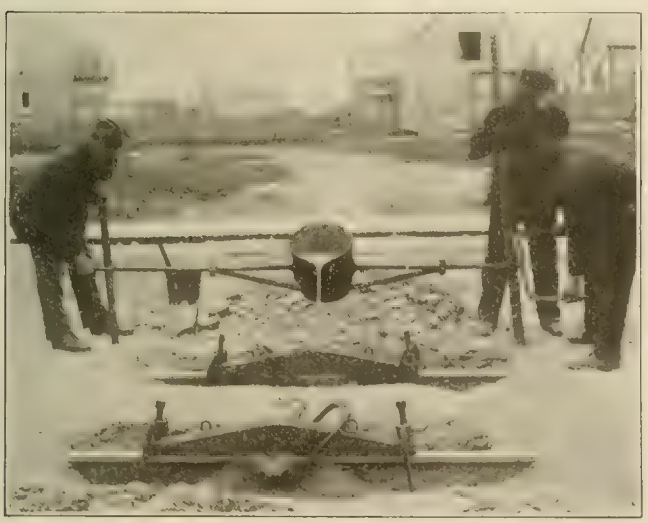


FIG. 7.—POURING JOINT

joint by any one of the methods. There are, of course, local conditions which may, in isolated cases, warrant a departure from the seemingly economical method, but our object is at all times to serve the majority, and therefore, while a much more exact comparison of cost will be easily obtainable during the discussion of this subject, such data as we have been able to secure is here assembled.

ZINC JOINTS.

No figures as to cost obtainable, these joints are controlled by the Lorain Steel Co.

FIG. [illegible].—COMPLETED JOINT

ELECTRICALLY WELDED JOINTS.

Information received from the Lorain Steel Co. as follows: "Our prices are from $6.00 to $5.50 per joint, depending on the number of joints contracted for. Ordinarily we do not care to accept contracts for less than 3,000 joints, on which, of course, the price of $6.00 per joint applies, contracts for 10,000 or more joints are made at the lower figure."

FIG. 9.—COMPLETED JOINT

FIG. [illegible].—SECTION OF JOINT

The figures in this case show that the entire expense of applying a weld on a rail of average size (under disadvantageous conditions) is but little in excess of $2.75, with $1.00 additional for opening and closing the street. This, including interest, taxes and depreciation charges on the capital valuation of the apparatus. Therefore, in conclusion, and in advance of future enlightenment on this subject, which it is our earnest wish the forthcoming discussion may evolve, the writer seems to see that under present general conditions the cast welded joint is so much more economical, from both the viewpoint of mechanical efficiency and actual monetary expense, as to recommend itself for first consideration.

If, however, the first cost of the portion of thermit required to make a joint can be reduced to the extent of 50 per cent or more

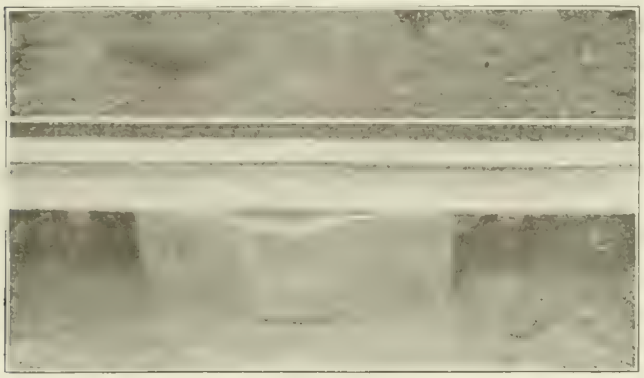


FIG. 11.—WORN-OUT CAST WELDED JOINT, SHOWING RAIL HIGH AT JOINT AND DEPRESSED AT EACH END OF CASTING

than quoted, the other inducements held out by this method are sufficient to give it first rank in point of desirability.

NICHOLS-LINTERN SANDERS.

A thoroughly efficient track sanding device is necessary in order to secure rapid acceleration and to maintain high speeds without an excessive power consumption and a device that contains the convenience of having the sand under instant control, the certainty of operation, and the absence of all movable mechanism subject to derangement cannot fail to appeal to practical street railway men These features are claimed for the Nichols-Lintern pneumatic track sander, manufactured by the Ohio Brass Co., and on exhibition, spaces 5 to 16, section D.

The supplementary sander valve in this device is attached to the motorman's brake valve and becomes practically a part of it, interlocking with the handle of the brake valve and rotating with it, so that the sander can be operated with the brake valve in any position. This feature gives the motorman absolute control of the sander at all times, automatically shuts off the flow of sand as soon as the pressure on the valve is released, and in throwing the brake valve in an emergency stop position, automatically opens and sands the track without any attention on the part of the motorman. A reducing valve is used in connection with the supplementary sander valve for reducing the air pressure, which ordinarily is higher than is necessary for operating the sander. If desirable an independent sander valve may be connected into the piping at any point where it is convenient to the motorman.

The sand trap is so arranged that only an application of air will drive the sand through it, so that there is no leakage or waste. The trap is absolutely air and water tight and may be installed at any convenient part of the car where the hose will properly reach the wheel. By means of a truck attachment the sand hose is securely fastened at any desired point with respect to the wheel, and follows the wheel on either straight or curved track.

BALDWIN LOCOMOTIVE WORKS.

The exhibit of the Baldwin Locomotive Works consists of one truck for electric railway service, and occupies spaces 12 and 13 of section I. These trucks are built under the same conditions of workmanship and supervision and to the same material specifications which obtain in the best locomotive practice. With the knowledge and experience gained in 70 years of locomotive building, and latterly in the construction of electric trucks, the Baldwin Locomotive Works is prepared to design and build trucks for the most severe service, and adapted to any designed railway motor. The general design and construction of Baldwin trucks may be seen in the one on exhibit. The booth is in charge of J. R. Dickey and Warren Thorpe.

THE WESTINGHOUSE COMPANIES.

The Westinghouse Companies are inviting delegates to the convention and their friends, to the Westinghouse reception headquarters on the first floor, Bellevue-Stratford, and to the exhibits of the Westinghouse Air Brake Co., the Westinghouse Traction Brake Co., and the Westinghouse Electric & Manufacturing Co., in section G, spaces 15 to 22, and of the R. D. Nuttall Co., at the exhibition hall. The Westinghouse brake exhibits include operative and sectional models of the latest types of Westinghouse traction brakes, air compressors, air valves, and blowing outfits, and a demonstration of the new AMS air brake equipment, designed for motor and trailer service in Boston, with automatic brake application and straight-air release; the SMA equipment for surface traction cars, which is a straight air brake with manual or automatic emergency application, on both motor and trailer cars; also the AMR equipment on one of the new Long Island R. R. steel motor cars, which is a quick recharge graduated release automatic brake. There may also be seen the company's new governor for motor-driven compressors, designed for either direct or alternating currents, as well as many other improvements in air brake equipments.

The electrical exhibits include an operative arrangement of the latest form of Westinghouse unit-switch control, with rectangular switch group, connected to two No. 113, direct-current railway motors; the complete control equipment of the Westinghouse single-phase railway system; various types of direct-current and alternating-current railway motors; and a 30,000-volt static outfit, for the demonstration, by the equivalent spark-gap method, of the protection afforded by Westinghouse lightning arresters to both direct-current and alternating-current circuits. The Westinghouse exhibits are lighted by Westinghouse direct-current, 500-volt arc lamps, and by the incandescent globes of the Sawyer-Man Electric Co.

Those officers and representatives of the Westinghouse Companies who are in attendance at the convention are: E. M. Herr, first vice-president; F. H. Taylor, second vice-president; Newcomb Carlton, fourth vice-president; H. C. Ebert, assistant to the third vice-president; W. M. McFarland, acting vice-president; H. C. Marsh, Cincinnati; N. J. Neall, engineer; W. E. Parker, Buffalo; S. C. Schenk, New York; E. B. Goldsburg, Philadelphia; Leon Goldsmith, Pittsburg; G. B. Fairbanks, Philadelphia; all of the Westinghouse Electric & Manufacturing Co. The Westinghouse Traction Brake Co's. representatives are J. R. Ellicott, eastern manager; W. V. Turner, mechanical engineer; Arthur Johnson, chief engineer; W. S. Bartholomew, western manager; E. H. Dewson, resident engineer; George H. Martin, Boston; C. J. Olmstead, Horace Clark, Fred V. Green, George E. Baker, and Alex. Cameron. The representative of the Westinghouse Machine Co. include E. H. Sniffn, sales manager, and J. R. Bibbins and L. C. Bullington, Others in attendance are F. A. Estep, vice-president, R. D. Nuttall Co.; J. C. McQuiston, superintendent, Westinghouse Companies' publishing department, and Graham Smith, also of the publishing department.

GILES S. ALLISON.

Giles S. Allison, 42 Broadway, New York City, represents the following lines of railway supplies: "Security" registers, which are built in a sufficient variety of types to suit the requirements of all railways; the Skinner station indicator and car sign for visibly announcing within the car the name of the next station at which it will stop; varnishes and colors manufactured by Valentine & Co.; the Orient adjustable register rod handle; the Armstrong oiler, which is designed to thoroughly lubricate a car journal with clean oil; the Ham Sand Box Co., manufacturers of sand boxes, air sanders and trolley catchers.

These manufacturers and products are represented in space No. 8 in the convention hall by this company, of which Giles S. Allison is president and H. C. Donecker, secretary and general manager.

The self-recording registers, both single and double, which this

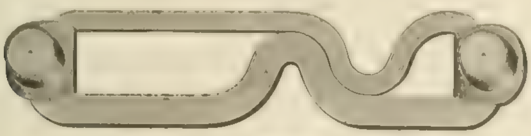
firm handles as one of its leading lines are said to bear the same relation to a car as a watchman's time clock to a factory, thus enabling everyone connected with the car while it is in service as conductors, motormen and inspectors to make absolute reports.

"PROTECTED" RAIL BONDS.

Among the many lines of specialties controlled by the Mayer & Englund Co. there is none perhaps more interesting or better known than the "Protected" rail bond. This bond, from the time of its inception ten years ago, has been typical of the progress made in scientific rail bonding. The peculiar location it was designed to assume on the rail, and the originality of its construction were, upon its introduction, considered a revolution of prevailing methods.

TYPE F-3, "PROTECTED" BOND

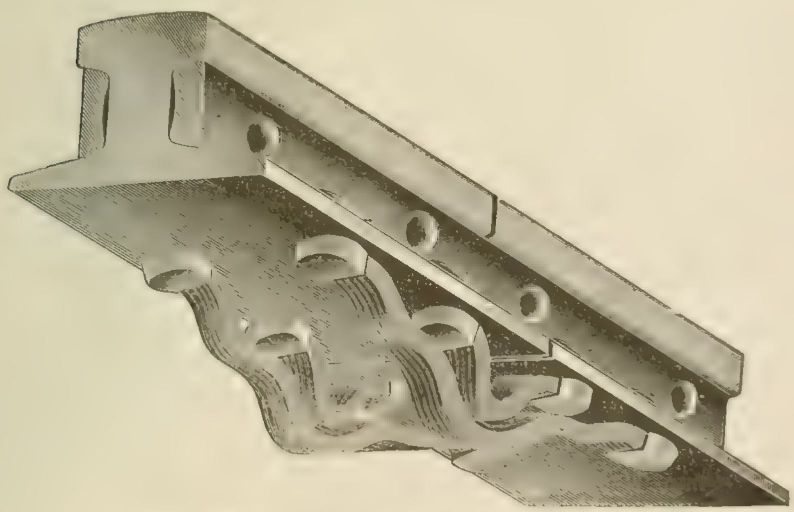
The promptitude with which it was adopted by the engineering profession established the soundness of the theory and its wide use today is an indorsement to the foresight and judgment of the railway men who first recognized its merit. It is the first rail bond that was devised to be applied under the fish plate, thus affording immunity from theft; and likewise it is the pioneer of flat wire rail bonds.



TYPE G-3-U, "PROTECTED" BOND.

The "Protected" rail bond is made of a continuous strand of flat, ribbon shaped wire, formed into a series of parallel loops one above the other, and each individual convolution of this ribbon bears its just proportion of the tension caused by the longitudinal movement of the rails' contracting and expanding, and this proportional distribution of the strain lengthens the life of the bond.

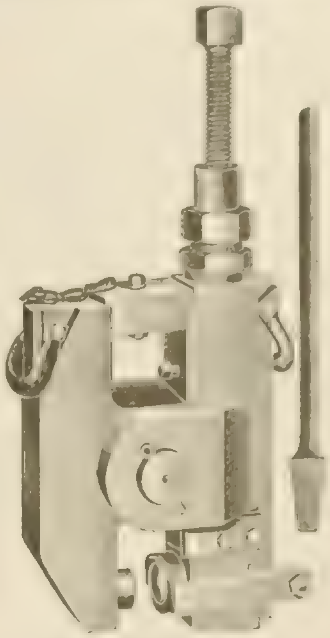
In its initial stage the "Protected" bond was made in the short



SPECIAL CONTACT RAIL—LONG ISLAND R. R.—FOUR L-3 BONDS.

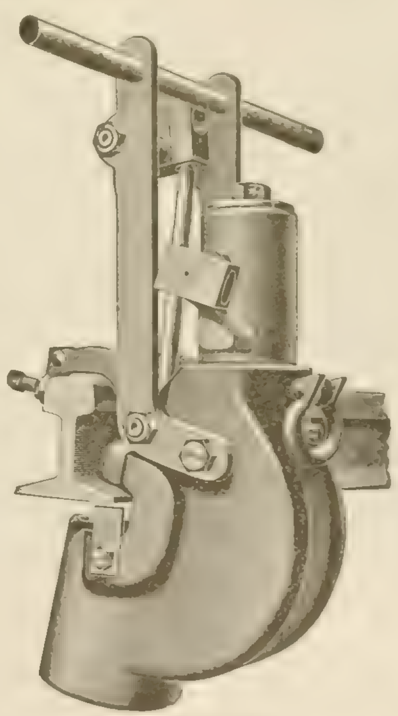
lengths, 3-in., 4-in. and 5-in., and while these lengths were found to be satisfactory for the conditions for which they were made, such as in paved girder rail work, where the vibration and the longitudinal movement of the rails are virtually nil, it early developed that for open T-rail work where there is always considerable movement of the rails in every direction, the short lengths were decidedly impracticable. The rapid adoption of heavier types of rails of all kinds also contributed largely to the abandonment of the short bond. With the heavier types of rails, naturally there came a demand for bonds of greater carrying capacity, and it was manifest that the larger units of cross-section could not be embodied in the short bond without sacrificing its flexibility, the increased amount of copper in so short a length making the bond extremely stiff.

The Protected Rail Bond Co. developed the hydraulically applied bond, for both the tram and the foot of rails, and is the manufacturer of the special hydraulic machines used for this class of work. This



HYDRAULIC COMPRESSOR.

kind of bond work has given the company prestige in the bonding of the third rail. The hydraulically applied bond has been adopted by the Boston Elevated Ry., the Aurora, Elgin & Chicago Ry., the Albany & Hudson Ry., the New York Elevated, the New York Subway, the Scioto Valley Traction Co., the Lackawanna & Wyoming Valley Ry., and most recently, by the Long Island R. R. The Pro-

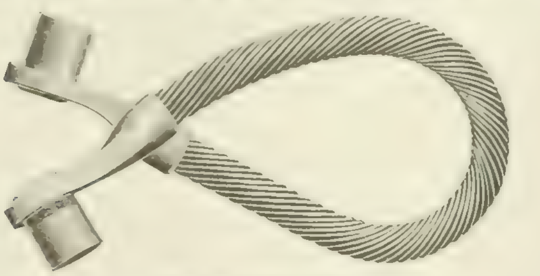


HYDRAULIC PUNCH.

tected Rail Bond Co. in every one of these installations secured the contracts for the track rail bonds in conjunction with the bonds for the third rail. The third rail of the New York Subway is double bonded on the web and double bonded in the base; and the Long Island R. R. third rail is quadruple bonded in the base, no bonds being applied to the web.

The Protected Rail Bond Co. has been consistent for a number

of years in advising decidedly against the adoption of a short bond, with the result that the length of bond considered good practice has increased steadily from 3 in. to 10 in., and the company states that



TYPE P 4. CROSS BOND

if the sales so far this year made by it for the larger bond installations in this country and abroad are a fair indication, the accepted bond length next year, especially for heavy steam road work, will be 12 in. to 14 in.

It is believed that fully two-thirds of the electric railways in this country, and many of the foreign ones, are wholly or partially bonded with the "Protected" rail bond, and many new patrons of the bond are being added to the list annually.

AJAX METAL CO.

The Ajax Metal Co. is one of the oldest manufacturers of bearing metals in this country, having been established in 1880. It started business in a small way, and has been growing steadily, until today it is making upwards of 20,000,000 lb. per annum. The main plant of the company is in Philadelphia, and about two years ago it bought property, the Bates Metal Co. at Birmingham, Ala., in order to handle to better advantage the immense southern trade which the Ajax controls. The plant at Birmingham is now operated under the name of the Ajax Metal Co. of the South, and is producing bearings, castings and other products, such as are also manufactured in Philadelphia.

The business was originally founded for manufacture of Ajax bearing metal, which was the first bearing metal on the market containing lead without an admixture of phosphorus. Previous to this, copper and tin alloy had been used for railway and other bearings, and was considered the standard alloy for such service. It was found, however, that the addition of lead gave the alloy a certain plasticity, which is so essential to a good bearing metal Bearings containing lead were less liable to heat than those without it, and at the same time the rate of wear was greatly diminished Later, by experiments made on Pennsylvania R. R. under direction of Dr. Dudley, it was found, to use Dr. Dudley's own words:

"1. The loss of metal by wear, under exactly same conditions, diminishes with increase of lead.

"2. The loss of metal by wear, under exactly same conditions, diminishes with diminution of tin."

It was further found that the amount of heating was likewise greatly reduced under the same conditions. Naturally, endeavors were made to make an alloy containing as much lead and as little tin as possible. The limit was found to be copper 78, tin 7 and lead 15. Alloys with less tin and more lead exhibited segregation.

This led the Ajax Metal Co. to experiment and endeavor to produce an alloy with lower tin and higher lead content. This it has accomplished. By means of a process invented and patented in 1900, the Ajax company is enabled to alloy copper and lead in any proportions, either with or without tin. It has adopted a formula containing 30 per cent. lead and 5 per cent. tin as the best, consistent with strength, for general purposes. This is termed "Ajax Plastic Bronze."

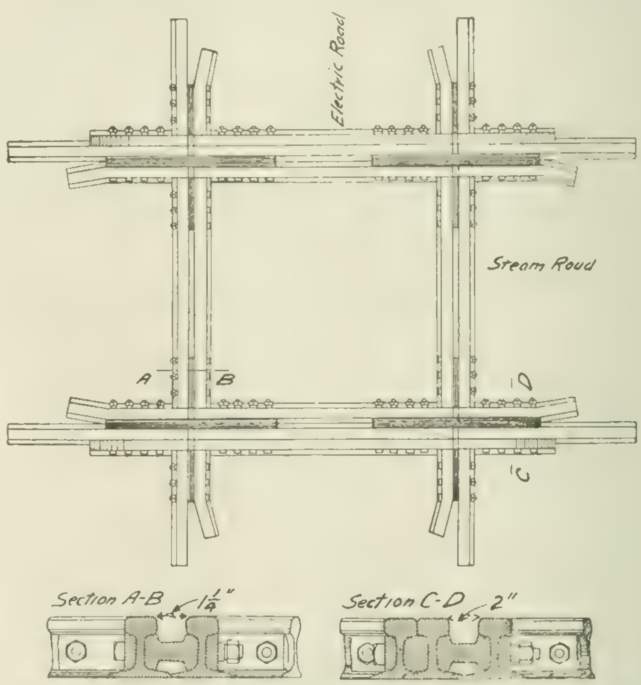
The merits of this metal were at once evident, and the sales increased steadily; the metal is used not only in steam railway but street railway service. Plastic bronze, because of its high lead and low tin content, is sold with a guarantee that the rate of wear is 50 per cent. slower than any other bronze, and that there is less liability of heating under similar circumstances. This guarantee is based upon the experience which the company has had, not only with laboratory tests, but with actual tests under ordinary service conditions.

Plastic bronze has been on the market hardly five years, but during that time the company has sold over 25 million pounds, which has entered into the manufacture of all manner of bearings. It is used on the heaviest and fastest locomotives in service, passenger and freight cars, and has been adopted by number of the leading electric railway systems for axle and motor bearings. As a motor bearing it has decided merits, not only on account of its slow wearing properties, as compared with other bronzes and babbitt metals, but because it has a high melting point, and will not allow the armatures to drop down and burn out, as is often the case when babbitt metal is used.

In addition to making bearing metals, the Ajax Metal Co. is also an extensive manufacturer of trolley wheels, babbitt metals, solders, etc., which are used in street railway service.

NEW "INDIANAPOLIS" CROSSING.

The accompanying illustration shows a design of a crossing made by the Indianapolis Switch & Frog Co., of Springfield, O., especially adapted for crossings of steam with electric railways at points of heavy traffic. The steam tracks are reinforced with a third or easer rail, designed to give sufficient width of tread to carry worn or grooved tires without striking the intersecting rails on electric track, thereby preserving alignment and reducing the cost of maintenance to a minimum. This crossing is so constructed that it is practically



CROSSING OF STEAM RAILROAD TRACK WITH INTERURBAN LINE.

self-contained throughout, relieving all direct strain from bolts and corner irons and greatly increasing the life of the work.

The favor with which the high grade and general character of this company's work is meeting is shown from the fact that although it has added to its plant and equipment until the main buildings alone occupy over two acres, it is running the works full capacity day and night, to fill orders for steam and electric railways throughout the United States, Canada and Mexico. The company is also establishing a general export trade.

LORD ELECTRIC CO. EXHIBIT.

The principal specialties exhibited by the Lord Electric Co., 112 Water St., Boston, Mass., are the Thomas soldered rail bonds and the Shaw non-arcing lightning arresters and static discharge. Descriptive bulletins of both are being distributed by the representatives of the company at its booth in space 20, section J. Those in attendance at the convention who are looking after the company's interests are: Henry M. Shaw, New York office; George W. Smith, Baltimore office; W. R. Garton, Chicago; George B. Crane and Edwin M. Hamlin, general manager railway department, Boston office.

THE PLANTS OF WM. WHARTON, JR., & CO., INC.

In the southwestern part of Philadelphia, at 25th St. and Washington Ave., and not very far from the convention hall, are located the main works of Wm. Wharton, Jr., & Co., Inc., the well known manufacturers of special track work. These works are devoted entirely to the manufacture of girder rail special work for street railways. Mr. Wm. Wharton, jr., the president of the present company, founded the works on the same site some 35 years ago, after having started in the business of making special track work in 1859, and the immense growth of the plant gives testimony in itself of the progressiveness and prosperity of the concern.

JENKINTOWN PLANT OF WM. WHARTON, JR., & CO., INC.

Anybody visiting the Wharton works will be impressed with the extreme care with which every piece of work, from the simple plain curve to the most complicated layout, is finished and the attention given to every detail, notwithstanding the very large output of these works. Many of the features and appliances, particularly for the manipulation of the manganese steel, which to such a large extent enters into the manufactures of this concern and which has established such a reputation for itself, are quite unique.

Fourteen miles out of Philadelphia, on the Philadelphia & Reading, at Jenkintown, Pa., are located the second works of the Wharton company, devoted entirely to the special work, that is, switches, frogs, crossings, etc., for steam railroads, and T-rail work for interurban electric railways, these being the works of the former Wharton Railroad Switch Co., whose business was absorbed by Wm. Wharton, Jr., & Co., Inc., some eight years ago. The works cover an immense area, and there also are found quite interesting methods for the handling this class of work, including the finishing of manganese steel parts. The introduction of manganese steel into steam railroad special track work has been made a specialty at these works, and the results obtained by this novel departure have been almost phenomenal in respect to the service given by this metal in comparison with the ordinary construction formerly used. Many cases of 10 times the life, and more, of ordinary work have been recorded for the Wharton manganese steel work.

WHARTON WORKS AT 25TH ST. AND WASHINGTON AVE.

HAROLD P. BROWN.

Mr. Harold P. Brown, electrical engineer, 120 and 122 Liberty St., New York City, is exhibiting a full line of the different types of rail bond manufactured by him, a complete portable testing apparatus with capacity of 3,000 amperes, and electrical contact alloys and bonding tools. The bonds exhibited include the plastic rail bond, the solid copper rail bond and the plastic plug rail bond. These bonds have been installed extensively throughout the country, the standard plastic bond having been in use under heavy service for nine years without loss of conductivity and injury, at Denver, Rochester and elsewhere. Mr. Brown is in attendance at the convention and is assisted by Julius Alsberg, James Hollowood, J. Maxwell Coote, William Temple, Harry Booth and John Roche.

"CONTINUOUS" RAIL JOINTS.

The exhibit of the Continuous Rail Joint Co. of America, Newark, N. J., at spaces 10, 12 and 14 in section C of the exhibit hall includes regular T-rail sections and "continuous" joints for 35 to 100-lb. rail. Also "continuous" joints applied to various sections of girder rails, ranging in height from 6 to 9 in.; "continuous" joints applied to various sections of rail, showing their adaptability with all standard types of bonds; "continuous" step joints, showing various T and girder rail combinations; and special girder joint and special shapes of trams used in connection with T-rails in paved streets by the Philadelphia Rapid Transit Co. The representatives of the company at the convention are L. F. Braine, general manager, and W. A. Chapman, B. M. Barr, E. A. Condit and George W. Smith.

The Cleveland Frog & Crossing Co., Cleveland, O., manufacturer of Lucas' patent steel rail frogs, crossings, switches, switch stands, etc., is represented at the convention by Mr. George Stanton, sales agent.

Midst a leafy bower Mr. Weeks and other representatives of the Buckeye Engine Co., are freely distributing "souvenirs from nature."

THIRD REGULAR ANNUAL MEETING

American Railway Mechanical and Electrical Association

Philadelphia, Pa.—Sept. 25-26, 1905.

TUESDAY MORNING SESSION.

The convention was called to order at ten o'clock. President Baker in the chair.

Mr. Simmons presented the report of the Committee on Way Matters, which will be found on pages 641 to 654.

Mr. W. Boardman Reed recalled the trouble which had been experienced with joints on railways, and discussed at length the causes of the trouble and the history of improvements in joints. Justice cannot be done to this in abstract.

The general discussion on Mr. Simmons' report was very animated, and resulted in the interchange of much information as to conditions and cost of making joints in different localities.

Mr. William Pestell, as chairman of his committee, made a brief report, as follows:

MAINTENANCE AND INSPECTION OF ELECTRICAL EQUIPMENT.

In considering the subject we have tried to take into account all the factors that enter into the operation of equipment working under different conditions. We have therefore written to all of the railway companies in the United States asking for information regarding details of their operating conditions and the methods pursued in caring for their equipment. From the information thus obtained we shall be able to deduce conclusions as to the best manner of handling equipment under the various conditions of urban, suburban and interurban service. We have been fairly successful in obtaining this information, and when it is complete it will furnish a means of determining how the different conditions affect the maintenance account. The committee asked for further time to carry on this work, as they believe the information when once obtained and properly tabulated will enable us to not only draw conclusions as to the best of the various systems now in use, but to segregate the best points of each of the systems and to devise therefrom a system complete and of economical value to us all. In this connection the accountants would be of incalculable value as after we were able to outline the salient points of the best apparent system they would be able to put it in concise form so that it could be handled with the minimum amount of labor. We would call your attention to the fact that the list of questions as submitted appeals to many as being entirely too much in detail and in many respects irrelevant to the subject. On careful examination, however, you will note that none of the points included are such as can be lost sight of in a careful consideration of the subject. The comparison of the cost of maintenance of the equipment of one road with that of another is only fair when all the elements entering into its operation, the track over which it operates, character of service and the equipment itself. The fact that we do not all of us have this information at hand indicates that we are not careful enough to consider all of the elements necessary to obtain the most economical results in the maintenance of our equipment. When we consider the vast amount of money invested in our equipment, the depreciation, and cost of maintenance, we realize the importance of an adequate system for following up and caring for the various details in connection with it. One point that shows up more clearly than any other in tabulating the answers to questions submitted, is the utter lack of standardization of materials. It seems to me that a permanent committee should be appointed by this association to consider and suggest ways and means of standardizing various parts of our equipment. This has been attempted before, but results can only be obtained by working continuously at it and we trust that this convention will take some steps towards starting the work of standardizing equipment.

An interesting discussion as to the extent to which standardization could with economy be carried in electric railway work followed. The concensus of opinion was that economies can be effected by standardization, especially on the larger systems, but that there is danger of discouraging improvements if too much is made of the feature of standardization.

TUESDAY AFTERNOON SESSION.

President Baker called the meeting to order at 2.10 o'clock.

The President announced that the paper on "The Power House," by Fred N. Bushnell, Chief Engineer of the Rhode Island Company, of Providence, R. I., was before the meeting for discussion. (This paper will be found on page 668.)

Mr. L. Le H. Smith expressed surprise at the lack of superheaters in some of the latest stations that had the newer apparatus which was expected only at its highest efficiency with superheated steam. In his opinion, the efficiency stated by Mr. Bushnell was not extremely high. He knew of an old station which had been operating for a dozen years that has a heat efficiency that is extremely near the one stated in the paper. What made this more significent is that in this station they are using a fuel which is high in heat units and hence expensive. The oldest station, to which he referred, which has an over all efficiency almost as high, uses inexpensive fuel with low heating values. In most stations there is a temperature on entering the stack of over 400°, and in certain known instances it is as high as 800°. He knew of a case where the alteration of the load on the station makes an alteration of steaming wide enough to make a temperature variation at the stack of perhaps 150 or 200°, but the station operated most economically at the rush hours when there was the highest temperature in the stack. The reason was that under these circumstances the excess of air was notably lower than when the station was working on lighter roads.

Mr. L. P. Crecelius said he thought that the experience with superheated steam was confined more to men operating steam turbine stations. In that case the question of cylinder lubrication does not enter to the same extent as in the reciprocating engines, and a great deal higher temperature can therefore be maintained in the steam. He would like to hear from some one operating a steam turbine on that question. He believed there was no question about the economy of superheated steam, and the limitations imposed upon it, for reciprocating engines, where the trouble in regard to the lubrication of valve mechanism and the different parts exposed to increased heat. By referring to the tests of steam generating apparatus it is seen that the curve will continue upward with the superheat quite a little.

Mr. Smith remarked that the last speaker had said in substance that superheated steam in a station of recent construction having the new style of apparatus would inevitably result in high efficiency. The author of the paper well stated that these efficiencies are for runs of only two or three hours, and always without the steam consumption of the auxiliaries. An extremely high vacuum is only attained at the expense of an unusual expenditure of energy in auxiliaries, and that means unusual steam consumption and so in the station spoken of, where they have no reciprocating engines at all, the efficiency of the station is much more significant than the results of, where they have no reciprocating engines at all, the efficiency of of the steam consumption of the main apparatus. He did not know of any station which attempts to regulate the auxiliaries, yet it seemed likely that a stage would be reached in station operation where the losses which are involved in allowing the auxiliaries to work right along irrespective of the load of the engine would be avoided.

Mr. William Pastell said he would offer a few words in connection with the regulation of axiliaries used in power plants. He

entered a turbine plant a short time ago where auxiliaries were driven by steam engines as well as by motor drive and what struck him particularly was the circulating pump for the condenser running at over 400 r. p. m. in the case of the electric driven unit and in the case of the steam driven unit at about 175 r. p. m., the same vacuum being maintained in both cases. These were surface condensers; there was very little difference in the temperature and the vacuum was something over 28 in., and it struck him there must be a great deal of power lost all the time in taking care of so much water. The pumps were designed to take care of 50 or 75 per cent. overload and worked all the time at that ráte, whereas in the case of the engine driven unit the pump could be regulated in accordance with the load factor on the turbine as the load changed from hour to hour.

Mr. C. O. Mailloux, replying to an inquiry as to whether centrifugal pumps had been used for boiler feeding, said that he had seen in Europe last summer a 40-h. p. pump of the multicellular stage type used for water feed, against a pressure of something like 140 lb. The manufacturers of the pump were ready to undertake to furnish the pumps to feed against any desired pressure for any purpose whatever. He understood that similar outfits would be obtainable in this country before long. The idea of using such pumps has been brought to the attention of American engineers and it was not unlikely that they would be in use here. He desired to call attention to the possibilities which might flow from the use of graphite in cylinder lubrication in the case of reciprocating engines and he would be glad to know if any one present had tried graphite, either by itself or mixed with ordinary cylinder lubricants, and what results had been obtained. He had heard recently of the successful use of graphite in gas engines and in oil engines, and it was stated that graphite is the only satisfactory lubricant in such cases. He thought that it was so acceptable in the case of gas engines in which the temperatures reached are higher than in the steam engine it ought to be suited to the purposes of reciprocating engines. He had heard of several cases where it had been used mixed with cylinder oil and it occurred to him that it would be interesting to find out to what extent the use of cylinder oil can be diminished; in other words, whether it would be possible to use so little oil as to practically get along without it.

Mr. Mailloux further said that in addition to the problem of superheating, which, as pointed out by Mr. Green, has its limitations due entirely to lubrication there is also the other important problem in central station operation of being able to use the water over again where the surface condensers are used, owing to the presence of oil. There are many cases where water for feed water purposes must be bought, especially in large cities, and in such cases it was very desirable indeed to be able to use surface condensers and use the water over again, becase the water for condensation might be available as it does not need to be of the same quality, yet today we are practically restricted in that respect and jet condensers have to be used in many cases and water purchased for boiler feed. In his opinion the oil separator problem cannot be said to have been solved to the satisfaction of station operators. A very thin film of oil on the inside of a boiler is sufficient to quickly increase the temperature which must be maintained in order to transmit heat across the film, in other words the heat conductivity is so greatly diminished that it may be considered that there is practically an insulating film, equivalent to a film of some non-conducting material, and the boiler efficiency is greatly reduced. Proper cylinder lubrication would enable engineers to satisfactorily and safely use the water over again for boiler feed and it would also enable them to attain a much higher degree of superheat, because the valve limitations are not so great that they cannot be remedied. He did not think there will be any difficulty in getting engines that have proper means of lubrication, especially with a lubricant that would not contain any objectionable substance, such as cylinder oil, or in the absence of that there would be found some satisfactory means of entirely eliminating the lubricant from the water.

Mr. Green thought that as the graphite went into the cylinders it would deposit itself in the cylinder and practically all of it stay there. The question of operating steam plants with economy in the matter of lubrication was an important one and it is a question upon which engineers are devoting a great deal of study at the present time. Some engineers can take a plant and operate it for just one-half the cost for lubricants per unit that others can. Some engineers feed the cylinder oil into the cylinder directly on top of the valves, and some go into the steam passages and some feed in the center of the cylinder on top. He believed that if engineers could be held down to one method of lubricating the cylinder some positive information could be secured on the question.

Mr. Mailloux replied that in gas engines the use of graphite has eliminated the difficulty Mr. Green referred to, where the deposits of carbon choked up the cylinders so as to necessitate frequent removal and cleaning of the pistons, as a matter of fact the graphite enabled the same engine to work for a longer period without any attention whatever. It was natural to expect that graphite would stand higher temperatures. One might consider that the lubricating properties of graphite might increase rather than decrease with increasing temperature and it was for that reason combined with the good reports he had heard of graphite when used in connection with gas engines that he thought it was worth the while of station managers and operators to experiment with it. It was conceded by all that in all ordinary lubrication graphite is at an advantage. He had used graphite many years ago in lubricating street car axles with considerable success.

Mr. L. R. Nash, of Savannah, said that about two years ago a plant in which he is interested made a trial of a graphite compound; he thought it was called "Perfecto." The trouble with most graphite is that it does not remain in suspension, but in the case he referred to the suspension of the compound was perfect and there was very little deposit to it. The results had been extremely satisfactory, up to two months ago when he last heard from the plant. The cylinders very shortly after the use of the graphite compound began to take on a high polish. Further than that the cost of lubrication was very much reduced. The compound cost something more than twice as much as a good grade of cylinder oil, but the quantity used was only about one-fourth, so that the cost of lubrication was not more than half. He thought that in the case of cylinders running with that compound for two years that if there was any trouble to be feared there would be some indication of it in that length of time.

Mr. A. H. Warren, of Brockton, said he could confirm what Mr. Nash had said. They had been running for 18 months with the graphite compound and had found a very material saving in the cost of lubrication and the cylinders are the best looking cylinders he had ever seen. There has been no cutting; there is a slight deposit on the cylinder head, but that has not bothered them in any way.

President Baker remarked that the experience in Boston for the last two years had been the same as described by Mr. Nash. Their cylinders are more highly polished, the cost of maintenance was reduced materially and the cost of packing rings, bull rings, etc., have been materially reduced since they started the use of this compound. They have about 1.5 to 2 per cent. of graphite in a high-grade cylinder oil. They had not so much success with it in connection with superheated steam and he did not know whether the fault lay in the condensation of the cylinder oil with which the graphite is compounded. The consistency of the lubricant is like a thick grease, with the graphite floating in it.

The paper on "An Emergency Brake," by Mr. F. F. Bodler, master mechanic of the United Rail Roads of San Francisco was then taken up. (Mr. Bodler's paper will be found on page 666.)

Mr. Edward H. Dewson said that the shoe used in this brake as he understood it, is Oregon pine, and with that shoe the co-efficient of friction on the rail is undoubtedly quite high and more than compensates for the weight that is taken off the wheels. With a mechanical brake applied to the track, it depends on the weight of the car to hold it down, nothing is gained without a shoe that has a high co-efficient of friction. In regard to the Westinghouse magnetic brake the case is quite different there, in that the magnet exerts a pull on the rail and practically increases the weight of the car about 3,500 lbs. per track frame.

In the paper the possibility of appplying air to these shoes is spoken of. He understood that this had been done in Staffordshire, England, in the pottery district where the track is slippery and the clay deposits get on it. As to applying the brake on curves, so far as the magnetic brake was concerned, there was no difficulty if it was given lateral motion enough so that it followed the track. The effect of the magnetic needle is to hold the brake shoe to the rail and it naturally would follow the track. In the case of a wooden shoe pressed down

there would be no such tendency, nothing to cause it to follow the rail and possibly it would slip off on the pavements and be destroyed.

Mr. H. B. Schreiber said he was in Pitttsburg a couple of weeks ago and understood they were meeting with success in the use of the track brake. He referred to the fact that they used the brake on the West Penn road, having taken off the air brakes on the interurban cars and put on the track brakes. They have a special controller for the track brake, the handle of which operates in the same manner as the handle for the hand brake. They put on the hand brake after they put on the electric brake. They also use the ordinary car resistances and use the resistances for the electric brakes. These resistances are going to serve the purpose of electric heating in the winter time, and even on the city cars they will use no other heating arrangement, which is a feature in favor of the track brake.

Mr. J. W. Bridge said that he could verify what had just been said in connection with the magnetic brake used on the West Penn road, with which he was connected. They had removed quite a number of air brake equipments and replaced them with the magnetic brake on account of the large number of dangerous curves which they have. They have a hand brake used in connection with the magnetic brake which operates on the same level and they secured very good results from the brake. The use of the magnetic brake had almost entirely overcome the difficulties from flat wheels.

The nominating committee then presented the following nominees for office.

President, H. H. Adams, Baltimore, Md.

First Vice-President, F. G. Simmons, Milwaukee, Wis.

Second Vice-President, J. S. Doyle, New York.

Third Vice-President, Paul Winsor, Boston, Mass.

Secretary and Treasurer, S. W. Mower, Detroit, Mich.

Executive Committee: The officers and W. S. Twining, Philadelphia, Fred. N. Bushnell, Providence, R. I., W. Boardman Reed, N. Y., and A. D. Campbell, Seattle, Wash.

On motion, the report was received and the secretary authorized to cast the ballot of the association for the nominees, which was duly done.

President Baker expressed, in a few well-chosen words, his thanks to the members of their co-operation during the term of his administration.

President Adams, First Vice-President Simmons and Second Vice-President Doyle and Third Vice-President Winsor each acknowledged the honor of their election to office and promised to do all that lay in their power to advance the interests of the association.

On motion of Mr. Olds, a vote of thanks was extended to the retiring President, Mr. Baker, the motion being carried by a rising vote.

The meeting then on motion adjourned.

STANDARD PAINT CO.

The Standard Paint Co. is exhibiting a complete line of its supplies of interest to electric railway men at spaces 11 and 12, section F. These include the well-known P. & B. insulating tape, insulating compound, preservative paint, flexide metal preservative paint, S. P. C. iron paint, Ruberoid roofing and Ruberoid color roofing. Its representatives are Paul M. Wade, Charles Earnshaw, J. N. Richards and R. N. Shainwald.

GOLD IMPROVED ELECTRIC HEATER.

It being generally conceded that a heater allowing a free circulation of air through its resistance coils will do much better work and use less energy in so doing than types in which this freedom of circulation is absent, the Gold Car Heating & Lighting Co., of New York, has incorporated this important feature in its electric heaters. In the construction of its heaters it is so arranged that the air in passing through the heater is thoroughly divided by heated wires, and each particle of air carries its share of heat out into the space to be heated.

A recent improvement made in these heaters by the company is the substitution of wrought iron casings instead of cast iron, which were too heavy, and being easily broken, often exposed the live wires as well as making jagged corners or edges, which look bad and tear clothing. This improvement has not only made the heater casing stronger and lighter in weight, but more attractive in that the smooth surface of wrought iron permits of the best japanning. The back of this new casing is stamped out of one piece of metal, and is lined with asbestos. Ridges are provided along its surface to increase its strength, and when the asbestos lining is laid against these ridges, a series of non-conducting air spaces are formed, so that no heat is lost from the back of the casing. Both the front plate and the back receive three coats of japan, baked over their entire surface.

THE TROLLEY SUPPLY CO.

A very complete display of trolley supplies may be seen at space 26, section L, where the Trolley Supply Co., of Canton, O., is exhibiting its well-known products, including a new No. 4 Knutson retriever and its new American catcher. Mr. Robert K. Fast, secretary and treasurer of the company, is in attendance and will be pleased to show those interested the well-known products of his company.

AMERICAN RAILWAY SUPPLY CO.

Mr. Walter Cher, general manager, is representing the American Railway Supply Co., whose exhibit is located at space 7, section C. The company has its products attractively displayed on a case, upon which are mounted the various stamped and embossed metal work used by street railways, such as badges, buttons, cap badges, metal plates, etc.

CONSOLIDATED ENGINE STOP CO.

The Consolidated Engine Stop Co., maker of the "Monarch" System of automatic devices, 100 Broadway, New York City, has an exhibit of photographs at booth 18, section D, showing a large number of recent installations made by the company. The Monarch engine stop and speed limit system was described in a recent issue of the "Review." Mr. Paul Muller is in charge of the company's exhibit.

UNDERWOOD TYPEWRITERS.

The Underwood Typewriter Co. is exhibiting a very complete line of its latest model typewriters at space 17, section D, which is in charge of Mr. F. Williams, manager of the Philadelphia office. The two important features of these machines which appeal to the operator are the visible writing and the tabulating device. A competent stenographer is in attendance at the booth and all delegates are extended the courtesies of her services during the convention.

CROUSE-HINDS CO.

The Crouse-Hinds Co. is represented at the convention by Nathan Shute, Frank Buchanan, W. D. Hawley and James H. Hurd, and its exhibit is located at space 1 and 3, section C. The exhibit consists of arc and incandescent headlights, guy anchors, switches, Norbitt lamp sockets, carpenters' bench clamps, and Hawley time register clocks.

EMPIRE SAFETY TREAD CO.

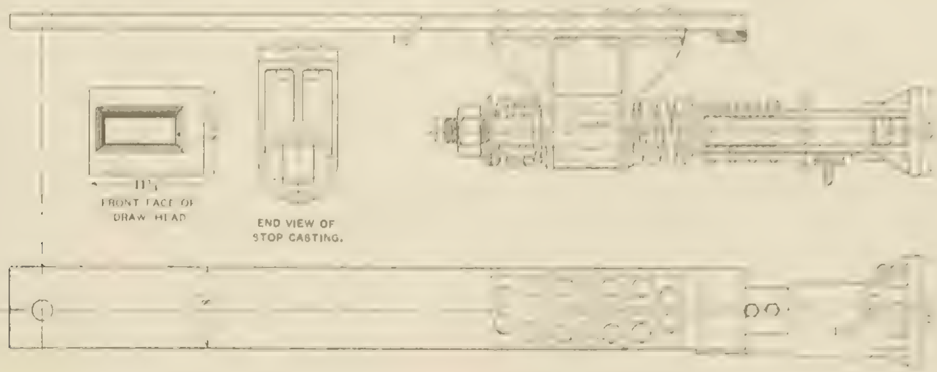
The exhibit of the Empire Safety Tread Co., 299 Pacific St., Brooklyn, N. Y., occupies space 10, section C. The company is represented by Frank H. Newcomb and J. W. Scott.

This tread is composed of a grit, carborundum, set in the channels of a rolled steel or brass plate, and because of the fact that each particle of grit will wear independently, it cannot wear smooth. The hardness of this grit is equivalent to that of a diamond, with its brittleness eliminated, and is assembled by a patent process in a manner that in the course of wear, because of its disintegrable ability, will insure at all times a tread that is non-slipping.

Dilworth, Porter & Co., Ltd., of Pittsburg, are represented at the convention by W. F. Schleiter, secretary, and A. Morrison, engineer. The company's exhibit is at space 1. section O, and includes tie plates and spikes of various designs and sizes.

W. T. VAN DORN CO.

The W. T. Van Dorn Co., manufacturer of Van Dorn automatic couplings and draw bar attachments, Chicago, is showing at its exhibit in space 8, section C, some of its latest type of couplings and draft rigging. The construction and operation of these couplings are shown and interesting demonstrations are made, showing the manner in which they meet the demands of the service in which they are placed. The merits claimed for the couplers include an absolutely perfect train service made by the prevention of any side motion at the point of the coupling, an arrangement of draw bars so that they are locked together and move exactly together, and a new and improved swivel connection to the car. The company has had a wide experience in the design and manufacture of couplings and the merits of its products are attested to by the records that have been made by these couplings. During four years' continuous service on the Manhattan Elevated in New York City, the cost of maintenance of 3,000 of these draw bars was practically nothing, while couplings used in two and three car trains for the past eight years at Washington, D. C., are still in good condition. Managers and master mechanics will find an interesting exhibit at the company's booth, where they may have an opportunity to secure a full understanding of the construction and operation of these couplings.



No. 19 HEAVY MOTOR TYPE VAN DORN COUPLER.

A WORD ABOUT "STERLING" VARNISH.

The manufacturers and users of electrical street railway apparatus have to contend with the damages to insulation from dirt, heat, water and lubricating oil. So far as the electrical apparatus itself is concerned the failure of the insulation is absolutely fatal. The Sterling Varnish Co., of Pittsburg, has for the last 15 years concentrated its efforts on the insulation problem, with the design of producing a material which would not be affected by any deteriorating influence. The task is a difficult one and probably will never be completely solved, but the company is satisfied that in the production of "Sterling" black plastic insulator it has taken a long step in the right direction.

Samples of fibrous materials coated with this insulator have for almost two years been exposed to temperatures which would have quickly destroyed other insulating compounds. It has been repeatedly demonstrated that after the insulator has been properly dried it becomes insoluble in any ordinary oil even when heated to 100 degrees C. The insulator is also unaffected by water or steam. In fact it has the curious characteristic of gradually coating itself with a film of non-volatile grease which covers the entire surface and prevents water, moisture or even the air itself from coming in contact with the insulating material. This grease does not evaporate and it is of the greatest advantage to street railway motor armature and field coils which from the very nature of their service must often be exposed to a dash of water.

So far as the dirt is concerned the surface may be wiped clean with a cloth or piece of waste dipped in gasoline and is as finished and effective as originally.

"Sterling" black plastic insulator is guaranteed by the maker to show a resistance to puncture due to high e. m. f. of from 1,200 to 1,500 volts per mil of thickness. The average of a large number of tests made during the past year is considerably above this figure.

Among the various departments of the Sterling Varnish Co. is one which, although of recent organization, is the outgrowth of many years of [illegible]. This department is devoted to the manufacture of protective coatings for iron and steel structures of all kinds.

While the materials have been fully tested, it is, however, only during the past year that these protective coatings have been on the market in a small way. [illegible] the company has been unable to supply the demand for materials needed for this and kindred purposes.

It now has in the course of [illegible] which will be completed by December 1st, and hopes that by the opening of the season for this class of work it will be in a position to fully supply the wants of all customers.

The following statement of what led the Sterling Varnish Co. to enter this field will be of interest: As a rule paint makers base their arguments for the superiority of their particular product upon the kind of pigment used. One favors graphite, another red lead, another lamp black, another asphaltum, etc.

All assert that the best oil for this purpose is pure linseed oil, as proved by the experience of centuries. However, it is admitted that a film of pure linseed oil spread out on a surface and dried is no protection to that surface, because such film is of a porous nature and through the open pores water and gases have ready entrance to the surface of the material which it is desired to protect. The paint makers' argument on this point is on the theory that the pigment used will stop up these pores most effectively and offer the best protection to the materials underneath. It is obvious that if the pigment does not effectively seal the pores, or if the pigment eventually washes or wears away a coating thus made will no longer be of value as a protective.

Mr. James Todd believing that a protective coating for the tremendous metallic structures which are incident to our modern life was a matter of prime importance undertook some years ago an exhaustive line of research and experimenting with a view of removing from commercial pure linseed oil those characteristics which cause it to dry in a porus film. Problems in organic chemistry are well known to be of a complicated nature and this particular one at the start appeared to be of unusually great proportion.

This research extended over a period of nearly ten years but the result of it has been the development of a pure raw refined linseed oil which when spread out on a surface does not dry to a porous film and is impervious to moisture and the fumes of combustion. He has now incorporated in this oil a pigment which does not readily form combinations with materials with which it comes in contact and has thus a protective coating of exceptional durability for metallic structures as well as one of fine appearance.

Steel vessel hulls coated with this material have for four or five years continually plied in the waters of the Ohio, Monongahela and Allegheny Rivers in the neighborhood of Pittsburg and are in good condition today. These waters are heavily impregnated with sulphur compounds from the coal mines in the neighborhood of Pittsburg.

To show you what the real stuff is like, Mr. Cool, of the Sterling Varnish Co., gives you a glad hand enclosing a sample of muslin as treated with this company's varnish.

Thanks are due to the Philadelphia Rapid Transit Co. and the Philadelphia & West Chester Traction Co. for the neat books of passes given to the registering delegates.

DAILY STREET RAILWAY REVIEW

PUBLISHED DAILY BY THE

KENFIELD PUBLISHING CO.,

1332-1338 Cherry Street, Philadelphia, Pa.

BRANCH OFFICES:

Chicago—45-47 Plymouth Court.

New York 39 Cortlandt Street. Cleveland 302 Electric Building.

London—82 Fleet Street.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.

France, Paris Boyveau & Chevillet, Libraire Etrangere, Rue de la Banque.

Italy, Milan—Ulrico Hoepli, Libraina Della Real Casa.

New South Wales, Sydney Turner & Henderson, 16 and 18 Hunter Street.

Queensland (South), Brisbane Gordon & Cotch.

Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

THE DAILY STREET RAILWAY REVIEW is published each year on the occasion of the meetings of the American Street Railway Association, the Street Railway Accountants' Association of America, and the American Railway Mechanical and Electrical Association, and contains the convention reports. This publication is separate from the *Street Railway Review*, published monthly at Chicago, Ill., but is in its nature supplementary thereto.

SUBSCRIPTION RATES:

In the United States, Canada or Mexico:

DAILY STREET RAILWAY REVIEW, (four or more issues)..$ .40
Street Railway Review (12 monthly issues) 1.75
Combined Subscription (DAILY REVIEW and *Review*) 2.00

In All Other Countries :

DAILY STREET RAILWAY REVIEW (four or more issues) .. .40
Street Railway Review (12 monthly issues) 2.75
Combined Subscription (DAILY REVIEW and *Review*) 3.00

Application made for entry as second class matter.

7TH YEAR No. 2 **WEDNESDAY, SEPT. 27, 1905.** SERIAL NO. { VOL. XV. No. 9 B

SAVE THE "DAILY REVIEW."

Special attention is called to the fact that the "Daily Street Railway Review," published at Philadelphia, September 26th to 29th inclusive, this being the seventh successive year, is in its nature supplementary to the "Street Railway Review" published monthly. Notwithstanding the "Daily" is a separate publication it should be bound with the monthly for convenient reference and in order to facilitate this, the pages of the "Daily" are given numbers consecutive with those of the next preceding monthly issue. Reference is again made to this fact for the reason that very frequently the "Daily" is entirely overlooked by subscribers when sending the "Review" to be bound, and as soon as the binder discovers that 150 pages or so are missing we receive a request to furnish the missing numbers, which unfortunately we are not always able to do.

One of the heartiest compliments that could be paid to the work of the American Railway Mechanical & Electrical Association was overheard to-day, when a general manager, who only arrived in time to attend the convention yesterday, said: "Hereafter I shall be on hand for the Monday meeting of the Mechanical Association; that is the only place where you hear interesting discussions."

OPENING RECEPTION.

The opening social event of the convention, a reception and dance in the ball room of the Bellevue-Stratford, was attended by a large number of the delegates and ladies. The many guests after passing the receiving line were ushered to the tastily decorated hotel ball room where dancing lasted until a late hour. In the large parlor adjoining the reception rooms a dainty luncheon was served throughout the evening.

GARTON-DANIELS CO.

The Garton-Daniels Co., Keokuk, Ia., manufacturer of electrical specialties, shows a full line of its products at space 2, section A, where it shares the reception room and quarters of the Mayer & Englund Co. In addition to a full line of the "Automotoneer" in the different styles and types for different controllers, the company is showing a full line of lightning arresters, including its 1906 models, and its line of alternating current arresters for voltages up to and including 10,000. A new type of "Automotoneer" recently designed by the company is being shown, the principal feature of which is its simplicity. The representatives of the company in attendance are J. V. E. Titus, president; W. P. Cosper, general sales agent, and I. R. Bliss.

THE CONSOLIDATED CAR FENDER CO.

The Consolidated Car Fender Co., 39 Cortlandt St., New York City, is displaying its products at spaces 9 and 10, section B. These include its four models of Providence fenders, as follows. Model "A," designed for use on moderately high cars and open summer cars; "B," for use on low box cars; "C," which can be used equally well on either high or low cars; and "D," which is made especially for use on interurban and suburban cars. The company is also showing the "Campbell" snow broom, the advantages claimed for which include a reasonable first cost and a minimum cost of maintenance and renewal, the broom head being refilled with new rattan as required. The "Millen" car step lifter is also on exhibit, and is a lifting device, attached to the under side of a car, and connected with both platforms, so that the motorman or conductor, by lifting up a handle, can turn up the long step of an open car, and fasten it up or let it down without leaving the platform. The company is represented by E. C. Hall and George Wesson.

OLIVER MACHINERY CO.

The Oliver Machinery Co., of Grand Rapids, Mich., is exhibiting four types of products at space 15, section K. These are a new type "C" single arbor saw table, carrying a 6-in. belt so arranged with self-adjusting compound idlers that a 6 in. cut on rock maple can be made without any slipping of the belt; type "C" band saw, the table of which tips with the hand wheel and worm 10 degrees back as well as 45 degrees forward; a new speed lathe, with hand guides and compound swivel rest; and a 16-in. type "C" jointer, very rigid but convenient for operating since it is supported by a column at each end allowing plenty of foot room.

The design and construction of these machines is up-to-date in every respect and are built on principles of economy of operation, durability and efficiency. The company manufactures a complete line of machines for cabinet and pattern work and a complete set of handsome photographs are used to illustrate them. The company is represented by George C. Hubbard and R. O. Lovell.

UNITED COPPER FOUNDRY CO.

The exhibit of the United Copper Foundry Co. is located at space 28 b, section I, where the company is showing a complete line of copper trolley wheels. This product is treated in a special manner to increase its tensile strength, which together with the non-arcing qualities of copper, make it a very desirable compound. Mr. Albert W. Mullin, treasurer, and Mr. Albert L. Cole, are representing the company, and advise that a great deal of interest has been taken by electric railway men in this product.

BRADY BRASS CO.

The Brady Brass Co. has a very spacious booth in section C, where its numerous products are tastefully displayed. These include trolley wheels, brass castings, battery zincs, cyprus bronze, babbitt metals, motor bearings, etc. The representatives of the company in attendance at the convention are Daniel M. Brady, Charles M. Reubens, William McKenzie and D. H. Ruby.

THE BUCKEYE ENGINE CO.

The Buckeye Engine Co., of Salem, O., is occupying space 19, section D, near the entrance to the exhibition hall, where it is displaying a small model engine and also distributing "souvenirs from nature". Mr. C. H. Weeks, vice-president of the company, is in attendance at the convention, as are also Messrs. Machold and Riddell, sales representatives.

FIRST CONVENTION OF THE CLAIM AGENTS.

The meeting of the American Association of Street Railway Claim Agents was called to order at 3 o'clock in the office of the Philadelphia Rapid Transit Co., Title and Trust Building. In the absence of Mr. W. A. Dibbs, president of the association, who has recently left the service of the Metropolitan Street Railway Co., Mr. E. W. O'Connor, vice-president, presided. After the report of the secretary and treasurer, which showed the association to be in good condition, resolutions were passed regarding the death of Mr. William White, claim agent Chicago City Railway Co., and a member of the executive committee.

Mr. W. H. Renaud then made a short address regarding the meeting of the executive committee of the A. S. R. A., held at Philadelphia June 13th, reciting the action taken at that time regarding the reorganization of the various associations. A general discussion followed, it being the sense of the association and various members that an affiliation and consolidation with the parent association is advisable. It was then decided that a committee of three be appointed to confer with the committee appointed by the other association to prepare a constitution and by-laws, it being understood that this association should elect its own officers and not be hampered in any manner by such reorganization. Mr. Farrell, of Buffalo; Mr. Renaud, of New Orleans, and Mr. Pratt, of Baltimore, were appointed to confer with President Ely as to the attitude of the A. S. R. A. regarding the matter, and what might be expected in the way of financial assistance, as well as otherwise.

A very interesting paper was read before the association by Mr. James R. Pratt, claim agent United Railways and Electric Co., of Baltimore, Md., in which he spoke at length on the subject of "Fakirs, Malingerers and Ambulance Chasers." He described the methods pursued by these classes of claim workers to secure money by dishonorable means, and more particularly the manner in which shyster lawyers secured these cases and the work of those employed by them to solicit such business, together with such suggestions as his experience has offered as to the manner in which they should be dealt with and what steps should be taken toward their elimination.

Following this a paper was read by Mr. O'Connor, in which he spoke briefly of the experience he had had with fake accident workers, and the benefit that might be derived by the exchange of experiences of claim agents and the diffusion of information regarding any operations by fakirs from time to time during the year. This opened the general discussion of claims and methods of handling them, and a very enthusiastic and interesting discussion followed. Mr. Mills, of the American Casualty Co., New York City, was then given an opportunity to explain the services offered by his company in the handling of matters pertaining to accident claims, as was also Mr. Holmes, of Hopper & Holmes, New York City. While these talks were rather limited, the propositions which these concerns had to offer in this field were clearly put forth.

The following officers were elected for the ensuing year:

President, S. L. Rhodes, claim agent Philadelphia Rapid Transit Co., Philadelphia.

First Vice-President, E. W. O'Connor, claim adjuster, Savannah Electric Co., Savannah, Ga.

Second Vice-President. Henry C. Bradley, claim agent, Chicago Union Traction Co., Chicago.

Third Vice-President, Andrew J. Farrell, claim agent, Interstate Railway Co., Buffalo, N. Y.

Secretary and Treasurer, B. B. Davis, claim adjuster, Columbus Railway & Light Co., Columbus, O.

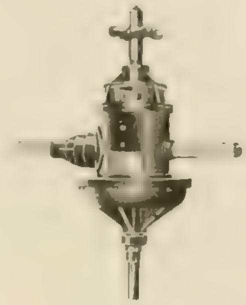
A vote of thanks was extended to the Philadelphia Rapid Transit Co. for the courtesies shown the association during the convention and the use of the company's offices, in which the meetings of the association were held.

A vote of thanks was also extended to the editor of Pearson's Magazine and the author of the articles appearing in the June, July and August issues on "Graft by Getting Hurt."

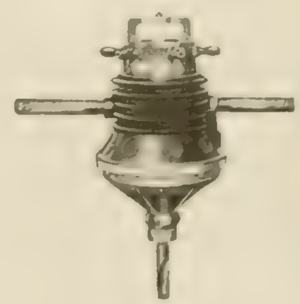
The work of the association during the past year has been developing rapidly and the growth in its membership from 8 at the St. Louis convention to about 60 at the present time, shows the efficient manner in which the affairs of the association have been handled and the interest that is being taken by the management of the various companies in the work of the association. The officers and executive committee of the association are to be congratulated upon the success with which it has met and the benefit which has been derived from the diffusion of information regarding the working of fakirs which has been distributed from [illegible].

DUNTLEY AIR-COOLED ELECTRIC DRILLS.

Among the products of the Chicago Pneumatic Tool Co., which are of interest to electric railway men are the Duntley air cooled electric drills, two sizes of which are shown in the accompanying illustration. These drills, which have passed through an experimental stage extending over a period of two years, were thoroughly tested under all actual working conditions before being placed on the market and have reached a state of perfection where they are fully equal to the requirements of the service for which they were designed. The general design of the different size machines is the same, being designed for operating from 110 and 220 volt circuits; these drills will not operate from a circuit of higher voltage without reducing it by means of a rheostat. The larger capacity motor drills are provided with a friction clutch, the slipping of which permits the motor to run at full speed while the drill spindle stops. Reversible and non reversible drills are furnished as specified.



SIZE 1-M-1-10.



SIZE 1-M-2-12.

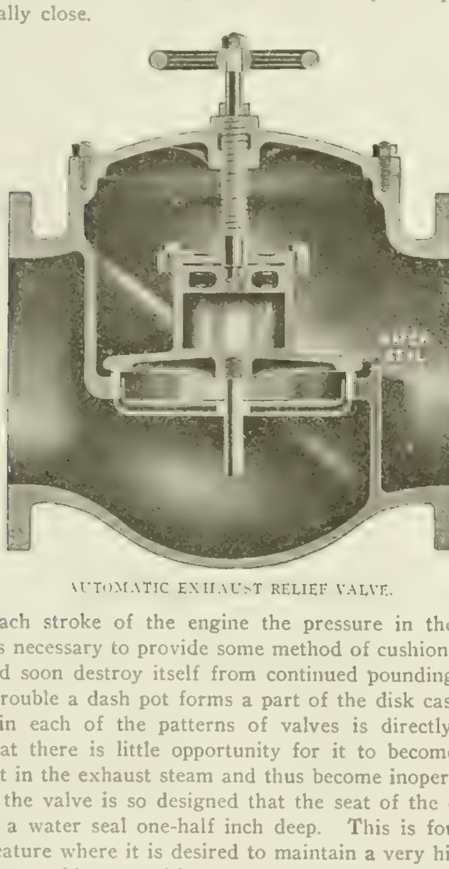
The size 1-M-1-10 drill shown, weighs 17 lb. and is adapted for drilling in steel up to ½ in. continuously and 9-16 in. for short periods. It is equipped with a No. 1 Morse taper socket and is wound for 110 or 220 volts direct current only, consuming from 1½ to 2 amperes when operating at maximum capacity. It is operated from any incandescent lamp socket when the current is of the proper voltage. The size 1-M-2-12 drill weighs 27 lb. and is adapted for drilling in steel up to ⅞ in. This drill is made in three sizes, ⅞ in., 1¼ in. and 2 in., being equipped with Morse taper sockets Nos. 2, 3 and 4 respectively. It is wound for 110 and 220 volts direct current and consumes from 4½ to 9 amperes when working at maximum capacity. It is preferable to operate these heavier drills from a line especially provided, although they may be operated from any incandescent lamp socket, provided the line is fused to carry the maximum number of amperes at which the machine operates. The switches on these drills are located at the base of the handle, where they are easily and quickly operated by thumb pressure.

Recent tests made at Cleveland, July 20th, show the following results: A size 1-M-1-10 drill, weighing 17 lb. and operating at 110 volts, bored a hole in cast iron, ⅜ in. in diameter and 1½ in. deep, in 1½ minutes, consuming from 1½ to 2 amperes. A machine of the same size bored a hole ½ in. in diameter and 1½ in. deep in cast iron, in 2 minutes, consuming 3 amperes. A hole of the same diameter and depth was bored in cast iron by the size 1-M-2-12 drill in 42 seconds, consuming 2½ amperes, while a similar machine bored a hole ⅝ in. in diameter and 1½ in. in cast iron in 55 seconds, consuming 4 amperes. A hole of the same diameter, ½ in. deep, was drilled in steel plate in 40 seconds, consuming 4½ to 5 amperes, machine oil being used as a drilling compound. These tests should be of considerable interest to the master mechanic and track man, and the tools in question may be seen at the Chicago Pneumatic Tool Co's. booth, where an interesting display of its products is made.

AUTOMATIC EXHAUST RELIEF VALVE.

In the operation of condensing engines, if from any cause the vacuum should be lost and no outlet for the exhaust from the engine quickly provided, there would result a steam pressure in the condensing system of sufficient amount to destroy the condenser valves or possibly wreck the whole system. To provide against such accident relief valves, designed to automatically open when the vacuum in the condenser is broken, are placed in the exhaust piping of condensing engines.

The illustration shows a late type of automatic exhaust relief valve manufactured by the Crane Co., of Chicago, for use in the condensing system of reciprocating or turbine engines, when operating condensing only. This type of valve is made in horizontal, vertical and angle patterns, the horizontal pattern being the subject of the illustration. By referring to the illustration it will be seen that as long as a vacuum is maintained in the condenser atmospheric pressure will maintain the valve in a closed position, but should the vacuum be lost the steam pressure of the engine exhaust will lift the disk from its seat and the engine exhaust through a suitably connected pipe to the atmosphere. Whenever the vacuum is restored. the valve from its own weight and the atmospheric pressure will automatically close.



AUTOMATIC EXHAUST RELIEF VALVE.

As at each stroke of the engine the pressure in the condenser varies, it is necessary to provide some method of cushioning the disk or it would soon destroy itself from continued pounding. To prevent this trouble a dash pot forms a part of the disk casting. This dash pot in each of the patterns of valves is directly above the disk so that there is little opportunity for it to become fouled by oil and dirt in the exhaust steam and thus become inoperative. The casting of the valve is so designed that the seat of the disk is submerged in a water seal one-half inch deep. This is found to be a valuable feature where it is desired to maintain a very high vacuum. The design provides a positive arrangement for holding the valve wide open in case it is necessary to run non-condensing.

"EUREKA" AUTOMATIC ELECTRIC SIGNALS.

The fundamental idea of "Eureka" signals is the operation of only one controller, to set the system to danger when cars enter the block, and to safety when they leave it. To protect a block, two controllers are used, one at each end, but, not being wired in series, their operation is independent and opposite to each other. Through the development of this idea, "Eureka" signals possess distinct advantages, in securing utmost certainty of action, no failures occurring, because two machines must work together as a unit; affording means to cars at opposite ends of a block of automatically signalling each other; permitting cars in a block to leave it at either end; and protecting either car remaining in the block, when two cars have taken it simultaneously at opposite ends, the car backing out automatically and properly setting the signals for the car keeping the right-of-way.

The contact maker which is easily the most important part of an electric railway signal, in the "Eureka" signals is free from mechanism, offering no obstacle to the trolley wheel, operates at high speed, and need be but 12 in. long. It also possesses the distinctive function of causing operation of signals to danger when cars make contact in going into the block, and to safety when they make contact on leaving the block. Other advantages are simplicity of mechanism and wiring, any number of cars can pass through a block together, all cars register upon entering a block, signals are visible by day as well as by night and show the direction car is moving in the block and when entering a block, the motorman has a signal ahead of him, making him solely responsible for his car, the conductor being left free to collect fares and attend to his other duties. The signals, which are the product of the Eureka Automatic Electric Signal Co., Lansford, Pa., are on exhibit at space 27, section D, of the exhibition hall.

BLAKE SIGNAL & MANUFACTURING CO.

The Blake Signal & Manufacturing Co., 246 Summer St., Boston, Mass., is represented at the convention by Edmund J. Burke, president, and C. Chandler Blake, vice-president and manager, who may be found at the company's exhibit, space 22, section I. Here the company has displayed the Blake standard semaphore signal for electric railways, where the details of its operation may be seen. Six points incorporated in this signal, to which attention is called, are:

1. When properly set up and adjusted, it is physically impossible for any other signal than the one desired to operate.

2. There is a positive answer back to the dispatcher, indicating that the semaphore arm has been set in the horizontal position, and that until the arm has reached an angle of about 45 degrees it is a physical impossibility for him to get this answer back, and the danger of a false answer back is eliminated.

3. The power for operating the signal is obtained entirely through the dispatcher's office, and there is no local circuit at each signal other than the signal lamp circuit.

4. There are no electrical contacts in series with the operating magnets at the various signals. The signal line is electrically continuous throughout, from the dispatcher's office to the return circuit at the end of the line.

5. If one signal lamp burns out, a second lamp is automatically cut in circuit. This second lamp is in an interrupted circuit and gives a flashing light, so that any crew can report it and a new lamp can be put in the following day. This detail removes the necessity of having a daily inspection of all lamps, as well as danger from a new lamp being defective and burning out a very short while after it has been put in.

6. The widely varying voltage of trolley lines is taken care of by relays which draw up at different voltages, and cut in or cut out resistance as the voltage which is supplied at the dispatcher's office rises or falls.

THE CURTAIN SUPPLY CO.

The Curtain Supply Co., 85-93 Ohio St., Chicago, has erected a very handsome booth at spaces 9 and 10, section A, occupying a space 20x20 ft. The booth is formed by having 11 handsomely finished columns, at proper distances from one another; these are finished in ivory white and surmounted with globes containing incandescent lights. For the benefit of friends the company has a desk and chairs for their convenience. There are four handsomely finished open car curtain frames, containing an "Acme" open-car cable curtain, a "Climax" open-car cable curtain, a Forsyth open-car cable curtain and new open-car "Ring" fixture curtain, this latter being new and now standard on the Brooklyn Rapid Transit Co. cars, over 300 cars equipped with it now being in service there, in addition to a number of other roads. There are also a handsome revolving mahogany model containing 8 curtains of pantasote, oakette and buck, equipped with Forsyth roller tip fixture No. 86 and Burrowes' No. 83 fixture, and two frames containing Keeler pinch handle curtain and Keeler eccentric curtain.

This company is represented by W. H. Forsyth, general manager; A. L. Whipple, in charge of the New York office; Ross F. Hayes, western representative; and E. S. Ludlow, sales agent.

OFFICERS AND EXECUTIVE COMMITTEE OF THE AMERICAN STREET RAILWAY ASSOCIATION, 1904-5.

E. C. FOSTER,
First Vice-President.

W. CARYL ELY,
President.

JOHN I. BEGGS,
[illegible]

RICHARD McCULLOCH,
Third Vice-President.

FRANK G. JONES.

C. G. GOODRICH.

T. C. PENINGTON,
[illegible]

W. E. HARRINGTON.

H. F. GRANT.

J. J. STANLEY.

AN EMERGENCY TRACK BRAKE.*

BY F. F. B[illegible],
Master Mechanic, United Railroads of San Francisco.

The emergency track brake here described is used on practically all the cars in San Francisco. While San Francisco is an ideal city for operating street railways in many respects, especially as regards the absence of snow, ice, and sleet, yet it has its drawbacks, namely an enormous number of steep grades. In order to operate safely over these in wet weather and on slippery rails it was necessary to provide another means of braking a car than the wheel brakes. This is successfully accomplished by means of the track brake.

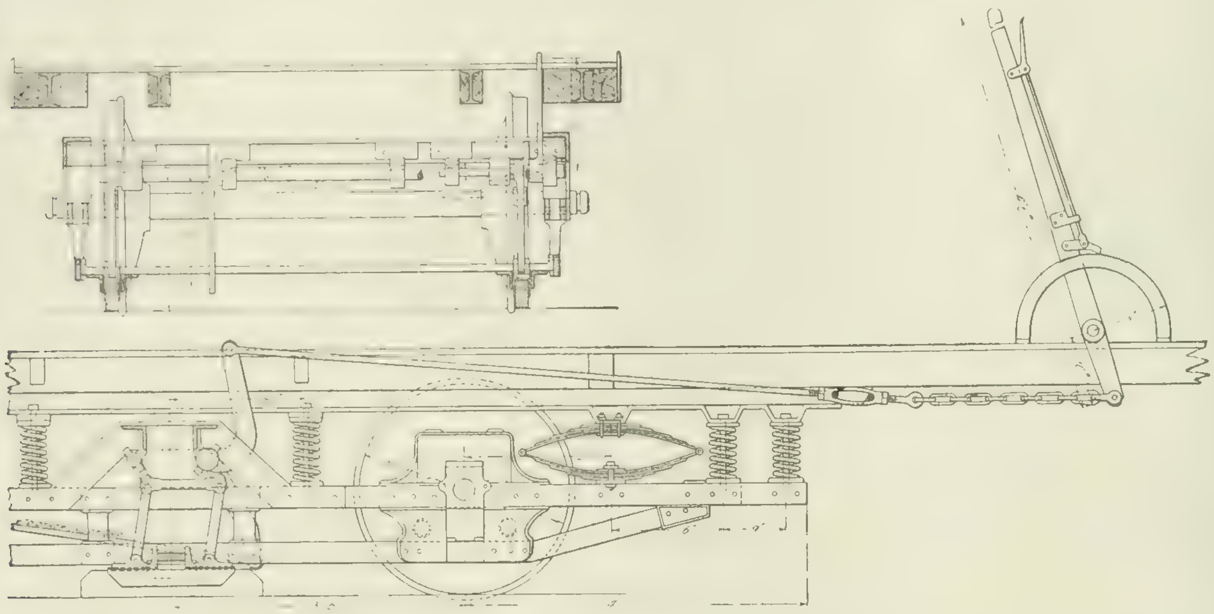
The first experiment with track brakes was made in 1883 or thereabouts, when the Market Street Railway Co. built a cable line on Market St. The brake was similar in principle to the present brake. It was placed on the rear truck and operated by a hand lever placed alongside of the grip lever.

In 1893 the Market Street Railway Co. consolidated with several other lines and in 1894 commenced to change the motive power of some of its lines from horse and cable to electricity. The first cars were of the single truck type, and were equipped with wheel brakes only. It was immediately discovered that an emergency brake was needed, as the cars could not be controlled on the grades, although the tracks were well sanded, and the wheel brakes were powerful enough to lock the wheels. This condition had not been met with on the cable cars, as the cars could not go faster than the cable.

In 1895 Mr. G. W. Douglas, then master mechanic of the Market Street Railway Co., started to experiment with a track brake on electric cars. Twelve single truck cars were equipped with track brakes, and operated successfully until 1899. In 1899, Mr. Douglas reconstructed his brake, and made it applicable to double as well as to single trucks. This is the brake which is now so successfully used in San Francisco.

Primarily the brake (see Fig. 1) consists of a hand lever, connected by a brake rod to an arm, which is keyed on a rocker shaft extending clear across the truck. This shaft is connected on each end by means of a short lever, keyed to the shaft, to a connecting link, and to a toggle lever. The connecting lever is connected to a lever, keyed to a short shaft, and to a toggle lever. The shell for holding the shoe is connected to the two toggles by means of the heels.

By pulling back on the hand lever, the shaft turns from left over to right, and the motion causes the toggle levers to assume a vertical position and to force the shoe to the rail. The heels mentioned, one on each side of a channel iron, across the truck, act as a guide and allow the shoe to travel only in a vertical direction. A lever with



FIGS. 1 AND 2.—TRACK BRAKE APPLIED TO PECKHAM SINGLE TRUCK.

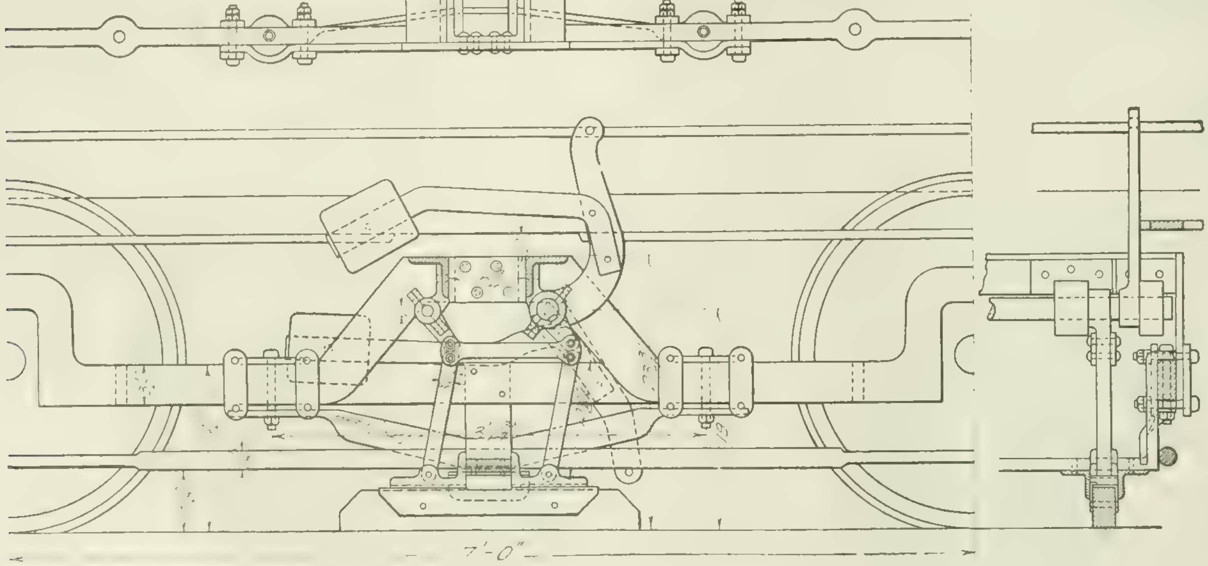


FIG. 3.—TRACK BRAKE APPLIED TO BRILL SINGLE TRUCK.

* Read before the American Railway Mechanical and Electrical Association, September 26, 1905.

a counterweight atached to it, keyed to the cross shaft at any convenient position or bolted to an arm, acts as a release.

In order to adapt this brake to a Peckham or Brill single truck it is necessary to fasten a flat iron, bent as shown, to the side frames, using the holes on each side of one of the spiral body springs. Two angle irons are placed transversely across the truck, and fastened to the bent flat iron. To these angle irons the brass boxes for holding shafts are bolted. The large shaft is held in position by 3 boxes, one on each end, and one near the counter-weight arm. The short shaft is held by 2 boxes, one on each side of lever.

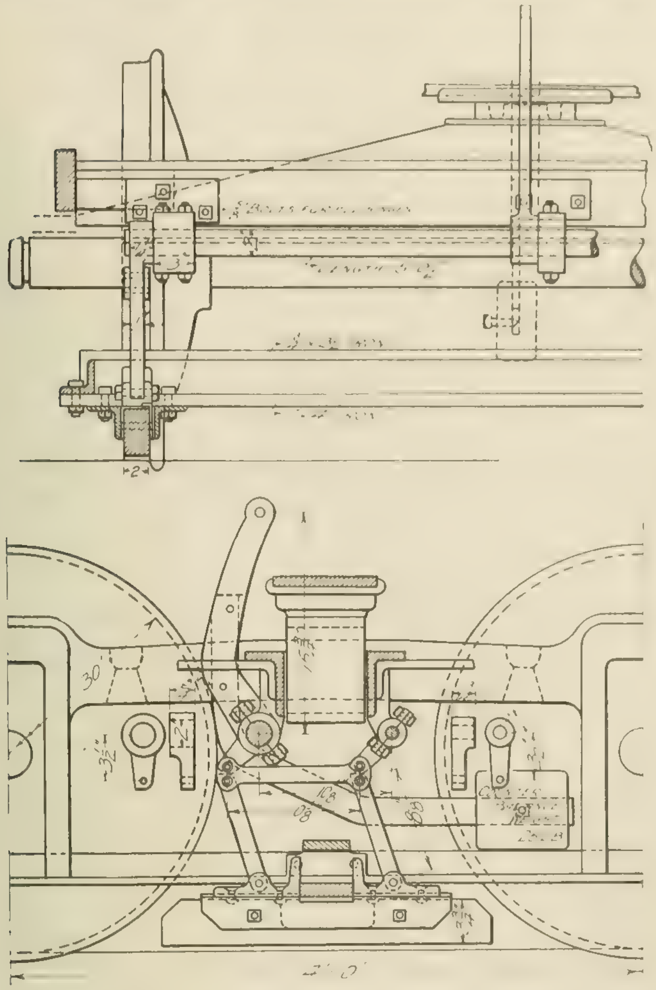


FIG 4 and 5.—TRACK BRAKE APPLIED TO BRILL G 27 DOUBLE TRUCK

To operate the track brake from the opposite end of the car, a second arm is keyed to the shaft, the brake rod being placed under and on one side of the motor, as shown in the drawing.

Considerable ingenuity had to be exercised in order to place these brakes on all cars. The counter-weight arm, for instance, in many cases had to be placed under the seat, the floor having been cut out. With a single truck car, the relative position of this arm on the shaft does not make any difference. Fig. 3 shows the brake applied to a Brill single truck.

This brake is placed on double trucks in practically the same manner as on a single truck, except that each truck has an independent brake, operated from the end nearest the truck. On double trucks the rocker shaft boxes are fastened directly to the transom angle irons. The counter-weight arm has to be placed in the middle of the shaft on account of the swing of the truck.

Fig. 4 shows a Brill 27-G truck with this brake.

Fig. 6 shows a standard [illegible] made of Oregon pine, costs about 2¾ cents and lasts about one week. The material to be used for shoes was the subject of many experiments. All kinds of wood, all kinds of metal, combinations of wood and metal, and metal with all kinds of inserts were experimented with. For cheapness, general utility, and highest braking efficiency the Oregon pine shoe was found to be the best. The shell for holding the shoe is made in two parts, of pressed steel. Two bolts pass through the holes shown in the shell and through the recesses shown in the shoe, not only clamping the shoe by means of the shell, but also preventing the shoe from slipping backward or forward. In order to facilitate the removal of worn out shoes, sections of rail slightly longer than the shoe, are sawed off and hinged on the car house tracks. The cars are placed with the shoes over these hinged rail sections, the hinged rail is swung out, and by loosening the two bolts the shoes drop out. The time required for replacing four shoes on a double truck car is about two minutes. The shoes can be adjusted when partly worn, by inserting wooden shims between the top of shoe and shell.

As seen by various illustrations this brake can only be applied on trucks having outside hung wheel brakes. On double trucks it can only be used when the bolster spring is half elliptic, and hung under the side frames. It can not be used on M. C. B. bolsters, on account of lack of room. In fact it requires close figuring to adapt it to the above mentioned trucks, in order to prevent the bolster from coming down on the connecting lever.

It has been proved that the brake is most effective when brake levers, as shown, are used. The efficiency of the brake is proportionate to the rapidity and force with which the shoe is brought down on the rail. An ordinary ratchet handle with the ordinary spindle is of little use. With a cam on the spindle it is decidedly more efficient.

The strong points of this brake are:

(1) Its extreme simplicity.
(2) Its high efficiency.
(3) Its low cost of maintenance.
(4) Its independence of all other brakes.
(5) Its being purely a mechanical contrivance.

This brake can readily be operated by compressed air, by the addition of a brake cylinder. To the writer's knowledge it has not been operated by that means, however.

Whether it would be as successful in cities where there is much snow, ice, and sleet, as it is in San Francisco, the writer would not care to say, yet there does not seem to be any reason why it should not.

It may appear to some that on account of taking considerable weight off the wheels, there would be danger of skidding the wheels, yet the number of flat wheels has steadily decreased since these brakes were put on. The reason for this is probably that there is no need of "cinching" the wheel brakes up so tight as there was formerly.

Cars as operated over one 17.5 per cent grade, one 14.5 per cent grade and any number of 10 to 12 per cent grades:

A single truck car, weighing 10 tons, can be stopped on the steepest grade over which electric cars are operated in the city, in a reasonable distance, by first applying the wheel brakes, and then the track brake.

The original intention was to use this brake only as an emergency brake; it has been found so serviceable, however, that it is used almost as much as the wheel brake is. It ought not to be used on curves, switches, or crossings, but should it be used, about the only damage resulting would be a split shoe.

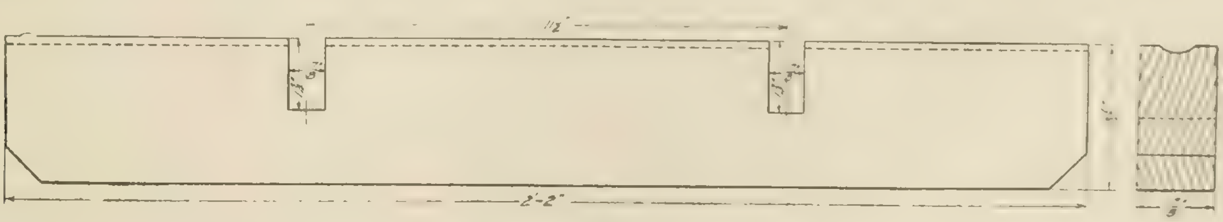


FIG 6.—STANDARD TRACK BRAKE SHOE

THE POWER STATION.*

By Fred N. Bushnell,
Chief Engineer, Rhode Island Co., Providence, R. I.

Since the advent of the direct connected generator, the tendency in power station design has been towards a more systematic and compact organization of the generating apparatus and the utmost simplification of the entire plant consistent with the highest efficiency. The practice of different engineers has gradually worked towards a type of station which is now so generally adopted for street railway work where limitations are not placed upon the design by the size or shape of the available site, that it can fairly be said to represent standard practice in modern power station engineering. It embodies the following essential principles:

1. Simplicity of design.
2. Subdivision of the plant into separate sections, so as to localize the effect of trouble to any part of the generating apparatus.
3. Provision for the symmetrical extension of the plant to provide for future power requirements.

This station in its simplest form consists of a boiler room, engine and generator room, and switchboard gallery, arranged in parallel lines and separated from each other by substantial fireproof walls. In stations of very large size the boilers are frequently arranged in two tiers, or in groups, each group having its own chimney and flues and independent systems of feed and steam piping. This arrangement of the station is now generally referred to as the unit system, the distinguishing feature of which is that the boilers, engines and generating apparatus are arranged in separate units or groups, each one of which embodies all of the essential features of a complete generating plant, and the great advantage of which lies in the fact that trouble with any single piece of apparatus is localized, so that its effect is felt only in that unit of which it forms a part. Provision for carrying the load in the event of a breakdown of any important part of the apparatus is made by installing an additional or spare unit.

While the unit system is now almost universally employed in the larger power stations, it is usually somewhat modified for smaller plants where the liability to interruption of the service is not so great or the results so disastrous, the chief difference being in the arrangement of the steam and feed piping. The steam piping from the boilers is run to a longitudinal header, from which the connections to the engines are taken off at convenient points. This steam header is divided into sections by means of gate valves, which permit of any section being cut out at the convenience of the operator for the purpose of making repairs. Usually two systems of feed piping are provided, one of which supplies hot water to the boilers through the heaters and economizers, while the second, or auxiliary system, supplies cold water, or water direct from the heaters, in case of trouble with the main system. This arrangement of piping provides sufficiently against interruption in small and medium-sized plants, and in a system carefully laid out with due consideration for the troubles which are likely to arise, it is hardly probable that the disarrangement of any one part will cause serious interruption of the service.

At the present time alternating current generating stations and distributing systems are regarded as the most efficient to install in large cities where heavy traffic is distributed over a very large area, requiring current to be delivered to the line at a number of points, and where the interest upon the investment in direct current feeders and cost of their maintenance would amount to more than the same charges plus the conversion losses in an alternating current system; and for long suburban or interurban railways where the power required at any one point is small as compared with the total power generated. The use of alternating current apparatus has steadily increased since its introduction, until at the present time approximately 60 per cent of the total power used by electric railways in the United States is generated by this type of apparatus.

In cities where the bulk of the business is within the economical radius of distribution for direct current lines, and where direct current generators form the larger part of the present equipment, the common solution of the problem is to use this type of apparatus for city work, adding alternating current apparatus to supply the more distant portions of the system, or roads operating through outlying districts.

There is undoubtedly a great advantage in having all the apparatus of a uniform type. This simplifies the wiring and switching part of the electrical equipment and permits of a more efficient distribution of the load in the station. But there can be no conversion of energy without loss, and in cases where a considerable part of the system can be supplied with direct current without the use of rotary converters, the composite type of station will frequently be found to offer advantages in lower first cost and higher efficiency.

The location of the power station, its general character, and the type of apparatus to be installed, depend to such an extent upon local conditions, that it is difficult to offer suggestions covering these points except in a general way.

If possible, the station should be located near an ample supply of water for condensing purposes, in order to secure the advantages from the use of the most efficient types of steam apparatus, and if possible, convenient also to a steam railroad or tide water where the coal can be received and handled for the least expenditure of labor. Its location in reference to the distributing system will depend upon the extent and type of the system employed. If the direct current system is used, it will be desirable to select a location as near as possible to its center of gravity, in order to reduce the investment in copper, but in the case of an alternating current distributing system, this is of less importance, and greater consideration will be given to the cost of the available site, the nature of the soil, cost of foundations, etc.

The building should in all cases be of fire-proof construction and of neat and attractive design, appropriate to and suggestive of the purpose for which it is used. In determining upon the dimensions of the building, it is important that ample room be provided for all of the apparatus to be installed, so as to avoid unnecessary crowding. Passageways should be provided between each battery of boilers, and at the rear for the convenience of attendants in cleaning the tubes and connections and for making necessary repairs. Sufficient room should also be provided around each piece of apparatus in the engine room so as to enable the attendants to inspect it regularly and keep it thoroughly clean, and to provide for the removal of any part in case of repairs.

In large cities, where land is extremely valuable, or the available area limited, the amount of power which can be generated per unit of ground area occupied is frequently the controlling factor in deciding upon the power station plans, and in such cases it is not always practicable to provide all of the space usually regarded as desirable for the convenience of attendants. This condition rarely exists, however, except in the larger cities, and in a great majority of cases no excuse can be offered for crowding the machinery to such an extent that it cannot be kept in proper condition and conveniently repaired by those responsible for the management of the plant.

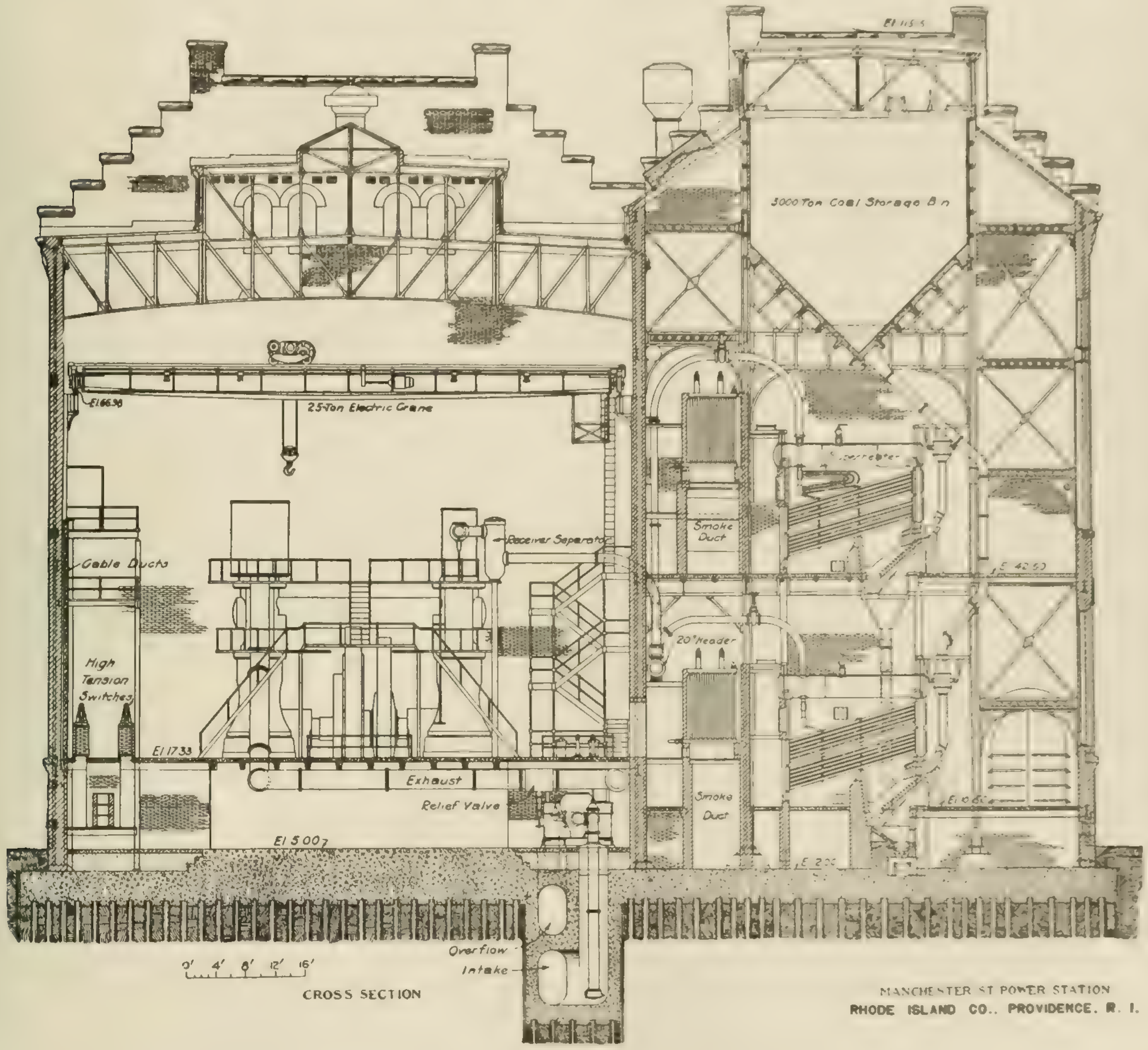
Cleanliness is absolutely essential to the successful operation of an electric railway power station. It is necessary that the building itself be kept free from oil and dirt, and each piece of apparatus thoroughly cleaned at all times, in order to maintain it in its highest state of efficiency. The designing engineer should contribute his share towards this result by providing ample light throughout the building—boiler room as well as engine or generator room. All the walls of the building should be painted in some light shade, preferably with some kind of enamel paint which can easily be washed down and kept clean. This will be found to reflect the light into dark corners of the building or spaces around the machinery which might otherwise form receptacles for dirt and rubbish. It will add very much to the cleanliness and general appearance of the plant, and will contribute toward its successful running.

In designing a power station, the primary object in view is to deliver power at the busbars for the least expenditure of money, due importance, of course, being given to reliability of operation, which is the controlling principle in power station work. The fixed charges—interest, depreciation, insurance and taxes, should be as carefully considered as the cost of fuel, labor, supplies, repairs and other items which make up the operating expenses. Consideration should be given to each of these elements in proportion to its importance as a factor in the cost of power. In the great majority of cases fuel is the most important item of expense, frequently amounting to more than all other operating costs combined, and the perfection of those details of design and management which will effect the greatest economy in its use will usually make the best return for the time and labor expended.

*Read before the American Railway Mechanical and Electrical Association, September 26, 1905.

Electrical apparatus has now been developed to such a state of perfection that in a well-designed and carefully managed power station over 90 per cent of the power of the engines is converted into electrical energy and delivered to the transmission system for the operation of cars. It appears, therefore, that no very great gain in coal economy is to be expected from the further improvement of electric generators or switching apparatus, and engineers are directing their efforts more than ever before to the steam portion of the power station, which offers a more promising field for a reduction in the cost of power.

The number and size of units to be installed is one of the most important problems bearing upon fuel economy which the engineer is called upon to solve. In order to obtain the maximum efficiency from the prime movers and their auxiliaries, it is necessary that they



CROSS SECTION

MANCHESTER ST POWER STATION
RHODE ISLAND CO., PROVIDENCE, R. I.

should be proportioned to the load they are intended to drive, so that if possible they may be operated at all times at or near their rated capacity.

In electric railway power stations it is not regarded as practicable to change the speed of the air or circulating pumps, or to alter the quantity of cooling water, to suit the varying loads upon the station, and these auxiliaries are usually operated at a point sufficient to take care of the maximum load. The power required to drive them is therefore practically constant, and their steam consumption per unit of output will vary indirectly as the load on the main engines. Under ordinary operating conditions, where the exhaust steam is used for heating the feed water, only about 12 per cent of the heat in the total steam generated can be used for this purpose, and all steam used by the auxiliaries in excess of this must go to waste; and it follows that in addition to the losses due to the reduced efficiency of the prime movers at light loads, the percentage of loss in the auxiliaries will increase very rapidly as the load upon the main engine decreases, and the best economy of the entire plant will be obtained only when the engines are operated at or slightly above their rated capacity.

The writer has before him the operating statistics of two railway power stations, a comparison of which illustrates the importance of proper attention to this subject. For convenience they will be referred to as Station A and Station B. Both stations furnish power for suburban railways upon which sufficient cars are run to provide a fairly uniform load during the greater part of the day, although subject to more or less violent temporary fluctuations. The general designs of these stations and their equipments are such that the fuel used per kilowatt-hour should be practically the same, provided the engines could be kept well loaded in both cases. In Station A there are three units, and the load conditions are such that one unit is operated during the night and early morning, when the travel is light; two are operated during the greater part of the day, and three at the peak of the load, which occurs shortly after six o'clock in the evening. By careful attention to the changes in the load, it is always possible to keep the running engines fairly well loaded.

In the case of Station B there are two units. The load at night and early morning is very light, so that the engine used is only about half loaded for this period, whereas for the greater part of the day the load is a little more than one engine should be required to carry, and it is therefore necessary to run both engines. The result, of course, is that the average load on the station is only a little more

than 50 per cent of the rated capacity [illegible], and they are consequently extremely wasteful of steam; and, too, the exhaust from the auxiliaries is probably quite a little in excess of that required to heat the feed water, which will also account, in a measure, for the low efficiency of the plant. Five pounds of coal per kilowatt-hour is the record of this plant, as compared with 3.8 lb. for Station A. The greater part of this discrepancy is undoubtedly due to the more efficient load conditions in the latter station. It is probable that had a storage battery been added to the equipment of Station B, the load on the engines could have been regulated so as to have made a much better showing in coal consumption, but it is still problematical if there is any net gain from the use of storage batteries in railway work, and the writer is disposed to think that the use of three smaller engines in place of two large ones would have been the proper solution of the question. Undoubtedly a saving in coal of from 15 to 20 per cent would have resulted from the use of engines better proportioned to the load.

In deciding upon the number and size of units, therefore, it is necessary that a careful study should be made of the load conditions throughout the entire day. In providing an increase of power for existing roads, data will be available from which station load curves under varying conditions of traffic can be constructed, and a fair average decided upon as the basis for determining the size of the units. In the case of a new railroad, this information will be more difficult to obtain, and an approximate load curve will have to be constructed from a study of all of the conditions bearing upon the subject. This involves decisions upon such matters as the location of track, with special reference to grades and curves, the distribution of copper in the feeder system, the weight and equipment of cars, and train schedules, all of which are important factors in determining upon the power required.

It is often necessary to estimate the size of a new power station before the final survey of the road is completed, or the details of the feeder system or train schedules definitely decided upon. In such cases the engineer will have to apply such data as he is able to obtain from other roads in which the conditions of track and the operating conditions are similar. But such data should always be used with the utmost caution, as vital differences in grades, in the feeder system, or in train schedules, must necessarily exist, which will render it extremely difficult to make comparison sufficiently accurate for a final decision upon the size of the station.

Having ascertained the power required during the different hours of the day, the plant should be divided into as few units as will enable the engines and generators to be operated at or near their rated capacity, while at the same time a sufficient number should be installed so that in the event of trouble one can be shut down without causing interruption of service. A three-unit station will permit of a fairly uniform distribution of the load in small plants, and in case of accident to one unit, the other two should be able, by overloading, to supply sufficient power until repairs are completed. This number of units is therefore regarded as the minimum which should be installed in any power station.

The type of apparatus to be used, whether alternating or direct current, will not materially affect the design of the station except in so far as the question of the use of reciprocating engines or steam turbines is involved. Up to this time the steam turbine, which is rapidly growing in favor for electric railway work, has been designed almost exclusively for use in connection with alternating current generators, and the manufacturers of electrical apparatus have held out scant encouragement that its speed could ever be so modified as to make its use with direct current generators, particularly the larger sizes, practicable. Reciprocating engines have therefore been regarded as the only type of steam motor available for this class of work. It is probable that this will be the case for some time to come, but it is interesting to note that considerable progress is being made in the development of direct current turbo-generators. A number of machines of this type as large as 500-kw. capacity are in operation, and work is well advanced upon units as large as 2,000 kw. There seems to be good ground for the belief that this problem will be successfully solved, and that in the near future this type of apparatus will be available in sizes as large as are generally required for direct current work.

Engineers and steam users generally have been prepared for some time to welcome any form of prime mover which could be shown to possess any considerable advantage over the reciprocating engine, as the latter had come to be regarded as having largely fulfilled its possibilities, and no very great improvement in economy was to be looked for. The steam turbine seemed to offer the solution of the question, and while, at the time of its introduction into this country, its superior economy had not been demonstrated, its great simplicity as compared with reciprocating engines, lower first cost, and less floor space occupied, insured its prompt adoption by a large number of power users, and from the first its progress has been rapid. In a report of the Committee for the Investigation of the Steam Turbine made to the National Electric Light Association, last June, it was stated that there were in operation at that time 224 turbines of an aggregate capacity of over 350,000 h. p., the greater number of which had been installed in the last two years. The writer is informed that the orders for turbines taken by the two largest manufacturers in this country aggregate (July 1, 1905) over 800,000 h. p.

The remarkable progress made in the manufacture of these machines, and their general adoption by many of the most progressive railways in the country, proves them to be a most formidable competitor of the reciprocating engine, if indeed it does not indicate that they have already established their commercial superiority.

It is to be regretted that most of the data upon the efficiency of steam turbines has been derived from tests covering very short periods of time, usually only a few hours, and that so little data is available of their performance under actual service conditions. To the street railway manager or engineer, power station records for long periods, showing the coal consumed per kilowatt-hour, or, better still, the efficiency of the plant expressed in percentage of heat energy in the coal converted into electrical energy at the switchboard, are of much greater interest and value than the record of any number of short-time tests for steam consumption only, as it provides him with a much more practical means of making comparisons with the performance of other stations with which he is familiar. The data which have been published illustrating the relative economy in steam consumption of turbines and reciprocating engines rarely ever show comparisons between units operating under identical conditions as to steam pressure, superheat, or vacuum, and therefore does not fairly represent the relative performance of the two types, and, too, the steam consumption of the auxiliaries is also invariably omitted, so that it is impossible to form an intelligent opinion as to the additional cost of the higher vacuum required for the turbine.

Up to this time most of the turbines installed in electric railway power stations are operated in connection with reciprocating engines, and owing to the difficulty of separating the operating charges, it has been practically impossible to obtain reliable information as to their performance under commercial conditions.

One of the plants where turbines are exclusively used is the Quincy power station of the Old Colony Street Railway Co., and through the courtesy of Mr. P. F. Sullivan, president of this company, the writer is permitted to publish some information regarding the performance of this station. This information was kindly furnished by Mr. C. F. Bancroft, superintendent of motive power and machinery.

It should be stated at the outset that this station, which will eventually furnish power for that portion of the Old Colony Street Railway Co's. system, extending from Quincy on the north to the city of Fall River on the south, is not yet in full operation. Its connection with the latter city, where a large part of the current is to be used, has not yet been made, so that at present it furnishes power for only about one-third of the number of cars which it will eventually drive. Only two of the five turbines in the station are required for this work. One of these machines is run for 17 hours per day, and two for 24 hours per day. When the station is in full operation there should be a more uniform load, and it is expected that the station efficiency will be considerably increased.

The station contains five 2,000-kw., 4-stage, vertical turbines, running at 750 r. p. m., and connected to 13,200-volt, 25-cycle, alternating current generators. The steam pressure is 200 lb. There are 10 horizontal water tube boilers of 750 h. p. each, equipped with internal superheaters, giving to the steam an average of 65 degrees superheat. Underfeed stokers are used. There are no economizers. One turbine is supplied with steam-driven auxiliaries; the other four have motor driven auxiliaries. At present, while only two units are in operation, the feed water is heated to 200 degrees Fahr. by the exhaust from the steam auxiliaries. The average daily output is 52,500 kw. h., giving a load factor of 54.7 per cent for the two

machines. Georges Creek Cumberland coal is used having an average calorific value of 14,000 B. t. u. per pound. The average coal consumption for this station, operating under the conditions outlined above, is 2.91 lb. per kw. h., showing an efficiency of [illegible] per cent. This record covers a period of [illegible] months, ending June 30, [illegible]

While this performance does not furnish conclusive evidence of the superiority of the turbine over reciprocating engines in electric railway work, it compares favorably with the results obtained in a large number of the better class of stations using the latter type of prime movers, and gives some force to the opinion that in actual practice there will be found to be very little difference in the coal consumption of steam turbine and reciprocating engine plants operating under similar conditions.

In order to develop the highest efficiency of the steam turbine, it is necessary to operate with a very high vacuum. It is claimed that each inch of vacuum above 26 in. will increase the economy from 3 to 4 per cent, and condensing apparatus is usually recommended which will produce a vacuum of about 28 in. of mercury, or 2 to 2½ in. higher than that regarded as the most efficient for reciprocating engines. The type of apparatus generally installed consists of a

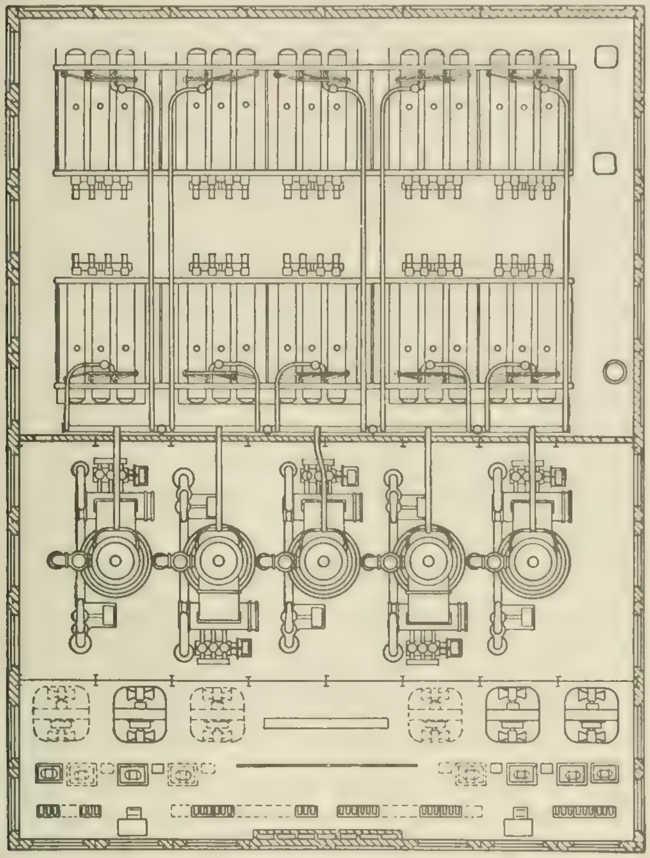


FIG. 2—QUINCY STATION, OLD COLONY STREET RAILWAY CO.

surface condenser with a centrifugal circulating pump, dry vacuum pump, and hot well pump. In practice no trouble has been experienced in obtaining the high vacuum desired with this type of apparatus, but whether the gain of 3 or 4 per cent in coal is sufficient to warrant the additional first cost of operating this rather complicated system, is a question which would seem to be open to discussion. In cases where the cost of feed water is a material factor in the cost of power, or where it contains a large percentage of calcium or magnesium carbonate, or other scale-forming materials, there will be great advantage in using a surface condenser on account of the pure distilled water returned to the boilers, but where these conditions do not exist, it will frequently be found to be practicable to use some simpler form of condensing apparatus, such for example as the injector or barometric type of jet condensers. These types of condensers offer very great advantages over the surface condenser in the matter of lower first cost, space occupied, greater simplicity, and less cost of maintenance. Up to this time they have not been very generally used, but there seems to be no good reason why they should not work as satisfactorily in connection with steam turbines as with reciprocating engines, and when properly proportioned to the work and installed with tight piping throughout.

[illegible] believed that [illegible] the [illegible] factor [illegible] compounded type.

A considerable economy in the steam consumption of both reciprocating engines and steam turbines has been shown to result from the use of superheated steam. [illegible] with either of these types of prime movers using dry saturated steam, the introduction of superheated steam can generally be depended upon to effect a saving in steam of about one per cent for every eight or ten degrees of superheat. Where the quality of the steam is not so good, and the conditions are such that the condensation in the pipes or cylinders of the engines is excessive, the saving may be much greater than this, sometimes amounting to one per cent for every 4 or 5 degrees of superheat.

With reciprocating engines, condensation in the cylinder resulting from the great difference in temperature between the incoming steam and the surfaces of the cylinder which have just been exposed to the temperature of the exhaust steam, has been recognized as one of the greatest sources of loss. Various means have been employed to reduce this loss, such, for example, as the use of steam jackets and reheaters, but these devices add materially to the complication of the engine, and under the most favorable conditions only affect a partial saving. For these reasons they have not been generally adopted in power station work. Superheated steam has been found to be a much simpler and more effective method of accomplishing this result.

Our knowledge of the subject of steam turbines is still so limited that it is impossible to state with any degree of positiveness just where the various losses occur, or to what causes we must attribute the gain in efficiency from the use of superheated steam. Undoubtedly a portion is due to thermodynamic reasons, and it has been suggested that a large portion is also due to the diminution of fluid friction within the turbine. Owing to the very high steam velocities in this type of apparatus, the friction of the steam passing over the surface of the buckets must cause a considerable loss, and this is probably very much greater where the steam carries a large percentage of moisture than when it is dry or superheated. It is probable, therefore, that the larger part of the gain due to superheating can be attributed to this cause.

The prevention of the deposit of water on the inside of the turbine casing, also, must effect some saving, although this gain is probably small as compared with that resulting from the diminution in the friction of the steam as it passes over the surfaces of the buckets.

Whatever the causes may be, there can be no doubt that there is a very marked gain in efficiency in steam turbines from using superheated steam, amounting to about as much per degree of superheat as in the better class of reciprocating engines.

The following table compiled by R. M. Neilson shows the reduction in steam consumption in steam turbines and reciprocating engines due to superheating. These statistics were obtained from a number of tests made in this country and in Europe. The apparent discrepancy in these tests is explained by the statement that there was considerable difference in the quality of th steam in the different cases, and the engines were of different types and of different sizes.

STEAM TURBINES.			RECIPROCATING ENGINES.		
Superheat Degree.	Saving. Per Cent.	Per Cent. per Degree.	Superheat Degree.	Saving. Per Cent.	Per Cent. per Degree.
13	6.1	0.47	31	7.86	0.25
50	8.0	0.16	40	8.65	0.22
60	5.4	0.09	50	12.00	0.24
66	12.1	0.18	100	20.55	0.20
70	7.5	0.11	150	[illegible]	[illegible]
84	7.7	0.09	216	[illegible]	[illegible]
100	14.0	0.14	225	33.7	0.15
140	12.6	0.09	225	[illegible]	0.15
150	19.0	0.13	440	[illegible]	0.07
200	23.0	0.115			
[illegible]	24.5	[illegible]			

Unfortunately, superheated steam is now known to be rather expensive to produce, particularly at the higher temperatures, and consequently economy in steam consumption does not necessarily mean economy in the consumption of coal. The chief advantage in its use is obviously in the saving which can be made at the coal pile, and unless this saving can be shown to be sufficient to pay for installing and operating the necessary superheating devices, it will be extremely difficult to convince a careful street railway manager that it will be profitable to use it.

This is a subject upon which there is a vast amount of conflicting information. In a number of instances the use of superheaters has been discontinued either on account of mechanical difficulties or because there was not a sufficient saving in coal to pay for keeping them in service. In other cases no mechanical difficulties have been experienced, and the saving in coal has been all that could be reasonably expected.

It is noteworthy that manufacturers of reciprocating engines and steam turbines, as well as engineers, while still recognizing the value of superheated steam, are disposed to be much more conservative than formerly in recommending its use. At this time, the weight of opinion seems to be in favor of a moderate amount of superheat, say not exceeding 125 degrees. Within this limit there should be a sufficient saving at the coal pile to justify its use, while the temperature is not sufficiently high to cause serious mechanical difficulties with any of the various types of steam apparatus generally used.

For many years after the inauguration of the electric railway industry, power station engineers seemed disposed to devote the greater part of their energies to perfecting the arrangement of engines, generators and switching apparatus, frequently neglecting the more important, though less showy, boilers and their accessories. In recent years they have come to realize that a larger percentage of saving can be made by a proper attention to the design and management of the boiler room than in any other department, as it is here that the greater number of preventable losses in a power station occur.

The designs of the standard types of steam boilers which are now generally used have been perfected to such a degree that efficiencies as high as 70 to 75, and even 80 per cent, have been attained under favorable conditions, and there are very few improvements which the power station engineer can suggest which will produce any considerable saving in fuel.

The design of the furnace, as distinguished from the boiler, on the contrary, is one requiring careful thought and study, to make it conform to the conditions required for the perfect combustion of the specific kind of fuel which is to be used. Anthracite coal, owing to its small percentage of volatile matter, can be satisfactorily burned in almost any kind of a furnace, provided the grate area and the draft are sufficient to burn the quantity required to develop the desired capacity, but in the case of semi-bituminous and bituminous coals and lignites, containing a much larger percentage of volatile matter, the furnace should be so designed that this volatile matter, as well as the fixed carbon, will be completely burned in order to develop the full heating value of the fuel.

The following conditions are necessary to insure the complete combustion of the fuel:

1. A sufficient supply of air.
2. Thorough mixture of air and fuel.
3. A sufficiently high temperature of the air and the combustible gases to insure their ignition and perfect combustion before they come in contact with the cooling surfaces of the boiler.

The principal source of loss is due to imperfect combustion of the volatile gases, which are distilled very rapidly after fresh coal is placed upon the fire, and not being mixed with air at a temperature sufficient to cause ignition, pass off unconsumed; or the air supply and the temperature being sufficient, they are allowed to come in contact with the comparatively cool surfaces of the boiler, and their temperature reduced below the ignition point before combustion is completed, so that they escape when only partially burned. The mixture, temperature and time are therefore important factors in the combustion of the volatile gases, and it follows that the combustion chamber should be of sufficient size to allow the gases to become thoroughly mixed, and that they should be raised to a sufficiently high temperature and be protected by fire-brick walls and arches from the cooler surfaces of the boiler shell or tubes until the combustible portion has been entirely consumed.

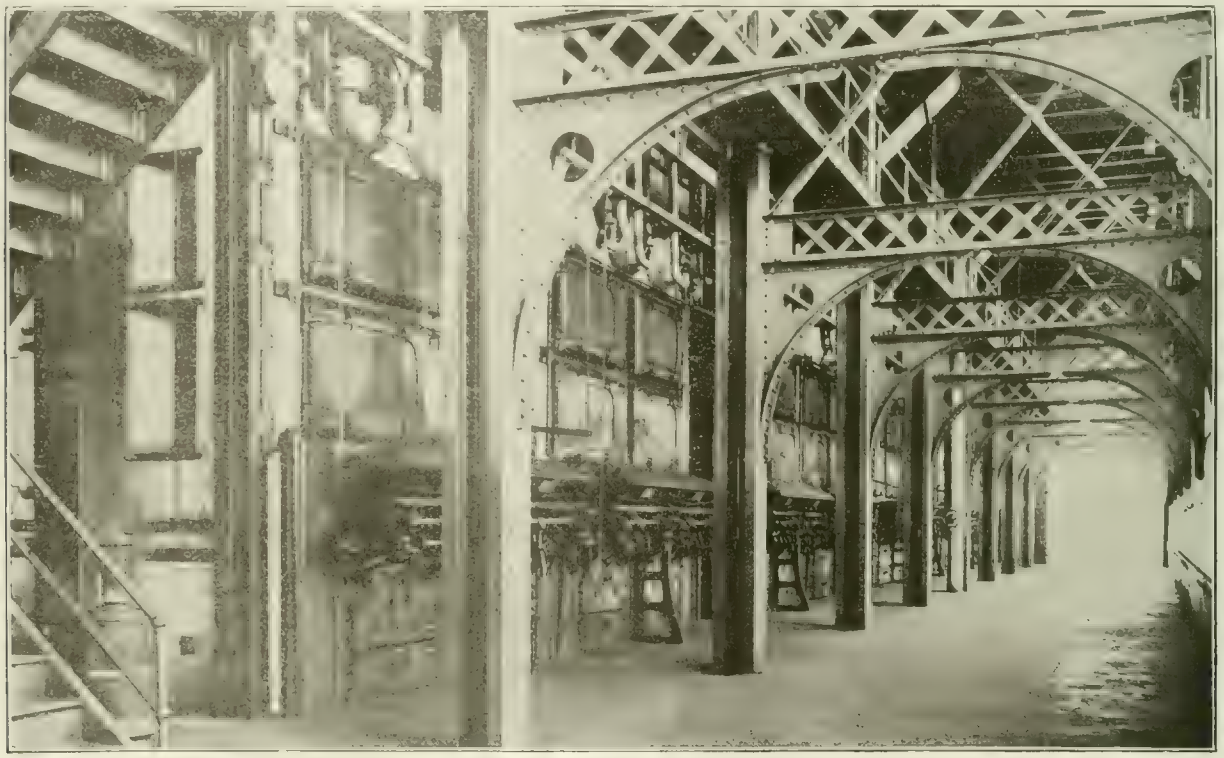


FIG. 3—BOILER ROOM MANCHESTER ST. STATION.

As to the proper place to admit the air for the combustion of the volatile gases, D. K. Clarke says:

"It is a matter of perfect indifference as to effect in what part of the furnace or flue it is introduced, provided this all-important condition be attended to, namely, that the mechanical mixture of the air and gas be continuously perfected before the temperature of the carbon of the gas, then in a state of flame, be reduced below that of ignition."

A number of furnaces have been devised in which the air has been admitted at the bridge wall or at the sides or front of the furnace above the grate, and there have been many ingenious plans for heating this air to the proper temperature before its admission to the combustion chamber. Some of these furnaces have been fairly successful as a means of reducing the smoke, but it is doubtful if the admission of air above the grate has ever materially increased the efficiency of the furnace. By far the most common practice is to

admit all the air through the grate, that required for the combustion of the volatile gases being heated to the proper temperature by passing it through the bed of incandescent fuel.

In many of the larger railway power stations the flue gases are regularly analyzed to ascertain the amount and distribution of the losses due to incomplete combustion and the amount of excess air admitted to the furnace, which information is necessary to enable those in charge to operate the boilers in the most efficient manner. The only way in which the waste which takes place in the furnace can be detected is by such an analysis, and its importance as a means of reducing boiler room losses is so great that it merits a much more general use.

In the combustion of coal the object in view is to produce the highest possible percentage of carbon dioxide per unit of fuel burned. The higher the percentage of carbon dioxide, the more perfect will be the combustion of the fuel and the higher the furnace temperature, as is shown from the fact that a pound of carbon burned to carbon dioxide will produce 14,600 B. t. u., while only 4,450 B. t. u. will be produced when, on account of an insufficient supply of air,

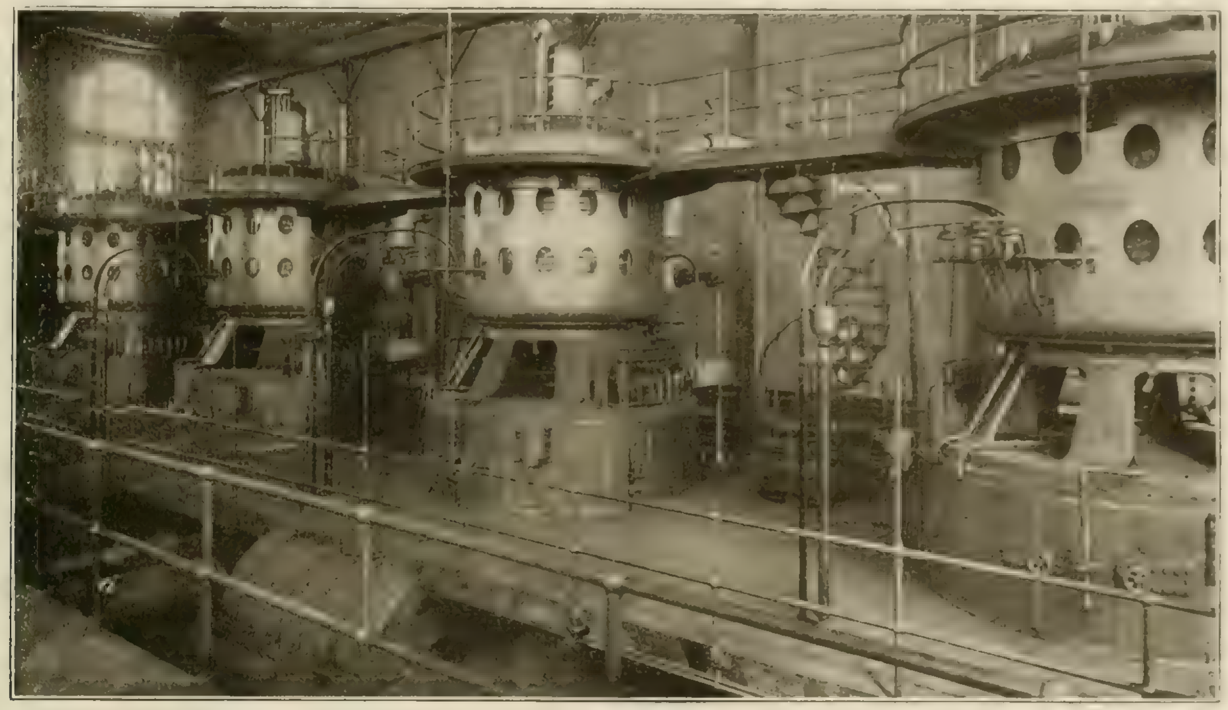


FIG. 4 TURBINE ROOM QUINCY STATION

carbon monoxide is formed. The gas analysis will show the percentage of carbon dioxide, carbon monoxide and oxygen. This information will enable the chemist to determine the total heat in the escaping gases, the amount of unconsumed gas, and the losses due to an excess air supply, and will also indicate the cause of these losses and suggest the proper remedy.

A low temperature of escaping gases is frequently regarded as an indication of efficient furnace conditions, but it is quite as likely to be caused by an excess of cold air, due to too strong a draft, uneven fires, or leakages through the boiler settings. The true condition of affairs can only be revealed by means of an analysis of the flue gases. Anything which will increase our knowledge of the conditions which take place within the boiler setting, and will permit of a more intelligent use of fuel, should be encouraged, and for that reason the practice of analyzing the flue gases is recommended in all railway power stations where the cost of fuel is an important factor in the cost of power. It is always preferable to have this analysis made by an experienced chemist, but in small stations where the saving to be made is not sufficient to warrant the employment of such a man, it is said to be possible to obtain fairly satisfactory results from the use of one of a number of automatic or semi-automatic devices which are now manufactured for the purpose.

Mechanical stokers are now almost universally employed in electric railway power stations, on account of the increased efficiency over hand-fired furnaces and the reduced cost of operation. In a properly constructed furnace of moderate size, equipped with flat grates, an intelligent and careful fireman can produce results equally as satisfactory as are [illegible] with any of the various types of mechanical stokers [illegible] that such firemen are not plentiful [illegible] men who will produce uniformly good results [illegible] of time. For this reason the average fuel [illegible] power station will generally be found to be [illegible] the firemen are assisted by some form of [illegible].

It should be borne in mind [illegible] size in space and the initial cost of the plant, the size of the boilers and the rate of combustion has steadily [illegible] until they have now reached a point where it is doubtful if the larger sizes can be properly [illegible] firemen.

The use of mechanical stokers [illegible] these large sizes of boilers, in order to drive them up to the capacity required in electric railway plants.

There can be no doubt that mechanical stokers accomplish a considerable saving in boiler house labor. A reasonable day's work for a fireman is the shoveling of sufficient coal for about 200 h.p. of boilers, which in a railway power station will amount to from six to eight tons every 12 hours. Where automatic stokers are used, and coal is delivered to the hoppers by gravity, one man should be able to take care of about 2,000 h.p. of boilers, which is equivalent to a reduction in labor of 75 per cent. The cost of maintenance of automatic stokers is somewhat greater than that of flat grates, and additional labor is required for repairs as well as for tending the coal handling machinery usually installed in connection with them, so that the net saving in labor will be somewhat less than that indicated above. There is a point, of course, at which this saving is not sufficient to pay for the additional fixed charges and repairs upon the mechanical stoking devices. This point is reached in a boiler plant of about 2,000 h.p. capacity. In a plant of greater capacity than this, automatic stokers can generally be shown to return a sufficient net saving to warrant their use, while in smaller plants it will frequently be found to be profitable to use them on account of the cheaper grades of fuel which can be burned and the greater capacity which can be gotten out of the boilers.

Perhaps the most difficult problem to be solved in connection with the power station is to secure proper attention to details of operation by the subordinate employes. In the most carefully designed plant, equipped with the most efficient types of machinery, the results which the railway manager and designing engineer may reasonably expect in the way of economy will not be achieved unless the utmost care and vigilance are exercised by the operating forces. The suc-

cessful operation of the station will depend largely upon the way in which the forces are organized, and discipline maintained. Just how the station organization should be made up is a question which can only be decided for each plant after a careful study of all the conditions; but it is safe to say that however the various departments may be organized, there should be one man in supreme authority, possessing considerable executive ability as well as a thorough practical knowledge of steam and electricity, whose decision should prevail in the event of disagreement among the heads of departments or at times of emergency. As he is the one who will be held responsible for the successful performance of the station, it is essential that whatever regulations there may be regarding the employment of his subordinates, he should have full authority to dismiss any who prove to be incapable or are not disposed to be attentive to their duties. It will be practically impossible to maintain proper discipline if among the employes there are those who feel a certain sense of security in their position through the influence of someone higher in authority than the man in charge of the station.

The work of the greater number of station employes is necessarily of a routine character. It is nevertheless important that they should be thoroughly instructed in their duties and required to perform them with the utmost regularity. For example, an oiler employed upon an engine should receive instructions as to the minutest detail of the work that he is required to do. He should not only be required to see that his lubricators are full and working properly, and that every part is receiving a sufficient quantity of oil or grease, but he should feel of every bearing and should observe every part of the engine as he passes around it to assure himself that it is in proper operative condition. He should be required to perform these duties at regular intervals of every twenty or thirty minutes, and his attention should be called to the time for him to commence his rounds by a bell or whistle, or some other form of signal. If there is any part requiring attention, it should be immediately reported to the engineer in charge, who will thus be given an opportunity to apply the proper remedy before the trouble has developed to such an extent as to cause damage or interruption to the service. If the oiler attends to his duties properly there will be no trouble from hot bearings, from keys, pins or bolts working loose, or from any changes in the adjustment of any part which it is possible to discover when the engine is running.

The work of all other station employes should be systematized along the same lines. The watch engineers should report in writing to the engineer in charge details of the apparatus which in their judgment require attention, and as soon as the machinery can be shut down, these parts should be carefully inspected, and if they show signs of weakness or excessive wear, immediately renewed or repaired. An examination of the enclosed parts of the engines and other working machinery should also be made at frequent intervals and before there are any outside evidences of trouble.

It is necessary that all subordinate employes should be under constant supervision to insure a proper attention to their duties, but this is especially true of the fireroom forces. Firemen are not generally disposed to take as much interest in their work as employes in other departments. They seem to be content to remain as firemen, and rarely endeavor by excelling in their work, to advance their positions. It is in this department that the greatest losses will occur through indifference on the part of the attendants, and it is therefore of the utmost importance that their work should be carefully done. The only way to accomplish this known to the writer is to place this department in the immediate charge of an intelligent and capable man, whose salary and the knowledge that the permanency of his position will depend upon the results produced, will be sufficient for him to keep constantly in touch with those immediately under him and insist upon their performing their duties properly.

In most power stations records are kept of the coal and water consumption, the temperatures of the feed water and flue gases, and the station output, by which the performance of the station from month to month can be compared. These records furnish a check upon the condition of the station, the manner in which it is operated, and assure its being maintained in a high state of efficiency. The writer has found that in addition to these records, an occasional test of the entire plant under actual operating conditions for periods of say twenty-four to forty-eight hours, are also of great value as a means of furnishing definite knowledge as to just what the station is capable of doing. Such tests also have a certain educational influence upon the employes, particularly the firemen, as they illustrate to them what can be done when all engaged on the work are exerting their best efforts to secure the most efficient results possible.

At the Rhode Island Suburban Railway Co's. Manchester St. station all of the usual records are kept, and the quantities and costs carefully determined for each month, and tests of the entire plant are also made as suggested above. The writer believes that these tests have a sufficient influence upon the regular performance of the station to justify a brief description of it, and the publication of the results in the matter of coal consumption from the time it was placed in commission, showing the gradual improvement in efficiency.

This station was originally designed for the Rhode Island Suburban Railway Co. to furnish power for its lines operating in the vicinity of Providence. It was intended to use horizontal units, and two 1,500-kw. alternating-current units and one 1,600-kw. direct-current unit were purchased. Before work on the building had progressed beyond the foundations, however, it was decided to increase the capacity of the station by installing two additional direct-current units of 2,500 kw. each. This required a number of changes in the structure, and necessitated double-decking the boiler room in order to provide the necessary additional boiler capacity. The present equipment of the station consists of 14 horizontal water tube boilers of 520 h. p. each, eight on the lower floor and six on the upper floor. The boilers on the lower floor have no superheaters, but those on the upper floor are equipped with internal superheaters, each made up of eighty-four 2-in. tubes suspended below the boiler drums. The superheaters on two of the boilers were designed for only 125 degrees of superheat, and contain 615.3 sq. ft. of effective heating surface each. Those on the other four boilers were designed for 150 degrees of superheat, and contain 855.5 sq. ft. of heating surface. Each boiler has 5159 sq. ft. of heating surface.

Roney mechanical stokers are used, each containing 112 sq. ft. of effective grate surface. A 280-tube Green fuel economizer is installed directly back of each battery of boilers, the flue being so arranged that the hot gases may be passed through the economizers or directly to the main flue as desired. The heating surface per square foot of grate is for boilers 46 sq. ft., for economizers 15 sq ft., or a total of 61 sq. ft. Natural draft is used. The boiler pressure is 145 lb. There are three horizontal compound engines with cylinders 32 and 64 by 54 in., operating at 94 r. p. m., and two vertical compound engines with cylinders 42 and 86 by 60, operating at 75 r. p. m. All of the engine auxiliaries are steam driven. Jet condensers are used, the air pumps being of the twin vertical type. The average vacuum in the engine cylinders is 25½ in. of mercury. There are two alternating current generators each of 1,500 kw. capacity, delivering current to the line at 11,000 volts, and one 1,600 kw. and two 2,500-kw. direct current generators delivering current at 600 volts. The normal capacity of the station, therefore, is 9,600 kilowatts. Direct current is furnished for 24 hours per day, and alternating current from 5 a. m. to 1 a. m. There are no feed water heaters between the engine cylinders and the condensers, but the exhaust steam from the auxiliaries is carried to two heaters located in the basement on the suction side of the feed pumps. These heaters are made up of horizontal U-tubes arranged in series, the steam entering at the top and discharging at the bottom, while the water enters at the bottom and discharges at the top. Each heater contains 750 sq. ft. of heating surface, and in practice all of the steam from the auxiliaries is condensed and is discharged at a temperature only about 35 degrees higher than the incoming cold water. The average daily output of the station is 102,500 kw. h.

The following is the performance of the station under actual service conditions from the time it was started in regular service, February, 1904. It should be borne in mind that the first battery of boilers with superheaters was installed eleven months after the station was started, and four months thereafter two additional batteries of boilers with superheaters were commissioned, and the performance of the station is therefore given for the periods covered by these different conditions.

Eleven months, saturated steam, 2.87 lb. of coal per kw. h.

Four months, slightly superheated steam (no record of temperature kept), 2.73 per kw.h.

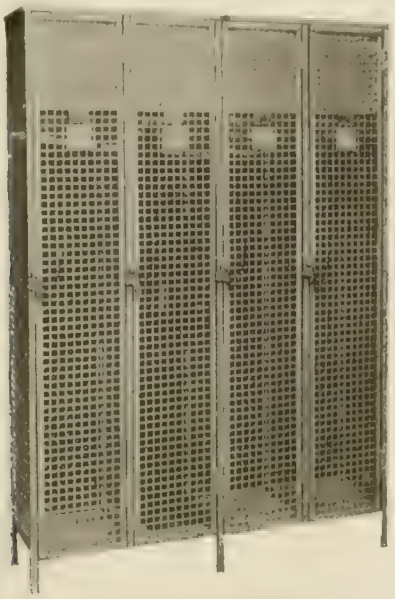
Three months, superheated steam, average temperature at engine throttle 465 degrees (102 degrees superheat), 2.46 lbs. of coal per kw. h.

The apparent reduction in coal consumption per kilowatt hour with steam superheated about 100 degrees is 14.3 per cent, but all

of this saving cannot be attributed to this cause. A large part of it is undoubtedly due to the increased efficiency of the fireroom attendants. Probably not over 8 to 10 per cent should be credited to the use of superheated steam.

PEN-DAR METAL LOCKERS.

The all steel locker as now generally used has many advantages over the earlier type with its wooden top and sides. Metal lockers can be built to any dimension either as units or in single or double rows. For the same interior dimensions the metal lockers occupy



PEN DAR NO. 115 LOCKER.

less space and are more sightly. As the material of which they are made will not absorb moisture, much less care is required to keep metal lockers clean and thus prevent any spreading of disease. Steel lockers when provided with locks furnish a secure place for storing personal effects. The Fire Underwriters [illegible] of locker construction and especially [illegible] open mesh sides, since any fire [illegible] easily be discovered and confined to one locality.

The "Pen-Dar" metal lockers of which an illustration is shown are manufactured by Edward Darby & Sons Co., Inc., Philadelphia, Pa. This firm also handles wire and iron window guards, railings and elevator enclosures, brass and iron grill work and office enclosures, together with a full line of wrought metal products such as screens, gratings, wire cloth, etc. The thorough satisfaction with which "Pen-Dar" metal lockers have been received is emphasized by this company's increased output and large number of duplicate orders.

THE T. H. SYMINGTON CO.

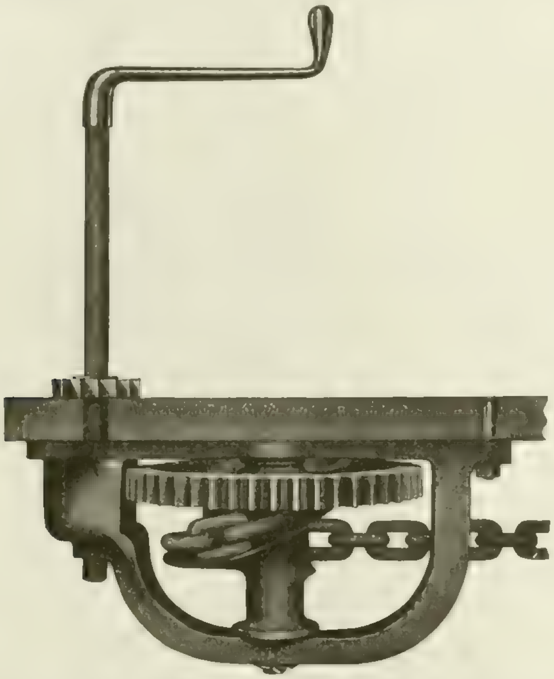
The T. H. Symington Co., Calvert Bldg., Baltimore, Md., is exhibiting a complete line of Symington journal boxes and dust guards and Baltimore ball bearings, center and side bearings, at space No. 25, section I.

The important factors in a successful journal box and those which have been incorporated in the products of the company are: 1. A simple, durable, dust proof lid, with a spring arrangement that will not fail in long service. 2. A simple, durable dust guard that will effectually keep dust out of the rear end of the journal box, and that can be easily and cheaply maintained in service. 3. A design that will positively prevent any settling of waste packing away from the journal; that will keep the waste from getting caught between the brass and journal; that will hold oil close to the journal. 4. A design that will give maximum strength to resist all the usual and unusual strains that occur in service, with a minimum weight of material. 5. A tough, resilient material which will resist wear on the internal brass stop lugs, and in the pedestal pits of truck boxes.

The following representatives of the company are in attendance during the convention and will be glad to explain in detail the features of its devices and the benefits to be derived from their use: E. H. Symington, manager western sales; J. F. Symington, manager eastern sales; A. H. Weston, mechanical engineer; and E. John Nichols, secretary.

C. STYLE "PEACOCK" BRAKE.

The "Peacock" brake in its construction includes the perfection of the spindle brake and the addition of a power multiplying device designed to place the vehicle at all times absolutely under control of the operator. The brake is attached to the under surface of the



car platform, the ordinary spindle brake-staff, turned down and key-seated, being inserted into the small gear wheel. The chain is then attached to the eccentrically-geared cam and the brake is ready to operate.

The C brake, or frame, has come into favor for the reason that it is more adaptable to extra heavy high speed suburban cars. The accompanying illustration shows all its lines and angles. It is constructed on precisely the same lines as the other "Peacock" brakes, except that it is larger and heavier, being 20¼ in. long by 9¼ in. wide over all, and projecting 9 9-16 in. below the platform. The ratio of bearing on the A and B styles is 14 to 34 while on the C it is 12 to 48. The C drum is precisely the same as the A and B drum and the amount of chain taken up for one revolution of the gear will be the same.

Striking testimony of the merits of "Peacock" brakes is shown in recent orders placed with the National Brake Co. by the Chicago City Railway Co., Brooklyn Rapid Transit Co. and several other of the largest city systems in the country, there being over 150 roads now having these brakes in service.

RAILWAY JOURNAL LUBRICATING CO.

The Railway Journal Lubricating Co., 1320 Havemeyer Building, New York City, has an attractive booth at spaces 2 and 4, section K, where it has an interesting display of "Economy" journal lubricators, "Economy" oil and dust guards, and several types of "Economy" journal boxes and covers now in service. Several demonstrating models of these apparatus are also shown and add materially to the interest of the exhibit.

In connection with the exhibit the company has introduced an original idea in arranging to give complimentary stenography service to the members of the three associations, having provided suitable stationery, stamped envelopes and a competent stenographer.

The company is represented at the association by the following officers: Burton R. Stare, vice-president and general manager; William H. Stare, superintendent; W. H. Baumann, specialist; Charles S. Rea, district salesman.

THE NATIONAL LOCK WASHER.

The National Lock Washer Co., 65 to 70 Johnson St., Newark, N. J., is manufacturing the National lock washer, of which 310,000,000 have been used in railroad track alone. This is a simple, very effective device that is easily applied and adapted for use on all kinds of work. It is made of a high grade of steel, hardened in oil and tempered. When the nut is screwed upon the bolt, it first strikes a rib on the lock washer, which being harder than the nut, progressively upsets and forces some of the metal of the nut into the thread of the bolt and positively locks the nut so that it cannot back off or jar loose. The washer is made for all sizes and any make of bolt or nut, a special bolt and nut not being necessary, and the same bolt, nut and lock washer can be used as often as required, advantages which will appeal to all track men.

"BOY-LESS" BOWLING ALLEY.

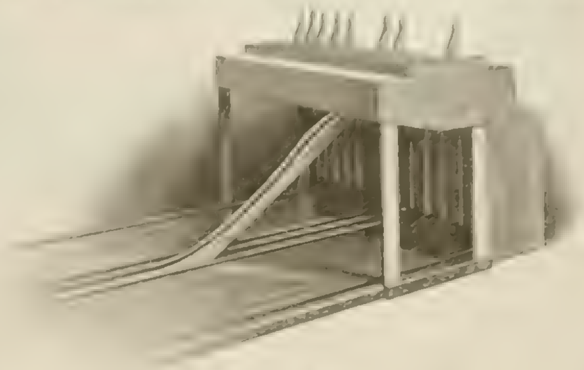
The accompanying illustrations show the "Boy-less" five pin alley, a new and fascinating form of bowling, which should appeal to the progressive street railway park manager as an amusement feature. The game is almost entirely automatic. The ball is delivered by

BOY-LESS ALLEY

the bowler in the same manner as a cocked hat ball. When the ball reaches the end of the alley it strikes a groove which causes it to loop the loop and strike a tripper, which in turn knocks down the pins which are hinged to the platform. The ball then delivers itself back to the bowler by gravity and is placed in convenient reach of the player [illegible] step. After the bowler has delivered three balls, the pins knocked down are reset by a simple pull [illegible] in the smaller view. The game is scored the same way as at ten pins, the maximum score being 150.

The game can be quickly [illegible] and requires more science than either ten pins or cocked hat, as there is none of the luck feature in the game.

From a park manager's standpoint [illegible] An alley [illegible]



RECEIVING END

which is the number one attendant can [illegible] advantage, will earn $7.20 an hour. Figuring on a [illegible] 30 hours per week, these alleys should earn $216 gross.

There is no appreciable wear and tear on the pins and balls. The alley is portable and is made in standard lengths of 40 ft., but can be made in any desired length.

The Matthews-Fahl Manufacturing Co., of 225 North Second St., St. Louis, states that it is prepared to deliver these alleys on short notice. The company has a representative at the convention with an exact model on exhibition.

DAILY STREET RAILWAY REVIEW

7TH YEAR, NO. 8 | SEPTEMBER 28, 1905. | SERIAL NO. VOL. XV. NO. 9 [illegible]

OFFICERS OF THE STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

[illegible] R. HENRY
First Vice-President.

W. G. ROSS.
President.

[illegible]

J. W. LESTER.
Third Vice-President.

[illegible]
Secretary-Treasurer.

[illegible] LINN, Jr.

F. E. SMITH.

G. B. WILCUTT.

P. S. YOUNG.

W. G. ROSS.

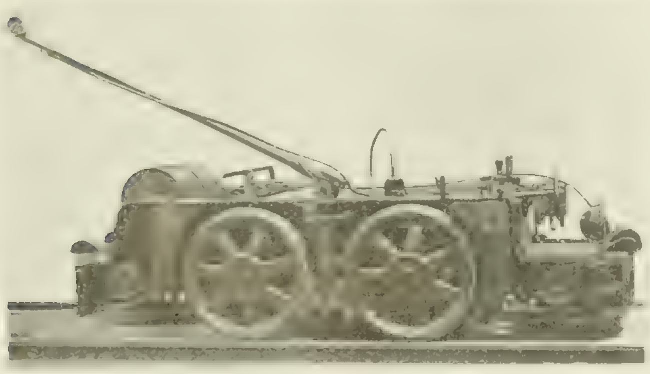
Mr. W. G. Ross, president of the Street Railway Accountants' Association of America, is managing director of the Montreal Street Railway Co., and an accountant of a wide experience covering twenty odd years. His first experience in this line began in the early 80's, when he was successively secretary, treasurer and assistant manager of the Windsor Hotel Co. Mr. Ross entered electric railway service in 1892, when he became associated with Mr. James Ross, who was very active in the development of the street railway properties of Canada and had large interests in several companies. In 1901, Mr. Ross was appointed secretary and treasurer of the Montreal Street Railway Co., succeeding Mr. M. H. Watts, and combining therewith the office of comptroller, which latter position he had held for some time. In July, 1903, he succeeded Mr. James Ross as managing director of the company and has since continued in that capacity. Mr. Ross has always taken an active interest in the Accountants' Association.

BALDWIN ELECTRIC LOCOMOTIVES.

The Baldwin Locomotive Works, of Philadelphia, built its first electric locomotive in 1895, it being intended for experimental work for the North American Co. The electrical parts were designed by Messrs. Sprague, Duncan & Hutchinson, Ltd., of New York. In 1896 a working arrangement was made with the Westinghouse Electric & Manufacturing Co., which was to supply the electrical portions of the equipment, the Baldwin Locomotive Works furnishing the running gear and installing the electrical parts. This arrangement is still in effect, and up to the present time about 500 locomotives have been built, which comprise designs for both mine and surface haulage.

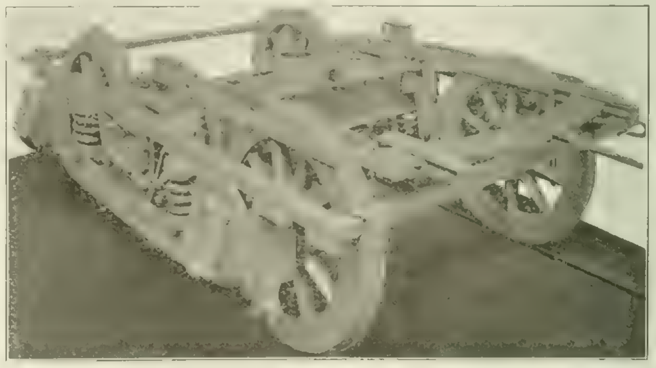
ELECTRIC LOCOMOTIVE FOR NAVAL PROVING GROUNDS

Accompanying illustrations show two recently constructed electric locomotives, one for the Pocahontas Consolidated Co. and the other for the United States Government Indian Head Naval Proving Grounds, descriptions of which should be of interest. The general dimensions of the former, which is known as class 4 2/15 C 47 and was built for mine service, are as follows: Gage, 4 ft $8\frac{1}{2}$ in.; motors, two No. 67, with full load speed of 6 m.p.h.; draw bar pull, running, full load, 2,000 lb.; draw bar pull starting, 2,400 lb.; diameter of drivers, 28 in.; wheel base, 3 ft.; journals, $3\frac{1}{2}$x$5\frac{1}{2}$ in.; width, 5 ft. 6 in.; height, to top of cab, 3 ft. 1 in.; length, 9 ft. 10 in.; weight, 10,000 lb. The general dimensions of the locomotive built for the United States Government, which is a much larger locomotive designed for surface haulage and is known as the company's class 8 4/50 E 9, are as follows: Gage, 4 ft. $8\frac{1}{2}$ in.; motors, No. 79, full load speed of 6 m.p.h.; draw bar pull running, full load, 8,600 lb.; draw bar pull starting, 9,000 lb.; diameter of drivers, 30 in; wheel base, 18 ft.; journals, $3\frac{3}{4}$x7 in.; width, 9 ft. 4 in.; height, 10 ft. 10 in.; length, 23 ft. 6 in.; weight, estimated about 45,000 lb.



BALDWIN ELECTRIC MINE LOCOMOTIVE

A large number of electric trucks have been built by the Baldwin Locomotive Works for various companies and intended for use on electric roads. These comprise both trailer and motor trucks although no electric installation is made on these before leaving these works. The accompanying illustration of one of these trucks shows the general design. These trucks are built in accordance with the best locomotive practice. The parts are interchangeable and accurately fitted with bolts in reamed holes, which are drilled to gages and templets.



BALDWIN ELECTRIC CAR TRUCK

A POSITIVE SPRING NUT LOCK.

The "National" lock washer, manufactured by the National Lock Washer Co., Newark., N. J., is claimed by the company to be a complete and positive preventive for loose nuts on all kinds of work. It is now being used extensively by the largest railroad systems in their track, on cars, locomotives and bridges, on frogs and switches, iron work, electric motors, cable and electric roads, motor car trucks, and all places where it is desirable to keep nuts tight. This lock washer, when set up, holds the nut tight independent of its spring, having all the spring possible, which takes up elongation of the bolt or looseness caused by settling or wear. When in the track it is so imbedded in the nut that there is no friction between it and the nut when wheels pass over it, and it therefore wears much longer. Tests have demonstrated that its use considerably prolongs the life of a joint. The washer is made for all sizes and makes of bolts and nuts and the same bolt, nut and washer may be used as often as required. The merit of the product is attested in the use of 310,000,000 in railroad track alone.

MOTOR BOX FREIGHT CARS FOR BROOKLYN.

The Laconia Car Company Works, 131 State St., Boston, Mass., has recently completed 15 motor box freight cars for the Brooklyn Rapid Transit Co., of which the accompanying illustration shows a type. The cars are fitted with M. C. B. type of bolsters and have yellow pine longitudinal sills and oak end sills. The bottom is reinforced by 4 x 1¼ in. truss rods passing through end sills over bolsters

LACONIA FREIGHT CAR FOR BROOKLYN.

and under queen posts, connected by 1¼ in. drop forged steel turnbuckles at the center. The platforms at each end of car are made circular in form and the bumper is plated with heavy steel. The platforms are also fitted with steel dashers supported by four stanchions with angle iron rail at the top. The fenders used are the Brooklyn Heights standard. The car is sheathed outside with North Carolina pine, and is also sheathed inside from floor to girth. Each side of the car has a sliding door 6 ft. wide, supported by Kanaley hangers; also a small door at either end 26 in. wide, extending from girth to under side of end belt. The roof is covered by cotton duck laid in white lead and thoroughly painted. The cars are equipped with "Columbia" ratchet brake handles, "Reliable" sand boxes, "Sterling" safety brakes, Neal headlights, and Westinghouse air brakes, and are mounted on Brooklyn Heights standard trucks.

These motor box freight cars have a capacity of 25 tons each and are of the following dimensions: Length over body, 35 ft.; length over dashers, 40 ft. 7⅛ in.; length over bumpers, 31 ft.; width over sills, 7 ft. 5⅝ in.; width over all, 8 ft.; length inside, 34 ft. 6⅝ in.; width inside, 7 ft.; bolster centers, 22 ft. 6 in.

THE INTERNATIONAL REGISTER CO.

The exhibit of the International Register Co., manufacturer of fare registers and railway supplies, of 124 West Jackson Boulevard, Chicago, will occupy spaces No. 2 and 3 in section G, having 20 ft. frontage and a depth of 15 ft. The exhibit comprises a full line of fare registers manufactured by the company, car fittings, Heeren badges, "International" ticket punches, "International" trolley cord, etc. The company is represented at the convention by John Benham, vice-president and treasurer; W. H. Brown, secretary, and A. N. Loper, sales agent.

THE UNDER-FEED STOKER CO.

The Under-Feed Stoker Co. of America, Marquette Building, Chicago, occupies space 26, section J, and is represented by David H. Hunter, Jr., Charles Bond, of Philadelphia, and Charles S. Crowell, manager of the stoker department of Charles Bond, engineer and railway supplies and eastern representative of the Jones under-feed stoker, at Philadelphia. The company's exhibit includes reading matter and photographs of recent installations made by the company in electric railway power plants. This also includes a report of a recent test made by A. W. Grabe, chief engineer, Plankington Estate Properties, Milwaukee, Wis.

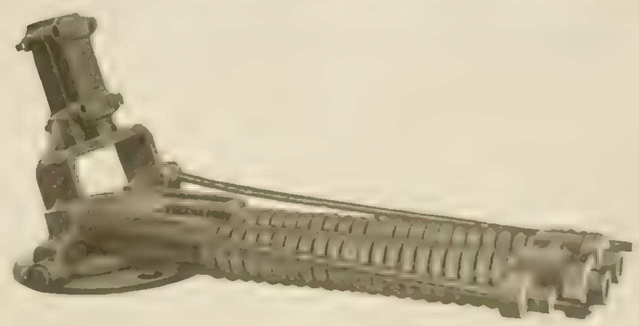
The representatives of the Standard Underground Cable Co., 1219 Betz Building, Philadelphia, in attendance at the convention, are T. E. Hughes, manager, Philadelphia; H. P. Kimball, New York; A. A. Anderson, Pittsburg, and C. A. Brown, Philadelphia. The company has in preparation a [illegible] engineering [illegible] will be ready [illegible]. Those desiring a copy are requested to register at the company's office in the Betz Building.

FRANKLIN RAILWAY SUPPLY CO.

The Franklin Railway Supply Co. [illegible] represented at the convention by Kenneth D. Hequembourg, [illegible] exhibit at space 15, section K. In addition to [illegible] the company is exhibiting a new type of [illegible] with a 50-lb. magazine coal capacity and [illegible] for holding coal or coke. The heater [illegible] for [illegible] fuel. Some of the recent [illegible] include 18 heaters for the Metropolitan [illegible] R. R., Chicago; [illegible] for the Syracuse Rapid Transit Co.; 16 for the [illegible] Traction Co.; 20 for the Schenectady Railway Co.; [illegible] for the Rochester Railway Co. C. S. Ayres is also looking after the interests of the company at the convention.

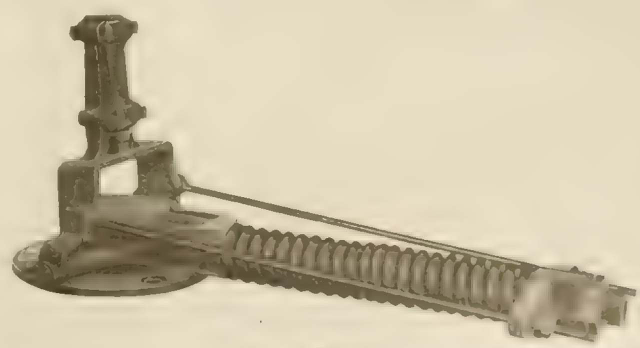
NUTTALL BALL-BEARING TROLLEY.

The R. D. Nuttall Co., Pittsburg, Pa., manufacturer of gears, pinions and trolleys for electric railway, mine and industrial haulage motors, has recently introduced a new type of ball bearing trolley, two forms of which are shown herewith. Forms 10 and 11 ball bearing trolleys have [illegible]



No. 10 TROLLEY.

although they are equally efficient in general service. The material used in the manufacture of these products is of the usual high standard found in Nuttall products, each part is properly proportioned and accurately machined. The ball races are made of high carbon steel and are carefully finished and adjusted, thus assuring a very sensitive and substantial trolley. The extreme height with pole in



No. 11 TROLLEY.

horizontal position is 4½ ft., but 4-ft. can be furnished when required. These trolleys, together with other products of the company, may be seen at space 3, section A, of the exhibit hall, where the company has a complete display of gears, pinions and trolleys.

LAGONDA MANUFACTURING CO.

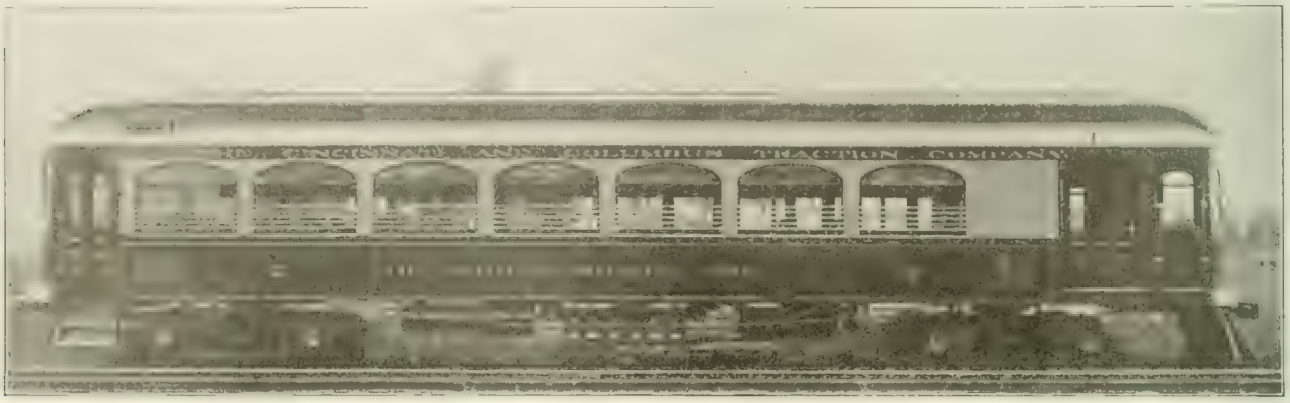
The exhibit of the Lagonda Manufacturing Co., Springfield, O., manufacturer of Weinland tube cleaners, boiler room and steam specialties, is represented at the convention by H. F. Weinland, vice-president, and L. B. Mellor. The company's exhibit consists of a full line of its four well-known appliances: The Weinland tube cleaner, tube cutter, damper regulator and reseating machine.

NEW CARS FOR THE CINCINNATI & COLUMBUS TRACTION COMPANY.

The Jewett Car Co. of Newark, O., has just delivered to the Cincinnati & Columbus Traction Co. eight combination passenger and baggage interurban cars of the latest type. The cars are 57 ft. long over buffers and 46 ft. 6 in. over the body. The width over posts is 8 ft. 8¾ in. and the width at the widest point is 8 ft. 11¾ in.

These cars include the late features of car construction and fittings. They are divided into three compartments; the main compartment seating 38 people, smoking compartment seating 16, and the baggage compartment, which is equipped with slat seats, can easily accommodate 12 or 14 people.

The finish throughout is selected mahogany of a rich color and marquetry inlay. The ceiling is of the semi-empire type. The seats are Hale & Kilburn latest high-back walkover type. Those seats in the main compartment are upholstered in green plush, and those in the smoking compartment with rattan. There is a toilet room in the rear end of each car. The Peter Smith hot water heating system is used, with the heater on the front platform. Large and substantial parcel racks are distributed along the sides of the cars. The curtains are of pantasote and were manufactured by the Curtain Supply Co. The glass throughout the car is 3/16-in. polished plate with the exception of the gothics and deck glass, which are ornamented green. Each end of the car is equipped with M. C. B. couplers, while the front end of each car is equipped with the locomotive type of pilot.



JEWETT CAR FOR CINCINNATI & COLUMBUS TRACTION CO.

The cars present a handsome appearance, the outside being painted chrome green below the sash rest and on the letter board; between the letter board and sash rest the color is cream yellow. Each car is equipped with "De France" air sanders, manufactured by the Newark Air Sand Box Co., of Newark, O., Westinghouse air brake, Mosher arc headlight, signal lamps, cocoa matting and safety treads on steps. Peckham M. C. B. 40-A double trucks with 6 ft. 10 in. wheel base are used, and 34 in. wheels with 5¼ in. axles. The motors are GE-73; all cars have four-motor equipments operated by multiple-unit control. All wires throughout are run in waterproof conduits and all contactors are assembled in a single fireproof box.

The Jewett Car Co. is also building cars for the elevated lines of the Brooklyn Rapid Transit Co., 70 elevated cars for the South Side Elevated R. R. of Chicago, and has just received a contract for the cars of the new interurban road of the Zanesville & Southeastern Traction Co. of Zanesville, O. This company also has recently delivered to the University of Illinois a specially designed test car to be used by the electrical engineering department of this university.

THE GENERAL ELECTRIC CO.'S EXHIBIT.

The General Electric Co.'s display covers a large space in the main aisle of the large hall in the north of the building. The company exhibits many of its latest products in the railway field, and for the first time at a street railway convention shows a curtis steam turbine. The exhibit includes a specially mounted car equipment for use on either direct or alternating current, with air compressor, motors and control in operation. The air compressor is designed for operation on alternating current and supplies air for the braking system. GE-605 motors are supplied with this equipment. The necessary alternating current for the motors is furnished by a 200-kw. rotary converter running "inverted" from the 500-volt direct current circuit. On another frame is shown a two-motor Sprague-General Electric multiple unit control, similar to those in operation on the Boston Elevated Ry.

In addition to railway motor equipments, various General Electric railway single motors are shown, including the GE-80, GE-87, GE-66 and GE-69. A motor-driven air compressor of the General Electric direct-current type is also shown in operation. Railway supplies are also on exhibition. These include field and armature coils in various stages of construction, giving a good idea of the care used in their manufacture, as well as the general structure. The company's lines of catenary construction material may also be seen as well as the various types of rail bonds.

Aside from this car equipment material a 500-kw. Curtis steam turbine is shown, dismantled, so that it is possible to see its general construction. A 25-kw. turbo-exciter represents the company's development of this type of apparatus, and a voltage regulator, an advance along another line. Both the latter are still exhibits. Various types of circuit breakers complete this general class of apparatus. The entire exhibit is lighted by the new G. E. M. lamps and enclosed arcs. The mercury arc rectifiers operating in parallel supply current for the sign and general lighting effects.

A feature of this exhibit which particularly attracts the attention of practical electric railroad men is a pair of GE-69 (200 h. p.) railway motors, which are lent by the Interborough Rapid Transit Co., of New York. These motors have been in continuous service since their installation on Oct. 2, 1903, and Dec. 10, 1903, respectively. One motor has been operated 45,248 miles and the other one 53,005 miles. These motors were borrowed by the company for this exhibit in order to illustrate the satisfactory condition which is typical of all of the 418 motors of this type which are in regular operation on the Interborough lines.

RIDLON BABBITTING DEVICE.

One of the latest productions of the Frank Ridlon Co., 200 Summer St., Boston, Mass., is a device for babbitting solid bearings. It is provided with a collapsible arbor which is broken down by removing the center core, the operation being quick and simple. No machinery is necessary on the bearing when babbitted by this method, as the ends are squared and the oil holes and oil ways are finished by the same operation.

The Weld babbitting device manufactured by this company is for babbitting split bearings, the operation and design being similar to that of the Ridlon device, the machine being furnished with split arbors, one for the top and one for the bottom bearing. Both of these devices may be seen at the company's exhibit, space 11, section A.

DUPLICATE TRANSFER & REBATE CO.

The Duplicate Transfer & Rebate Co. is represented at the convention by H. M. Brown, general manager; T. C. Carey, traveling representative, and C. E. Horney. The company has a booth at space 4, section G, where it will be pleased to explain the line of work it is doing to those interested.

NEW MEMBERS OF THE MECHANICAL ASSOCIATION.

At the first meeting of the American Railway Mechanical and Electrical Association, Secretary Mower reported the following as new members since the St. Louis meeting:

ACTIVE MEMBERS.

J. M. Africa, chief engineer, Lewistown & Rudsville Railway Co., Lewistown, Pa.

J. R. C. Armstrong, New York Central & Hudson River Railway, New York City.

Norman Bury, superintendent car repairs, Sao Paolo, Brazil.

Edw. H. Berry, engineer roadways, Cincinnati Traction Co., Cincinnati, O.

Fred Bushnell, chief engineer, The Rhode Island Co., Providence, R. I.

M. H. Bronsdon, mechanical engineer, Old Colony Street Railway Co., Boston, Mass.

E. J. Bechtel, electrical engineer, Toledo Railway & Light Co., Toledo, O.

A. W. K. Billings, chief engineer, Havana Electric Co., Havana, Cuba.

H. H. Boyd, assistant electrical engineer, Canadian Pacific Railway, Winnipeg, Canada.

L. M. Clark, master mechanic, Indianapolis & Northwestern Traction Co., Lebanon, Ind.

H. W. Clapp, New York Central & Hudson River Railway Co., New York.

Frank B. Connelly, master mechanic, Conestoga Traction Co., Lancaster, Pa.

J. S. Doyle, master mechanic, Interborough Rapid Transit Co., New York.

Z. T. Daniels, chief engineer and superintendent of construction, Kansas Southern & Iowa Electric Railway, Iola, Kas.

T. M. DuBois, master mechanic, Syracuse Rapid Transit Co., Syracuse, N. Y.

D. W. Dozier, chief engineer, Twin City Rapid Transit Co., Minneapolis, Minn.

G. L. Enfers, chief engineer, Fitchburg & Leominster Street Railway Co., Fitchburg, Mass.

D. A. Faut, superintendent of shops, Chicago City Railway Co., Chicago, Ill.

A. O. Fletcher, chief engineer, Harvard power station, Boston Elevated Railway, Boston, Mass.

H. B. Fleming, superintendent of way and structures, Chicago City Railway Co.

Ernest Franklin, foreman car repair department, Portland Consolidated Railway Co., Portland, Ore.

W. M. Greenwood, Havana Electric Railway, New York.

N. H. Heft, general manager, Stamford, New York & Greenwich Tramway Co., Bridgeport, Conn.

Thomas Higgins, president, Manitowoc & Northern Traction Co., Manitowoc, Wis.

Hugh Hazleton, electrical engineer, Interborough Rapid Transit Co., New York.

Wm. H. Harton, engineer maintenance of way, South Covington & Cincinnati Street Railway, Newport, Ky.

J. A. Kreis, Jr., superintendent of power and master mechanic, St. Louis & Suburban Railway Co., St. Louis, Mo.

Geo. A. Kimball, chief engineer elevated construction, Boston Elevated Railway, Boston, Mass.

G. H. Kelsay, superintendent of power, Indiana Union Traction Co., Anderson, Ind.

J. M. King, chief engineer and electrician, Danville Railway & Electric Co.. Danville, Va.

G. C. Killeen, master mechanic, New Jersey & Pennsylvania Traction Co., Trenton, N. J.

F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Co., Philadelphia, Pa.

Norman Litchfield, assistant engineer car equipment, Interborough Rapid Transit Co., New York.

E. D. Latta, Jr., general superintendent, Charlotte Electric Railway, Light & Power Co., Charlotte, N. C.

F. Marchant, superintendent track and roadway, Chicago & Joliet Electric Railway, Joliet. Ill.

Lee Massengale, master mechanic, East St. Louis & Suburban Railway, East St. Louis, Ill.

A. B. Metcalf, assistant master mechanic, Brooklyn Heights Railway, Brooklyn, N. Y.

J. Z. Murphy, chief engineer, Union Traction Co., Chicago, Ill.

E. T. Monger, master mechanic, Metropolitan West Side Elevated Railway Co., Chicago, Ill.

H. B. Nichols, engineer of way, Philadelphia Rapid Transit Co., Philadelphia, Pa.

C. L. Peterson, chief engineer, Central Power Station, Boston Elevated Railway, Boston, Mass.

George E. Pellisser, civil engineer, Holyoke Street Railway, Holyoke, Mass.

Frank R. Phillips, master mechanic, Cincinnati, Newport & Covington Light & Traction Co., Newport, Ky.

Wm. E. Rolston, superintendent, Dayton & Troy Electric Railway, Tippecanoe City, O.

W. Boardman Reed, engineer maintenance way and buildings, New York City Railway, New York.

C. C. Smith, president, Oshkosk & Western Electric Railway, Milwaukee, Wis.

F. H. G. Small, chief engineer, Dorchester Power Station, Boston Elevated Railway, Boston, Mass.

A. W. Senter, division superintendent, Boston Elevated Railway, Boston, Mass.

F. P. Slater, principal assistant electrical engineer, interborough Rapid Transit Co., New York City.

H. V. Schreiber, chief engineer, Augusta Railway & Electric Co., Augusta, Ga.

H. N. Sporborg, electrical engineer, British Thompson-Houston Co., Ltd., Rugby, Eng.

L. M. Sheldon, inspector, National Electric Co., Milwaukee, Wis.

R. C. Taylor, mechanical engineer, Brooklyn Rapid Transit Co., Brooklyn, N. Y.

Wm. T. Taylor, assistant superintendent, Sacramento Electric, Gas & Railway Co., Sacramento, Cal.

F. I. Wilkins, division superintendent, Boston Elevated Co., Boston, Mass.

A. A. Warner, chief engineer, Lincoln power station, Boston Elevated Co., Boston, Mass.

H. Wallerstedt, engineer car equipment, Interborough Rapid Transit Co., New York City.

George L. Wilson, engineer and road master, Twin City Rapid Transit Co., Minneapolis, Minn.

H. P. Wellman, superintendent motive power, Camden Interstate Railway, Ashland, Ky.

ASSOCIATE MEMBERS.

New York City Railway Co., New York City.
Ottowa Railway Co.. Ottowa, Can.
Calumet Electric Street Railway Co., Chicago, Ill.
Interborough Rapid Transit Co., New York.
Toronto Railway Co., Toronto, Ontario.
Utah Light & Railway Co., Salt Lake City, Utah.
Broooklyn Rapid Transit Co., Brooklyn, N. Y.
Capital Traction Co., Washington, D. C.
Philadelphia Rapid Transit Co., Philadelphia, Pa.
Pittsburg, McKeesport & Connellsville Railway Co.

JUNIOR MEMBER.

John L. Sullivan, electrician, United Railway Co., St. Louis, Mo.

ADAM COOK'S SONS.

The exhibit of Adam Cook's Sons, 313 West St., New York, is made at space 28, section I, over which is placed the sign—"Albany Grease, 'Nuf Sed." The company is distributing samples of Albany and "Alpha" grease, the latter product having been used with satisfaction on car motors by some of the largest electric railway systems in the country, including the Philadelphia Rapid Transit Co., the Connecticut Railway & Lighting Co. and the Wheeling Traction Co. A recent report received by the company from Zanesville, O., stated that the company using Albany grease for the past two years had not had a hot box on any of the cars on which it was used. In addition to the sample packages being distributed the company is also presenting its callers with calendars. The company is represented at the convention by Adam Cook and C. E. Tanberg.

WARREN-JAMESTOWN CAR.

The car shown in the accompanying illustration was built by the St. Louis Car Co. for high speed interurban service, using alternating current, on the lines of the Warren & Jamestown Street Railway Co., Jamestown, N .Y. The general dimensions of the car are: Length of car body, 40 ft.; length over all, 51 ft.; total width, 9 ft.; height from rail to top of roof, 12 ft. 10 in.

The framing of the car body is the St. Louis Car Co.'s standard for interurban cars of this type, the side sills being of 5 x 8-in. yellow pine, re-enforced by steel channels. The center sills consist of I beams filled with yellow pine full length, while the intermediate sills are of yellow pine 4½ x 6 in. The platforms are made of oak and are re-enforced by heavy steel plates. The car is framed for seven double-windows, arranged in sets of two, with gothic sash extending over each set of two windows. The sash are arranged

ST. LOUIS CAR FOR WARREN & JAMESTOWN STREET RY.

to raise. There is a smoking compartment in one side of the end, seating six persons. A hot-water heater is located in one end of the smoking compartment.

The seats are of the St. Louis Car Co.'s high-back, roll-top type, covered with plush. Opalescent art glass is used in the ventilators and decorated and embossed glass in the side gothics. The cars are mounted on the builder's No. 23-B trucks, with steel tired wheels. Locomotive pilots are placed under each end, the steps are made of steel sides, and the wood treads are covered with safety treads. The entire interior finish of the car is in mahogany, with marquetry inlay, while the ceilings are painted a light green and decorated.

OHMER FARE REGISTER CO.

The exhibit of the Ohmer Fare Register Co., of Dayton, O., consists of ten different types of fare registers, including the Ohmergraph and four new types of two-fare machines especially built for use in city railway cars. The company is represented at the convention by John F. Ohmer, vice-president and general manager; J. H. Stedman, secretary; E. B. Grimes, assistant general manager, and the following representatives from the company's sales department: C. W. Ketteman, W. E. Hinmon, C. V. Funk and H. A. Eckert.

LORD ELECTRIC CO.

The Lord Electric Co., whose exhibit of rail bonds, lightning arresters and other railway material is made at space 20, section J, is represented at the convention by Ed. W. Hamlin, general manager; H. M. Shaw, manager New York office; George W. Smith, Baltimore; W. R. Garton, Chicago; E. J. Hudders, New York City.

THE GLOBE TICKET CO.

The Globe Ticket Co., 112-114 North 12th St., Philadelphia, is manufacturing a great variety of tickets for use by street railways, summer parks, expositions and all places of amusement, as well as transfers, cash fare receipts, passes, calendar pads, ticket punches, ticket reels, rubber stamps and ticket destroyers. In addition to the many styles of tickets which are standard in their respective uses, the company makes special designs and autographs when requested, which materially enhance the appearance of the work and make counterfeiting more difficult, and, in case of an autograph signature —a forgery.

Having made a specialty of ticket printing for over 25 years, the company has attained such knowledge of the requirements of street railways that it is enabled to supply the most approved tickets for every class for this service. The printing is from plain, bold type or especially engraved designs, with autograph signatures on one or both sides and with geometrical lathe-work tints when desired, as a further safeguard against counterfeiting.

Among the standard fare tickets manufactured by the company are the "L" strip, which derives its name from the style used by the largest consumers in the world, the Manhattan "L" road, New York; the "Trolley", 1x2 in. in size, which differs from the "L" in that it is attached on the broad side; the commutation or pass book for interurban, reduced fare, complimentary, employes' or workmen's passes; excursion and round trip tickets and many types of annual and trip passes, cash fare receipts and transfers, including the Ham patent "A. M. and P. M. Time-Limit" transfer.

J. G. WHITE & CO.

J. G. White & Co., 43-49 Exchange Place, New York City, are represented at the convention by W. E. Harrington, operating manager of the operating department; W. E. Goldsborough, business manager engineering department, and William Pestell, assistant mechanical engineer, in charge of matters relating to rolling stock and equipment of the street railway and engineering department of the company.

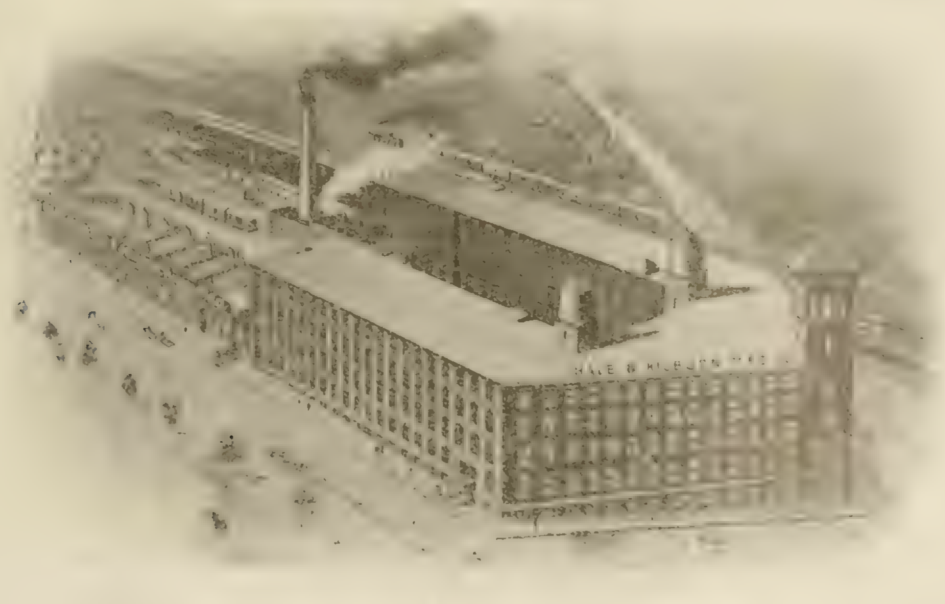
The H. W. Johns-Manville Co., 100 William St., New York City, has published the second of its series of three catalogs, mention of which was made in the "Review" for September. This catalog is of the same size and general appearance as the first and the arrangement of the charts, price lists, descriptive matter, codes, indexes, etc. is the same. In this book the well-known "Noark" enclosed fuse devices for 1500-10,000 volts are fully illustrated and described. One book on 250-volt devices remains to be published, and the three books, when combined, will comprise a complete line of fuse devices suitable for all voltages.

HALE & KILBURN MANUFACTURING CO.

The new plant of the Hale & Kilburn Manufacturing Co., which is located in that section of the city known as North Philadelphia, was erected on a site comprising 3¼ acres, and having a frontage on the Pennsylvania R. R. tracks of 750 ft. The plant, which is a four story and basement structure, is of slow burning mill construction and brick, with blue stone trimming. It is served by [illegible] tracks from the Pennsylvania R. R.; electricity for the arc and incandescent lights is furnished by the company's own plant, and an automatic sprinkler system has been installed for fire protection. The one-story building

HENRY S. HALE,
President Hale & Kilburn Mfg. Co.

shown in the accompanying illustration contains the machine shops and mechanical drafting rooms and engineering department. The first three floors of the railway-track wing are devoted to woodworking shops and the fourth floor is the finishing shop. In the opposite wing the first floor is utilized for packing and shipping, the second for rattan upholstery, the third for fabric upholstery and the



NEW PLANT OF HALE & KILBURN MANUFACTURING CO.

fourth for fitting and storage. The private and general offices of the company are located on the first floor of the building fronting on 18th St., where there is also a spacious sample room. Entrance to the part of the building [illegible]. The second floor of the building is devoted to [illegible] frames, and experimental and testing rooms. [illegible] superintendent's office and the [illegible]. The [illegible] of this building is devoted to a dining room for the workmen.

The concern is the [illegible] improvements, and [illegible] for electric surface lines, interurban lines, and steam railroads. Henry S. Hale is the inventive genius of the concern.

The concern was organized in 1857, under the firm name of Hale, Kilburn & Co., by Cheney Kilburn and Warren Hale. To perpetuate the business of Hale, Kilburn & Co., it was incorporated in 1876 as the Hale & Kilburn Manufacturing Co. Cheney Kilburn was its first president, and Warren Hale, vice-president. Mr. Kilburn died in 1894, and his partner a short time previous. The present officers of the corporation are, Henry S. Hale, president; J. Warren Hale, vice-president; H. Warren K. Hale, second vice-president; H. G. Barnes, treasurer, and John B. Kilburn, secretary.

This company was the pioneer in the introduction of new and improved methods of construction, and new principles in the operation of car seats, having produced from time to time, a series of valuable improvements and inventions, which have resulted in the many modern appliances for increasing the comfort of railway travel. Among the car seat improvements originated by this concern are the following:

Rattan spring car seats, canvas-lined rattan seat covering, downwardly-curved spring slats, broad steel top spring bands, elongated oval base for seats, single swinging automatic footrest, detachable back for a car seat, high backs with corrugated shape for headroll and shoulder-rest, angle or T-iron connecting rails, bronze grab handles on corner of seat backs, automatic reversing mechanism to reduce the width of back without diminishing the leaning surface, all steel and absolutely fireproof seating for subway, underground and elevated railways.

Among the recent installations in the electrical railway field, this concern has secured most of the large and important contracts. These include the entire equipment of fire-proof seating for the 300 all-steel cars used in the New York subway as well as new steel frame cushions and backs; the entire seating for the lot of 500 cars for the Interborough Rapid Transit Co., a special building having been erected which was devoted to the manufacture of this order. All cars on the Manhattan Elevated Ry. in New York City are equipped with Hale & Kilburn standard spring seating upholstery in rattan, as are also the majority of cars operating on the various elevated and interurban lines in and about Chicago, including the seat equipment of the 200 cars recently purchased by the Chicago City Railway Co. Another recent important order comprises all steel rattan spring seating for the 150 cars recently built for the Long Island R. R., for use in the East River Tunnel. A duplicate of this order for the Chicago City Railway Co. cars has recently

been placed by the United Railways & Electric Co., of Baltimore. The entire seating equipment for the initial order of 455 cars, for the London Underground Rys, was awarded to the Hale & Kilburn Manufacturing Co. All the various up-to-date features and advantages brought out by this concern, for elevated and underground railway seating, are embodied in this large order for London, which has only recently been completed. Every particle of wood and upholstery material, as well as the outside rattan covering, was thoroughly fireproof by the best known methods. A further order, covering the entire seat equipment for 180 additional cars, of this same fireproof seat construction, has just been placed with this company, and record time will doubtless be made in the execution of the order.

THE WHARTON EXHIBIT.

The exhibit of Wm. Wharton, Jr., & Co., Incorporated, consists of various samples of their well-known manganese steel special track work, showing, however, quite a number of important recent improvements in the constructions of the different parts, and several novelties. The main part of the exhibit consists of two tracks, in one of which is shown the various styles of switches and frogs, of girder rail and T-rail construction for street railways. One of the special features shown is their new heel-less tongue switch for girder rail work, in which the pivotal part of the tongue is entirely covered and protected by an overhanging part of the bed of the switch, notwithstanding which the tongue can easily be removed from the switch without lifting any cap or destroying the integrity of the switch itself. The pivot part is of very large size and is held by bearing boxes, similar to the crank shaft bearing of an engine, readily adjustable to take up wear. The tongue, as well as the bed of the switch, is made of manganese steel, the bed being ground true to give a perfect bearing for the tongue.

A pair of tongue switches designed for steam railroad tracks laid with heavy girder rail, in paved city streets, made to sustain the heaviest locomotives and cars, forms quite a prominent feature of this portion of the exhibit. Solid manganese steel tongue switches and also solid manganese steel frogs, for T-rail work of electric railways, attract considerable attention. There is further shown the style of fastening of manganese steel centers in girder rail special work which this company brought out some one and a half years ago and by which the centers can be renewed easily, without disturbing the pavement. So satisfactory has this method proved that, notwithstanding the easy renewability, not a single one of some thousands such centers put into use has shown any signs of coming loose. It might be said, however, that the Wharton company claims that the necessity of renewing its centers is confined to only exceptional cases of hidden defects developing, as the manganese steel centers as a rule outlast the adjoining rail.

Th second track in the exhibit shows a number of devices, embodying unbroken main line track through switches. The Wharton unbroken main line switch for girder rail track, which has come into such extensive use, has been shown a number of times before, but the new through line tongue switch and mate, in which the projection above the general street level has been reduced to the minimum of the depth of the wheel flanges, as well as a switch working like a split switch, but giving an entirely unbroken main track, designed for narrow tread wheels such as ordinarily used on street railways, are quite novel and of much interest. There is also shown in this track the original Wharton unbroken main line switch for steam railroads, which, however, within the last few years, has been greatly improved by Mr. Wharton, and in its present shape has found introduction on many of the important railroads. This switch should also be of particular interest to interurban electric lines, whose cars are equipped with the regulation M. C. B. standard wheels. In connection with this steam railroad switch is also shown the company's manganese steel steam railroad frog, of which many thousands have been put into use in recent years by the standard railroads of the country. The results obtained from this frog and other special track parts equipped with manganese steel, are illustrated by a number of photographs, one of which shows the original test frog put into the Pennsylvania railroad tracks and which was taken out after having outlasted 17 ordinary frogs, and which afterwards was restored by a patented process of the company to a condition practically as good as new, and was again put into service for a second lease of life. Another picture shows the manganese steel T-rails in a curve on the Boston Elevated, which has so far outlasted over 30 ordinary Bessemer steel T-rails, with only about one-third of the wear. Actual samples of these manganese steel T-rails which are used by the Boston Elevated Railway Co., and by the Pennsylvania Railroad Co., are also shown.

Further features of the exhibit are a manganese steel faced guard rail, with the Wharton guard rail clamps, various springs, spring throw and locking devices for tongue switches, several crossings of street over street railways, as well as street railways over steam railroads, in which latter the steam railroad rails were entirely of manganese steel, also parts of special track work for electric railways with underground conduit, in which the protection of the crossing of the track rail over the slot by manganese steel was illustrated.

The entire exhibit is got up in an elaborate manner and is tastefully arranged, being in keeping with the progressive management of this company.

Simultaneously with the convention, the company issued a handsome supplement to its Catalog No. 10.

The representatives of the company in attendance are Wm. Wharton, jr., president; Victor Angerer, vice-president; J. C. Robinson, of Boston; Arthur S. Partridge, of St. Louis; W. McLain, of Pittsburg; J. W. Stringfellow, of Richmond; T. K. Bell, chief engineer; R. C. McCloy, sales agent; L. R. Ashhurst, jr., manager street railway works, and other members of the Philadelphia staff.

MACON-EVANS VARNISH CO.

The announcement is made that the Macon-Evans Varnish Co., Pittsburg, Pa., has recently completed arrangements for the opening of an office in Chicago. Mr. Arthur B. Weeks will have charge of this office and will represent the company in the states of Indiana, Illinos, Wisconsin and Michigan. Mr. Weeks' previous experience with the Sherman-Williams Co., of Cleveland, O., and the Dielectric Co., of St. Louis, Mo., especially fit him for this work. The Macon-Evans Varnish Co. manufactures a full line of insulating compounds and varnishes. It also handles a complete line of insulating cloths treated with "Macon" insulating varnish. The same care is exercised in selecting these cloths on which the varnish is applied as in the manufacture of the varnish itself. These cloths possess high insulating properties and retain their flexibility.

AMERICAN STEEL & WIRE CO.

The American Steel & Wire Co. has an attractive display of its products for electric railway work at spaces 5 and 6, section E. These include its terminal steel bonds, soldered rail bonds, a new twin terminal bond, hydraulic compressors, gasoline motors for operating drills and grinding machines for attaching soldered rail bonds.

The company is represented by F. A. Keys, New York; R. K. Shepard, Philadelphia; G. A. Greenburg, Buffalo, and C. R. Sturtevant, Worcester.

U. S. METAL & MANUFACTURING CO.

The U. S. Metal & Manufacturing Co., 25 Broad St., New York City, is displaying the various products of the manufacturing concerns for which it is representative, at space 1-b, section C. These include the Columbia lock nuts, the special advantages of which are well-known among railway men; the "Perfect" pressed steel car replacer, a light and handy replacer for yard use; the "Victor" cast steel replacer for standard steam railroads, electric street and interurban railways and elevated railroads. In addition to these the company has on exhibit a working model of a new trolley brake, known as the U. S. trolley brake, the important feature of which is the application of the brake shoe to the track as well as the wheel. The company is represented by B. A. Hegeman, Jr., F. C. Dunham and Fred Atwater.

CONSOLIDATED CAR-HEATING CO.

The exhibit of this company occupies spaces 2 and 3, section E, of the convention hall, and the company is represented by the following gentlemen: Francis C. Green, general manager; Cornell S. Hawley, general sales agent; W. S. Hammond, Jr., district manager Western territory; S. B. Keys, district manager Eastern territory; C. C. Nuckols, from the Chicago office, and J. Arch Mears, from the New York office.

TWENTY-FOURTH ANNUAL MEETING

AMERICAN STREET RAILWAY ASSOCIATION

Philadelphia, Pa.—Sept. 27-28, 1905.

WEDNESDAY, SEPTEMBER 27TH.

The first session of the Association was called to order at 11 [illegible] a. m. by the president, Hon. W. Caryl Ely, who delivered his annual address.

ADDRESS OF PRESIDENT ELY.

For the third time the selection of the place of annual meeting has been made by the executive committee solely with the desire to locate it at the place deemed by all to be the most desirable from the point of view of the association as a whole. The merits of Philadelphia as a place of meeting were so conspicuous as to force themselves unaided upon the attention of the executive committee. Yet notwithstanding the fact that pursuant to the new method of procedure the tent of the association has been pitched here purely of our own volition, the courtesies and attentions which have been and are being showered upon us by the president and other officers of the great company which has in its charge the street railway transportation interests of the city, and of the chairman and officers and members of the Manufacturers' and local committees which have assisted in making all the arrangements for the meeting, could not have been exceeded had they been solely responsible for our being here. The conditions presented here for the holding of such meetings as this are almost ideal. The fine hotel wherein our headquarters are located, together with the other hotel accommodations of the city, are ample and convenient in that regard. These buildings of the Philadelphia Commercial Museum and their accessories are splendidly adapted to the purposes of the exhibits. Philadelphia herself possesses attractions to every patriotic citizen scarcely equalled by any other city. Her early history as the first meeting place of the Continental Congress, the birthplace of the Declaration of Independence, the glorious part played by her and her sons in the War of the Revolution, and a meeting place of the Federal Congress are enforced upon our attention almost at every turn. She seems to have preserved more of the landmarks of the early days than any sister city. To us in our particular line she appeals not only by reason of her almost superlative position as a manufacturing city, but also as the place where the immortal Franklin conducted the experiments which perhaps may be characterized as the foundation of electrical science. Manufactures incidental to transportation are here conducted upon a large and interesting scale, and the electrical transportation interests of the city are large and intensely interesting, but to crown it all at this particular juncture in the affairs of this association, when we are about to take steps that will bind us all together in one harmonious set of organizations, working for the common good together along well defined and coherent lines, what place could be more fitting for our meeting that the City of Brotherly Love.

In the general field of electric railway work the events of the last year have been noteworthy. The work of electrification of certain portions of some of the great steam railroads is progressing, and although the projects under way have not yet been completed, nevertheless the continued investigation of the subject has served to make more clearly apparent the relations that ought to obtain between the steam and electric railways of the country, in order that the public, as well as the companies themselves, may realize the greatest benefits from their operation.

Many of the larger steam railroad systems are changing their policy regarding the construction of electric railways from one of active and in some cases bitter opposition to either passive acquiescence or quiet assistance. This is an approximation to the conditions that ought to and some day surely will prevail.

The ideal railroad situation both from the point of view of the companies and the public would comprise a heavy long distance railroad doing the freight and through passenger business, aided by a light interurban [illegible] urban and interurban passenger [illegible] in connection with these two factors the [illegible] adjunct to the intermediate and [illegible] functions of ordinary street railways, as well as those of bringing to and taking from the depots of the first mentioned systems travelers and their baggage. In this equation we have three factors, each of which supplements the others, and if such a system could be conceived as having been constructed [illegible] with reference to the relations existing between them we would there have exhibited the ideal transportation system, calculated to serve the convenience and economy of the railroad companies, and the public in the very highest degree. Possibly this ideal system may not be hoped for, but a modification of the attitude which has been heretofore exhibited by the managements of nearly all the great steam railroad corporations towards street and interurban railways may do a great deal to procure for all concerned the benefits outlined.

The consolidation of small properties into large and strong organizations continues, and may well be said to be the order of the day. We think it must be conceded that the public and the companies themselves have been benefited in every instance. These large organizations have the means with which to employ men of greater skill and experience in the mechanical and operating departments; to provide better tracks and equipment and give better service than would be possible upon small weak properties.

The standard of transportation employes is continually being raised, and all railway organizations are giving greater attention to the proper instruction of employes, thereby insuring better service and greater safety to the public. The instruction car and other educational apparatus are now becoming regular features of the equipment of many of the large companies wherein all motormen are required to demonstrate their proficiency in the operation of such equipments before they are given charge of cars. In many cases such instruction is supplemented by schools, where lectures are given on technical and popular subjects by men of prominence.

The conditions attending street and interurban railway employment are continually being improved. The business is becoming established and recognized as one offering solid and substantial rewards to the men who take it up as a profession and life work. Nevertheless it is a far cry to perfection. Much remains to be done, in the accomplishment of which it is difficult to conceive a more potent instrumentality than this association when reorganized and readjusted with reference to its affiliated organizations and all others interested in street and interurban railway work.

In the line of technical investigation the work of the Electric Railway Test Commission at the St. Louis Exposition is of great value. The testing began at St. Louis in the middle of June, 1904, and was continued there until the middle of November, when the corps was transferred to Anderson, Ind., where the tests continued until the latter part of March, 1905. Immediately upon the completion of the tests the Commission proceeded with the editing of the report. It was expected that the printed report would be ready for distribution before this meeting, but by reason of the large amount of work done and the care required in the preparation of the published volume, it will not yet appear for some little time. It will comprise a bound volume of about 500 pages octavo, and it is believed will be of great value as a contribution of fact concerning some of the things that have been long embraced within the realm of almost pure conjecture.

The importance of such investigations and indeed of all the measures now being taken toward securing the facts concerning everything involved in our business, and making them available for all, instead of locking them up in the breasts of a few, cannot be overestimated.

Notwithstanding the rapid advance in the state of the electric railway art, I think it will be conceded by all that the ratio of advance has not been what it should have been, nor indeed anything like what it would have been if those engaged in the business had been brought properly in touch with each other through the medium of some recognized authority which was at one and the same time the repository of the experience of all, a common investigator and classifier of facts and experiences; accessible to all for advice and assistance and always ready to furnish desired information. Causes must be revealed before defects can be finally remedied and the ascertainment of cause depends upon thorough, careful, long continued and scientific investigation.

With the growth of interurban roads the necessity is becoming more and more apparent of their owning, if not all, at least a greater portion of their own right of way. It is especially important where high speeds are desired, as it is practically impossible to make fast time within the limitations created by vehicular traffic and the location of the ordinary highway. All now agree that wherever practicable private rights of way should be acquired in the first instance of widths ample for the accommodation of double tracks, and in many cases it is considered desirable to grade the right of way and locate the first track and construct the bridges with reference to the future accommodation of a second track. The experience of the steam railroads with double and single track construction is being repeated by the electric interurban railroads. There is practically no difference between them, except that of motive power. In all other things it would seem that good common judgment would dictate that we avail ourselves of the long experience of the steam roads. Double tracks are much simpler, easier and safer of operation, and the increased fixed charge occasioned by the double track is in the judgment of experienced operators more than compensated by the saving in dispatchers, signal men and other like employes, and the injuries and damage accounts, to say nothing of the greatly increased carrying capacity.

In the consideration of this branch of the case are involved proper traffic agreements between interurban and city roads, and the laying of T-rails in cities where practicable to accommodate the deeper flange and broader tread of the wheels of the interurban cars. It is interesting to observe the growing tendency on the part of municipal authorities to recognize the good to be derived from the installation of T-rails in paved city construction. There is also a noticeable recognition of the value of adequate terminal facilities for interurban roads in cities. In some places union depots are being constructed for the handling of passengers, freight and express, and especially is this true in the middle West.

The convenience of passengers, especially commercial travelers, in the middle west has brought about the adoption by the interurban railway companies of central Ohio and Indiana of a coupon book, which is known as the Ohio Interurban Coupon Book, and is recognized upon a number of connecting lines. This is not only proving a convenience to the public, but is having a tendency to regulate fares upon a better basis, which in a number of places have been fixed too low in the beginning, due no doubt to the misconception of the cost of electric railway work which has so generally prevailed in the past. The element of mystery has been pretty well eliminated from the electric railway business, and it will be difficult for any one to successfully demonstrate the possibility of a lower rate of fare than five cents in cities, or from one and one-half cents to two cents a mile upon first class, well constructed and safely operated interurban railroads.

While speaking of the features of safe operation, it seems proper to mention as a subject worthy of careful consideration the standardization of wheels for interurban practice. In many places steel or steel tired wheels are being adopted. The best operators agree that they should be productive of good results.

It is pleasing to note that the adoption of safety devices is becoming more general. The first great burden upon the directors, as well as the operating officers of street and interurban railways is the safety of the passengers entrusted to their care. The elimination of grade crossings of steam railroads, the installation of block signals and other automatic signals, safety gates, etc., indicate that in electric railway practice, as in steam, the minds of all traffic managers are on the alert to conserve the safety of the traveling public.

Progress is being made in the problems involved in practical operation of single phase electric railways. While the manufacturers and engineers have been experimenting in these matters for several years, it is only within the present year that railroads have been equipped with this system. The motors and equipment are so designed that the cars may be operated on the standard 500-volt direct current system in cities, and on 2,200-volt single phase alternating current between cities. The principal advantage gained is that no rotary converters are necessary in sub-stations, stationary transformers being alone necessary, thus decreasing costs of plant and superintendence. The principal disadvantage which has developed has been the poor acceleration, but this defect is now being remedied. The further progress along this line of development will be watched with great interest, especially when considered in connection with the problems which are attendant upon the electrification of the steam railroads.

It will be remembered that at Detroit three years ago much time was consumed in the consideration of the question of steam turbines, and much doubt was expressed concerning them. The progress in the installation of the steam turbine in railway generating stations affords another notable illustration of the rapid progress in the electric art. The Philadelphia Rapid Transit Co. has recently installed turbine units of 6,000 kw. capacity each, and the Pennsylvania R. R. electric lines on Long Island are operated by steam turbine units of 5,500 kw., while the plans of the New York Central in the neighborhood of New York include 60,000 kw. of steam turbines in units of the same size as that of the Philadelphia Rapid Transit Co. The devotion of so much of the time of the St. Louis and of this convention to the subject of power is not to be taken as an infringement of the prerogative of the Mechanical and Electrical association, but is to be attributed to a desire manifested by the managers to follow up the subject continuously to some definite conclusion.

The matter of fire protection in car houses has received a great deal of attention from street railway companies and insurance companies during the past year. Tests of sprinklers have been conducted at Cleveland, Ohio, and Newark, New Jersey. The Newark test was attended by Mr. W. Boardman Reed, engineer of maintenance of way and buildings, New York City Railway Co.; Mr. Albert H. Stanley, general superintendent, Public Service Corporation of New Jersey, and Mr. H. S. Wilgus, engineer of way and structures, Brooklyn Heights Railroad Co., representing this association. The question of insurance of street railway properties is closely linked with the important question of fire protection. For several years attempts have been made to establish a system of insurance that would comprise exclusively street and electric railway risks. It is a subject of the greatest importance, and the belief is becoming general that a great saving can be effected in this item of general expense. On th reorganization of this association there will undoubtedly be established an insurance committee, which in connection with the Accountants' Association, will thoroughly investigate this matter, and undoubtedly make a report that will be of great value to all concerned.

With this brief general resume of the progress of electric railway work during the past year I will leave the subject and come to those that in their nature are fundamental; those that affect the every day life of the corporations, and in their last analysis practically determine their rights to exist and to hold and manage their property and enjoy the legitimate profits thereof. At this juncture it may be interesting to note the magnitude of the interests involved in street, interurban and elevated roads at present included in the electric railway industry. In the United States in the year 1904 there were operated 993 roads, having a total of 30,187 miles of track, operating 75,904 cars and representing a total capitalization of about three and one-quarter billions of dollars, while in Canada there were 42 roads with a total of 900 miles of track, 2,639 cars and a total capitalization of sixty-nine and one-half millions of dollars. In addition to these figures there are to be considered the roads in Mexico and certain of the colonies of the United States. When considered in connection with billions of invested capital the questions alluded to above become of all absorbing interest and importance to this association. For many years past there has been evidenced in this and similar organizations a disinclination to discuss such questions, or even investigate them to any great extent. Within the past two years, however, there has appeared a growing desire in this association for the investigation of such questions, and the collection of accurate data and information concerning them. With a view of ascertaining the subjects uppermost in the minds

of the men engaged in the practical consideration of the problem today surrounding electric railways, I have within the past few months addressed inquiries, both oral and written, to many thoughtful and able men, and am now able to state that from nearly every one there has come a response pointing out the necessity for information and the facts. It may be of interest to you if I quote from one of the letters written by an officer of this association, one who is the active manager of an important property, and by reason of business association intimately acquainted with the operation of a number of other railway properties. My correspondent writes as follows:

"I hope and believe that the association will be reorganized at the coming meeting along the lines which have been suggested and which have recommended themselves to the executive committee, and the Bureau or Department of Statistics and Information, which I have considered would be of the greatest benefit to member companies, will be promptly organized and work begun, so that the information obtained by it would be soon available for use.

"In the middle west and on the Pacific Coast, public opinion is being very rapidly crystalized by individuals, presuming to represent public interest, to the end that municipal control and ownership of public utilities may soon become an issue in municipal and state politics.

"A great mass of erroneous information is being recorded and published, which is tending to influence the public mind and which, if not refuted in some manner by a recognized association or authority by the publication of correct and verified information, will tend to seriously affect invested interests in these utilities. It seems to me that it is within the reasonable scope of our association to cause to be circulated and widely published statements of facts that will controvert statements made by these self constituted censors of the public good."

Others of wide experience, several of whom are perhaps in closer touch with public sentiment and what is going on in the world along these lines than any other individual members of this association, have said to me in substance: "The question is up; it will not down at our bidding; one side of the case only is being presented and argued and the arguments in favor of the proposition are largely based upon alleged propositions of fact that are either erroneous, or concerning which a gross misconception prevails." Our side of the case has never been presented, nor indeed has any publication of the facts as we know them ever been made to the public. The forum resounds with the cries of agitators and demagogues aided by many honest but misguided or misinformed men, while among the representatives of the vast interests which are thus injuriously threatened silence prevails. Some have indeed taken the position that a wave of sentiment is sweeping over the land that is founded upon error and will dissipate itself. That it is founded upon error we all believe, but at present the indications are that there is pretty nearly an unanimous sentiment in favor of taking means to assist in correcting the misunderstanding which seems to prevail.

At the meeting of the New York State Street Railway Association held at Lake George last June the feeling was pretty nearly unanimous that the subject should be taken up and thoroughly investigated, and that Association determined to actively assist this Association in its investigation in any way in which it might be called upon. In the most interesting paper then presented by Mr. Henry W. Blake, editor of the Street Railway Journal, the author said:

"It is now apparent that a serious wave of agitation in favor of municipal ownership, so-called, is sweeping over the country; that the principle is un-American and contrary to our theories of governwent which have so far proved so successful." * * * "What has been or can be accomplished in this direction under autocratic, bureaucratic or socialistic governments, is not the question in America unless we adopt one or the other of these forms of government. The question is, can or cannot municipal ownership and management be more successful under our present forms of state and municipal government, than the system which has operated so successfully in this country? So far, the education of the American peeople upon the subject of municipal ownership has principally been academic, theoretical, haphazard and unbusinesslike, generally conducted by those who have no practical familiarity with the subject."

I must content myself with this brief quotation from Mr. Blake's admirable and very exhaustive paper, and commend the same to each and every one of you.

At the 28th convention of the [illegible] Association at Denver and Colorado Springs, [illegible] upon the subject of municipal ownership [illegible] Williams, of the New York Edison Co. [illegible] the question as affecting electric lighting properties [illegible] upon railway interests is clearly evident, and the pamphlet of nearly 200 pages abounds in statements of fact [illegible] wide publicity would undoubtedly do much to change the feeling in in the minds of the ordinary property owning citizen and voter in our great municipalities. Mr. Williams among other things refers to the statement which has been given general circulation, that electric lighting in Chicago costs something less than $60 annually per arc lamp, and then shows from an exhaustive presentation of the figures and facts involved in that case that many important items of cost are deliberately omitted in the Chicago lighting accounts, notwithstanding that the omissions, as he states, have been frequently brought to the attention of the municipal authorities. Some of the items are the rental value of the offices occupied by the lighting department; services rendered by other departments of the city government, including the legal department, and that through which supplies are purchased; the paving of the streets for original subway work, as well as for repairs, which is done by and charged to the street department; water, taxes, insurance, interest and depreciation.

Mr. Williams further calls attention in his valuable report to the Consular Reports upon municipal ownership, issued by the Department of Commerce and Labor of the United States Government during the month of May. He says that they seem to have been referred to by the press of the country as favorable to municipal undertakings, but that he has been able to find little, if anything, in them which justifies this view. That making no allowance for the omissions usually found in municipal bookkeeping, with very few exceptions they appear rather to support the opponents of municipal ownership and operation.

Since reading Mr. Williams' report I have read the Consular Reports referred to, which comprise the reports of United States consular officers upon the subject of municipal ownership from 1897 to 1905. Even the brief examination, which in the time allotted to me I have been able to give these reports, convinces me of the correctness of Mr. Williams' conclusions, and I commend the pamphlet, No. 2256 of the Daily Consular Reports, to the careful attention of those present.

Within the last year the mayor of a great middle western city has called to his aid the manager of the street railways in the city of Glasgow, who has made an investigation and report. While the contents of the report have not been made public, it is my understanding and those of others who have conversed with the expert, that his opinion is not favorable to municipal ownership of street railways in the cities of this country under existing municipal conditions.

Let us pause for a moment and reflect upon the fact that in the neighboring city of New York, according to statements in the metropolitan press, one of the great political parties is contemplating prosecuting the coming municipal campaign upon the principle of municipal ownership of street railways and other so-called public utilities. From figures obtained from the presidents of the different railroads in the city of New York it appears that there are approximately 34,000 men employed in street railway work in that city. This number of men constitutes nearly six per cent of the total vote cast in the last mayoralty election in Greater New York, and more than 50 per cent of the plurality received by the successful candidate. If an average wage of $60 a month is assumed, thse men are paid and receive more than $24,000,000 per annum. These figures are the more remarkable when it is considered that all or nearly all of these 34,000 men have fathers, brothers and others eligible to vote who are more or less dependent upon them.

I think there could be little doubt concerning the probable tenor of a report from Mr. Dalrymple upon the desirability or non-desirability of this proposition in Greater New York.

However, it is not my purpose to now enter upon a discussion of the doctrines involved in the question of municipal socialism. The foregoing are intended as mere allusions made in order to attract your attention to the importance and desirability of investigation along certain lines intimately affecting the interests which you represent, and brings we to the question of the reorganization and re-

formation of this association and those associated with it. I take it that it will not be necessary for me to make any extended statement at this time concerning this matter. The proposed new Constitution and By-Laws have been sent, together with a letter from your president, carefully explaining their purpose and all that has been done in relation thereto, to all members of this association, and also, accompanied by a communication from the Membership Committee, to all non-member electric railway companies, throughout the countries which are within the jurisdiction of the association. This proposed form of Constitution and By-Laws will now be brought before you for final action. They embody the result of two years' careful and thoughtful work, and it is believed by your executive committee and a large number of others who are prominent in the association, that they are well adapted to bring about an organization which will be of great value. There are many questions of detail that will remain to be settled after their adoption, and I desire to say now, once and for all, that there is not in the mind of any of those who are responsible for the proposed changes a thought in derogation of the autonomy or dignity of any of the affiliated associations. It is intended that in a well defined and intelligent way the work of all the associations shall be carefully laid out in advance, so that by harmonious and correlative work the greatest advantage may be secured from the united efforts of all. In determining the work to be done the various committees will be consulted, so that the final programme will represent and constitute the common judgment of representatives duly accredited from each of the organizations. In behalf of the parent organization, any intention to weaken or unnecessarily interfere with any of the affiliated organizations is expressly disclaimed.

It seems proper to say that it is intended that there shall be a well equipped general secretary's office, where will be properly collected and cared for, information concerning electric railway properties and questions which may hereafter seem of such importance to the association as to require investigation. The accumulation of such data will be systematized, and the members of the association will from time to time by announcements and notices be made conversant with the resources of the secretary's office and in every way encouraged to call upon the secretary for information.

It is also intended that a great deal of work shall be done by small compact working committees, whose records shall be kept on file in the office of the general secretary, and that he shall be secretary ex officio of all of said committees. However, I find myself in danger of going too much into detail, and I will conclude my reference to this subject by saying to you that I heartily believe that the adoption of the new forms of organization and their careful working out will result in unqualified benefit to all.

The first product of the reorganization has been the manufacturers' association. It has succeeded almost beyond the most sanguine expectations of its promoters, and the exhibit which has been assembled here affords the very best justification of the change that has been made. Splendid as this exhibit is, it has been assembled here without any expenditure of time or money on the part of any of the officers of this association. The Manufacturers' association not only pays its way, but it has provided this hall, which is our meeting place, and in other ways is contributing to the comfort and convenience of the members of our different associations. I did not feel that I could close these remarks without referring specially to the gentlemen who by their unremitting efforts have assembled here this really beautiful and complete exposition of articles used in electric railway work, and provided so generously for our entertainment and pleasure. I feel, however, that I ought to warn you not to devote too much time to the examination of these exhibits lest you be caught in the predicament of the friend of Mr. Dooley's who to use that gentleman's language, "wint to th' Cintinyal in Philydelphy an' los' th' use iv his legs thravelin' fr'm th' display iv mohair shawls to th' mannyfacthry iv open-face watches."

In concluding I wish to return my sincere thanks to all the members of the executive committee, and many others, both in and outside of this organization, but interested in its work, for the invariable courtesy and patience with which they have met many trying situations that have arisen during the past year, and with which they have always met my requests for assistance.

I trust that when you leave this place it will be with a feeling that this, the 24th annual meeting of this association, has been its crowning achievement.

I thank you again for the invariable forbearance which has been shown to me as your presiding officer, and bespeaking a further continuation of it, I await the pleasure of the convention.

The next business was the approval of the minutes of the last meeting, and they were approved as printed.

The secretary then presented the report of the executive committee, which report consisted of the minutes of the various meetings of the committee held during the past year on February 3d and 4th, June 12th and 13th, and September 26th. The report was accepted and ordered to be filed.

REPORT OF SECRETARY AND TREASURER.

In substance the report of Mr. Penington is as follows:

New members since last meeting:

Chattanooga (Tenn.) Rapid Transit Co.
Cleveland & Southwestern Traction Co.
Columbus, O., Dayton, Springfield & Urbana Electric Ry.
Dubuque, Ia., Union Electric Co.
Fairmont (W. Va.) & Clarksburg Traction Co.
Fitchburg (Mass.) & Leominster Street Ry.
Hampton, Va., Newport News & Old Point Railway & Electric Co.
Lansing (Mich.) & Suburban Traction Co.
Macon (Ga.) Railway & Light Co.
Madison (Wis.) Traction Co.
Manila Electric Railroad & Light Co.
New Haven, Conn., Consolidated Railway Company of New Haven.
Philadelphia & West Chester Traction Co.
Richmond (Ind.) Street & Interurban Railway Co.
Sheboygan (Wis.) Light, Power & Railway Co.
Spokane (Wash.) Traction Co.
Wellston, Mo., St. Louis, St. Charles & Western Railroad Co.
Tacoma (Wash.) Railway & Power Co.

The number of members Sept. 20, 1904, was 196; 18 new members have joined, 6 have withdrawn and 2 have been suspended for the non-payment of dues, leaving 206 members at this date.

The financial statement showed cash on hand Sept. 20, 1904, \$7,646.56; receipts to Sept. 15, 1905, \$5,278.29; expenses to Sept. 15, 1905, \$6,192.65; cash on hand Sept. 15, 1905, \$6,732.20.

Mr. Penington concluded his report as follows:

"The executive committee of this association desiring a technical man to act in the capacity of secretary, also a man who can devote his entire time to the work of such office, this is, in all probability, the last year I shall serve the association as secretary.

"In looking back over the past ten years I can truthfully say that I have filled the office of secretary to the best of my ability. Of course, there have been errors made, but 'to err is human' as everyone knows.

"I wish to take this opportunity of thanking the many friends, old and new, whom I have made during the years of my work for their kindness and assistance; and, in case I have been unfortunate enough to have gained the ill will of any, I sincerely trust that it has not been lasting. I hope you will call upon me at any time in case I can render any assistance."

President Ely spoke of the fidelity with which Mr. Penington had performed his duties, and he was sure that no one who had ever come in contact with Mr. Penington during the 10 years of his work cherished any feeling toward him but that of respect and warm friendship. The President stated that suitable resolutions would be reported by a committee appointed for the purpose, expressing the feeling of the members with regard to the service of Mr. Penington, with the hope that when Mr. Penington looked upon these resolutions he would know that they emanated from the hearts of his friends.

On motion the report of the secretary and treasurer was received and filed.

The President stated that a number of letters had been received from different persons expressing their regret at being unable to attend the meeting. The President further said that he wished at this time to express the thanks which he owed to the members of the executive committee and many other gentlemen connected with the association for their very kind and valuable suggestions made to him, at his request, concerning the remarks in his address. He desired to express his grateful acknowledgments.

The President stated that the next business would be the report of the committee on the reorganization of the association. As this was a very important matter, it seemed proper that it should be presented in its entirety, so that all might understand thoroughly the great amount of work and thoughtful investigation that had been bestowed upon the question of reorganization.

The secretary then read the minutes of the various joint conferences between the representatives of the parent association and the allied organizations.

At one o'clock the association took a recess until [illegible] o'clock.

WEDNESDAY AFTERNOON SESSION.

The President called the meeting to order at 2 [illegible] o'clock.

The President stated that he had addressed a letter in his official capacity to the presidents of the different street railway associations and clubs, asking for suggestions in regard to the plan of reorganization of the association, and he was pleased to state that in every instance he had received replies many of which were very interesting, approving the idea, and suggesting that it might be possible to arrive at means whereby the work of the state associations might match in with the work of the American Street Railway Association and its affiliated organizations. Some of these associations had formally designated delegates to represent the associations at this meeting. Among them the New England Street Railway Club had designated Mr. E. E. Potter; the Ohio Interurban Railway Association had designated Mr. Fred W. Coen, Mr. Harry P. Clegg; the New York State Street Railway Association had delegated Mr. J. H. Pardee; the Massachusetts Street Railway Association had designated Messrs. E. P. Shaw, F. H. Dewey, R. S. Goff, E. E. Potter and H. C. Page.

The President stated that he had written letters of invitation to attend the present meeting to all the past presidents of the association and had received letters of regret from Mr. B. F. Longstreet, Mr. Robert McCulloch, Mr. J. M. Roach, Mr. C. B. Holmes, Mr. Thomas Lowry, Mr. Henry M. Watson and Mr. H. M. Littell. Some of these gentlemen had taken occasion to refer to the matter of the plan of reorganization in a very commendatory way.

Also that he had also sent an invitation to some of the members of the different state boards of railroad commissioners and had letters of regret from some of them; also from the president of the National Association of Railroad Commissioners. He was pleased to see a general manifestation in the interest of the work of the association on the part of the members of the different state boards of railroad commissioners.

Also that the executive committee decided it would be a good thing to secure the attendance at the meeting of Mr. Henry L. Doherty of the National Electric Light Association, who had been chiefly instrumental in bringing order out of chaos in the work of that association, and whose efforts had produced results which were very gratifying to the men in that branch of the business.

Mr. Doherty addressed the meeting and said that he had never realized so keenly the scope and perplexity of the street railway industry until faced with the responsibility of delivering an address upon the association work it demands; the wide scope of work not only dictated the necessity for wise planning of the individual company organization, but an equally wise and comprehensive organization of the association. The work in the street railway field required a knowledge of thermodynamics, mechanical engineering, electrical engineering, legal matters, materials, amusements, municipal engineering, and especially regarding paving, proper relations with state and municipal authorities, the newspapers and the general public. The association, to administer benefits to the fullest extent of its possibility, must be comprehensive and therefore probably complex and extensive.

Mr. Doherty referred to the fact that proposed changes in every organization are apt to meet with opposition from chronic objectors to progress These persons forgot that while all chang.es are not improvements, yet all improvements are the result of changes and for better results changes must be made. He would suggest that the association be known as "The American Traction Association," because such title seemed to be comprehensive. He urged the necessity of well located, well equipped permanent headquarters under direction of a permanent secretary. The entire organization of the association should be primarily intended to protect and develop the interests of existing properties and ample funds should be provided from these properties [illegible] in the organization.

He believed that it was recognized [illegible] ing his knowledge or acquaintanceship with other men in the same line of work the labor would be rendered more valuable to the company. He considered the following divisions of self-evident value: traction electrical engineering; accounting; park and amusement superintendence; transportation superintendence; traction lawyers. He considered that the adoption of a "Question Box" on a comprehensive scale was the most valuable adjunct in any association work. He referred to the great value of the question box in the National Electric Light Association and [illegible] Association. It had been arranged that all information collected by means of the question box shall be put in the hands of a competent revision committee and from it a very comprehensive hand book would be evolved. Information held by one man can in this way be made common to the entire fraternity and the field of research and experimental work can thus be reduced to that portion which is unknown to all.

Mr. Doherty further said in planning the reorganization of the association that it was well to keep in mind that a special wave of antagonism seems to be passing over the country against corporations and this wave of antagonism was particularly directed against quasi-public corporations. The corporation is held up as the tool of the rich for the oppression of the poor, while the reverse was really true. In the superficial treatment of the press and platform the theory which gave the corporation birth is lost sight of. Some enterprises by their very nature can only exist by the employment of immense amounts of capital. Ability to incorporate is simply a legal means of co-operation. If such co-operation is not provided for, the undertakings requiring considerable capital would be only open to the few men possessed of the required capital and these enterprises will exceed the capital available in large amounts and therefore the possessors of large amounts of capital could make these enterprises as productive as their greed might dictate. Legalized incorporation is simply a means for co-operation on the part of capital which enables the men of moderate means to join their interests and render their capital as productive as that of the man possessed of great wealth. Ability to incorporate is not essentially necessary to the rich but absolutely essential to others.

Mr. Doherty further said that sooner or later those who want to see the truth prevail rather than sensationalism must take steps to give the voter the reasons why the ability of incorporation should be increased rather than lessened. Industrial associations for this reason should arrange provision for communication and co-operation among themselves. A marked tendency toward more rigid control on the part of municipal and state authorities was evident. The state or city now presumes to prescribe the service rendered by quasi-public corporations, fix the rates and assess them for taxation. Owing to faulty tax laws, individuals and firms and corporations other than quasi-public corporations can escape their just burdens of taxation by securing through concealment or otherwise, low assessment values on their property, while the quasi-public corporation, if compelled to pay taxes and fix rates on the same valuation, is bound to secure either inadequate rates or unjust taxation burdens. For this reason the quasi-public corporations must explore the resources of political economy to provide and enforce honest taxation of all property. He mentioned this simply as an example why more intimate communication should exist between organizations such as the Ohio Gas Light Association, the American Street Railway Association and the National Electric Light Association

As a conclusion to his remarks, Mr. Doherty made the following recommendations based on many years of experience in association work:

First: Listen to the recommendations of your active workers with a receptive mind.

Second: Do not forget the fact that improvements cannot be secured except by changes.

Third: Do not criticise unless you can see positive harm, and then sparingly, unless you can offer some better suggestion.

Fourth: Do not oppose the man who is trying to do the work but support him. Put a premium on interest in association affairs and work in behalf of association advancement.

Fifth: Accept and act favorably upon the recommendtions of workers aiming to secure organization upon higher and broader lines. If the plan suggested by them cannot be executed, delegate authority to either your officers or a special committee chosen by your officers to reorganize under some comprehensive plan which they may adopt and for the success of which they are willing to accept the responsibility. Give them full power to take all necessary steps, fix initiation fees, dues, accept new members, etc., and thus save waste of the most valuable thing required to secure progress, that is time.

The President expressed the thanks of the association to Mr. Doherty, and stated that at a proper time a resolution expressive of such thanks would be adopted and spread on the minutes.

The secretary then read the proposed constitution and by-laws of the American Street and Interurban Railway Association.

Since the proposed constitution and by-laws had been printed, at the meeting of the executive committee held on Tuesday, the following changes had been embodied in the draft:

CONSTITUTION.

Art. 3, section b, make the first sentence read "Associate members consisting of individuals, co-partnerships, and corporations who are actively identified with street and interurban railway interests and other persons who in the opinion of the executive committee have had experience of such a nature as to render desirable their connection with the association."

Art. 4, amended to read that "Provided the proposed amendment shall have the approval of two-thirds of the executive committee," etc.

BY LAWS

Art. 2, section b, was amended to read as follows: "The President and Vice-Presidents of the Association shall be elected at the annual meeting of the association. All such elections shall be by ballot and a majority of the votes of all members present shall be necessary to an election. The Secretary and Treasurer shall be appointed by the executive committee and both offices may be held by the same person.

Art. 5. The last sentence of the article was stricken out, namely, "He may or may not be in the employ of an active member of the association."

Art. 6, section b, the last sentence of the first paragraph was changed to read: "A majority of the members of the executive committee shall constitute a quorum at all meetings."

In the second paragraph of section b a portion was changed to read "and all such notices shall as far as practicable specify the business to be brought to the attention of the committee at such meetings."

Art. 10 was changed to read as follows: "All votes except as herein otherwise provided shall be viva voce, and in case of a tie the presiding officer shall vote."

Art. 12, section a, was amended to read: "By authorizing the formation and approving the constitutions of such associations."

Section c, of the same article was made to read: "By granting financial assistance to such associations."

In Art. 14, the schedule of dues was made to read as follows:

FEES.

XIV. Active members shall pay an admission fee of $10 and annual dues payable in advance based on gross earnings from rail way operation during the preceding fiscal year (ending June 30th) as follows:

Gross Receipts.		Annual Fee.
0 to	$50,000	$15.00
$50,000	100,000	25.00
100,000	250,000	50.00
250,000	500,000	75.00
500,000	1,000,000	100.00
1,000,000	2,000,000	150.00
2,000,000	3,000,000	200.00
3,000,000	4,000,000	250.00
4,000,000	5,000,000	300.00
5,000,000	6,000,000	350.00
6,000,000	7,000,000	400.00
7,000,000	8,000,000	450.00
8,000,000	9,000,000	500.00
9,000,000	10,000,000	550.00

An animated discussion on several details of the committee's report then followed, after which the Constitution and By-Laws were adopted as amended by the committee as heretofore described.

The secretary announced that the Engineers' Club and the Manufacturers' Club of Philadelphia tendered to the officers and members of the association the privileges of the respective club houses for this week.

The Chair announced the appointment of the following committee on nominations: Messrs. Parsons, of Philadelphia; Vreeland, of New York; Sergeant, of Boston; Stebbins, of Columbus, O; Read, of Salt Lake City. Also the following committee on resolutions: Messrs. Allen, of Utica, N. Y.; Rigg, of Reading, Pa.; and Smith, of Omaha.

Mr. H. J. Davies, of Cleveland, stated that in line with the suggestion in the address of the president and the recommendation of the executive committee, he wished to move the appointment by the president of a standing committee of five upon insurance and fire protection; the duties of which committee shall be to gather statistical information and to study the subject of fire insurance and more particularly the protection of street railway property against loss by fire and the consequent loss to business. The more important part of the duties of the committee would be the consideration of the better construction of car houses and better protection against loss or damage by fire, for the loss to the business to the company consequent upon fire is much greater than the amount which is likely to be collected from any insurance company after a fire. Fire protection is more important than fire insurance. Properly protected car houses can be insured at a much lower rate than car houses as they now exist, as a rule. A reduction in rates would follow naturally the better protection of the houses. The rates on car houses at present are much too high. Reports from more than 400 street railway companies of the amounts paid by them for insurance in the past ten years, and the amount of losses sustained, indicate that the losses have been less than one-third of the amount paid for insurance, so that there has been great profit in the insurance of railway property to the insurance companies. This committee could verify the figures and gather information which will be of benefit to every member of the association and there would be presented to the committee plans for the insurance by street railway companies themselves of their own property at actual cost.

The motion was carried.

The meeting then adjourned.

WATER CIRCULATION.

It is a recognized fact that a water jacket insures the most rapid circulation known, because of the lack of resistance ordinarily found in a close wound coil. This has been proven by tests made during operation under serious conditions. On the Mississippi Valley Traction Co. lines, in a 38-ft. car, the Western water jacket car heater obtained a complete circulation in 18 minutes from the time the fire was lit. On the lines of the Rochester Railway Co., in a 36-ft. car, the same heater obtained a complete circulation with a fire started with wood and hard coal in 28 minutes. This road has 120 of these heaters in operation, 76 of which were in service last winter, and records of coal consumed were accurately kept, and showed that the cost per car day for coal was 16 1-3 cents, with coal at $6 per ton. This heater is manufactured by the Franklin Railway Supply Co., Franklin, Pa., and may be seen at the company's exhibit at space 18, section K.

Messrs. J. A. Hanna, of the J. A. Hanna Co., Cleveland, O., and Edwin Besuden are here in the interests of the Jewett Car Co., of which the J. A. Hanna Co. is Cleveland representative.

Mr. Albert H. Sisson, eastern sales agent St. Louis Car Co., 51 Broadway, New York, and Frank McCoy, Pittsburg representative, are taking care of the company's interests at the convention.

The lines of track and railway supplies sold by the Barbour-Stockwell Co., of Cambridgeport, Mass., are being boomed by Wm. W Field.

DEARBORN DRUG & CHEMICAL WORKS.

The Dearborn Drug & Chemical Works, Rialto Building, Chicago, makes a specialty of analyzing and correcting boiler feed waters and has for this purpose the most complete equipment and extensive commercial laboratories. The work accomplished by the company is as follows: In boilers badly coated with incrustation, it converts the scale formation into tannates, gallotannates and saccharates of lime, magnesia, etc., so that there is no danger of this newly-formed mud settling and burning the sheets by keeping the water from the iron. Dearborn boiler preparations are in the form of a heavy, solid, concentrated paste, most of the moisture having been driven off and excluded. The preparations are very soluble in water—more so in hot water—so that they can readily be reduced, making liquid compound as wanted.

The company has also been manufacturing for the past few years high class lubricating oils and greases for railway work. The company has some twenty branch offices throughout the country and it is its intention to open a general laboratory similar to those in Chicago in connection with its eastern office at 299 Broadway, New York City, Jan. 1, 1906. The company's exhibit is at space 13, section F, and it is represented by Robert F. Carr, vice-president and general manager; W. B. McVicker, second vice-president and general eastern manager, New York; George W. Speer, third vice-president; R. R. Browning, assistant secretary and treasurer, and Thomas Brannon, of the Philadelphia office.

NACHOD AUTOMATIC BLOCK SIGNAL.

The Nachod automatic block system for electric railways is designed for single-track roads having turnouts for the passage of cars; or for double-track roads where they converge into single-track on account of bridges, tunnels, viaducts, or narrow streets on which cars operate in both directions.

The system embodies a mode of operation greatly desired, but not hitherto realized. By its union of speed, flexibility and safety it will prove of the greatest value to high-speed interurban lines, especially where these are in competition with steam roads. Its object is to inform the motorman, when at a turnout, whether the succeeding block of single track is clear, or occupied by a car, the direction of that car being also indicated.

The equipment for one block comprises a signal box, to be mounted on a pole at each end of the block, containing a red and a green light, and magnetically operated switches for controlling the circuits. In each branch of the trolley wire there is required an overhead switch. This latter is extremely simple, has no moving parts, does not project below the trolley wire, nor does it require the wire to be cut. It is of sufficient length to operate the signals at any speed the car may safely take the track switches, and its location overhead precludes any tampering with the signals.

NATIONAL CARBON CO.

The exhibit of the National Carbon Co. is space 2, section C, where its products are attractively displayed. A new expansion connection carbon brush has recently been introduced by this company and is worthy of special attention.

It consists of a carbon brush, of any size, having a hole drilled into it, penetrating about one-half of the length of the brush. A piece of plaited flexible wire, terminating in a cable shoe, is unraveled at the end opposite to the cable shoe, and this miniature wire net is formed cylindrically around a little brass sleeve. This sleeve is of the same length as the hole in the carbon brush, and is slotted over two-thirds of its length. The slot is tapped so that the closing screw fitting into the slot is forced into a tapering hole. The resistance with which the screw meets on account of this tapering is overcome by the sleeve expanding so that the whole appliance acts as a wedge when the screw is inserted, making a very close and rigid contact between the flexible wire and the interior of the brush, which is even increased through expansion of the metalic parts should the brush become slightly heated while in use. This flexible connection is very easily detached and can be connected to a new brush simply by use of a screw driver, obviating the necessity of attaching by means of the soldering process. This connection is so arranged that the distance between the commutator surface and the terminal connection is reduced to a minimum, thereby reducing the carbon resistance between [illegible] higher efficiency and a [illegible] and the end of the connection.

OHIO BRASS CO'S. STEEL HOSE BRIDGE.

The Ohio Brass Co., Mansfield, O., is displaying at its exhibit in section D, a new steel hose bridge [illegible] cars to run over track [illegible] It consists of two parallel trusses, 10 ft. in length, provided with openings through which [illegible] arranged that the trusses are [illegible] The hose bridge can be [illegible] minute, and when "knocked down," it occupies a space only 10 ft long by 8 in. square, and several hose bridges can be readily carried on a repair, or tower wagon. It is constructed entirely of steel and malleable iron, and will carry the heaviest electric cars with perfect safety.

The side trusses are flat on the bottom, and set on the top of the rails. They are held in position by means of four lugs which project downward from the lower edge of the trusses, and rest against the side of the rail flange. The height of the trusses at the highest point is $6\frac{1}{4}$ in., and the slope toward either end is gradual. The hose bridge as regularly furnished will accommodate four lines of 3-in. hose, and weighs approximately 300 lb. This hose bridge can be furnished to order to accommodate six lines of hose.

EARLL TROLLEY RETRIEVERS.

The Earll trolley retriever is on exhibition in space 1, section M. It is connected to a regular 12-ft. pole mounted on a standard Nuttall trolley base which is adjusted to give a tension on the trolley rope of 32 to 35 lbs. The notable features of this exhibit are that notwithstanding the power of the retriever to pull the pole down about four feet it is easily reset with one hand, and although it weighs only 14 lbs. and is only $7\frac{1}{2}$ in. in diameter and 5 ft. deep it will actually take in 25 feet of No. 10 trolley rope. Mr. Earll has produced a number of good railroad devices. He was one of the engineers of the Broadway, N. Y., cable road and designed the grip curve mechanism and special track constructions for that road. The slot and track switches which he designed are still used by the New York City road for the conduit-electric system.

THE GENERAL RAILWAY SUPPLY CO.

The General Railway Supply Co., Pittsburg, Pa., is represented at the convention by George W. Provost, president; J. P. Provost, vice-president; T. M. Cluley, secretary; and R. M. Kercher. The company represents the following well-known manufacturers: R. D. Nuttall Co., gears, pinions, and trolleys; General Electric Co., overhead line material and rail bonds; International Register Co., complete line of registers; Heil Rail Joint Welding Co., cast welded joints; and sells a full line of material and supplies, including Westinghouse and General Electric repair parts for the equipment and maintenance of electric railway, mine and Industrial haulage plants.

The exhibit of the Pantosote Co., which is represented at the convention by D. E. Bonner and H. M. Greer, occupies space 5, section C. Here the company has display of its products, which are too well known to require further comment than that several new patterns have been designed recently, the quality of the curtains and seat covering remaining at the same high standard which has characterized these goods.

Merritt & Co., 1024 Ridge Ave., Philadelphia, have a complete line of the various types of expanded metal lockers manufactured by them open for inspection at space 29, section D. The officers of the company and its local repesentatives are active among the delegates in the interest of their products.

Mr. W. J. Cooke, vice-president of the McGuire-Cummings Manufacturing Co., Chicago, is attending the convention. The company has reserved space in the convention hall but the exhibit shipped from Chicago has gone astray and has not yet been received.

DAILY STREET RAILWAY REVIEW

PUBLISHED DAILY BY THE

KENFIELD PUBLISHING CO.,

1332-1338 Cherry Street, Philadelphia, Pa.

BRANCH OFFICES:

Chicago—45-47 Plymouth Court.

New York—39 Cortlandt Street. Cleveland—302 Electric Building.

London—82 Fleet Street.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.

France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.

Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.

New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.

Queensland (South), Brisbane—Gordon & Cotch.

Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

THE DAILY STREET RAILWAY REVIEW is published each year on the occasion of the meetings of the American Street Railway Association, the Street Railway Accountants' Association of America, and the American Railway Mechanical and Electrical Association, and contains the convention reports. This publication is separate from the *Street Railway Review*, published monthly at Chicago, Ill., but is in its nature supplementary thereto.

SUBSCRIPTION RATES:

In the United States, Canada or Mexico:

- DAILY STREET RAILWAY REVIEW, (four or more issues)..$ .40
- *Street Railway Review* (12 monthly issues) 1.75
- Combined Subscription (DAILY REVIEW and *Review*) 2.00

In All Other Countries :

- DAILY STREET RAILWAY REVIEW (four or more issues) .. .40
- *Street Railway Review* (12 monthly issues) 2.75
- Combined Subscription (DAILY REVIEW and *Review*) 3.00

Application made for entry as second class matter.

7TH YEAR No. 3 — **THURSDAY, SEPT. 28, 1905.** SERIAL NO. { VOL. XV. NO. 9C

THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.

The American Street Railway Association is now a thing of the past, after nearly a quarter of a century—a period within which have been effected a multitude of revolutions in urban transportation—the organization gives way to the American Street and Interurban Railway Association. This reorganization is now complete so far as a paper writing can make it, and the future will depend upon the extent to which the spirit of reform pervades the active men in the association.

At the meeting yesterday the proposed Constitution and By-Laws as printed in the "Street Railway Review" for Sept. 15, 1905, pages 576 and 577, were adopted after making a few minor changes.

The important changes were in regard to fees and the relations of the association to the various departmental associations. Article XII, section a, of the By-Laws was amended to read: "By authorizing the formation and approving the constitutions of such associations." Section c was amended by striking out the words "for specific purposes," so that it now reads: "By granting financial assistance to such associations."

Article XIV was amended by reducing the minimum fee to $15 instead of $25 per annum, and increasing the number of steps to reach the maximum which is $600 as in the original.

The "Form of Charter" to be granted to auxiliary associations is stricken out as being unnecessary in view of the changes noted.

The auxiliary associations have all welcomed the assurances of the reorganization committee, expressed through President Ely, that autonomy of the several affiliated bodies is considered essential, and all will work to make the whole plan effective.

The thanks of all interested are due to President Ely and his colleagues for the work they have done.

MANUFACTURERS' ASSOCIATION.

The annual meeting of the American Street Railway Manufacturers' Association was held at the Exposition Hall yesterday afternoon. Three of the five retiring members of the executive committee were re-elected for three years and the committee now comprises the following:

J. R. Ellicott, Westinghouse Traction Brake Co.
John A. Brill, J. G. Brill Co.
Charles Knickerbocker, Griffin Wheel Co.
Fred S. Kenfield, Kenfield Publishing Co.
Charles K. King, Ohio Brass Co.
George J. Kobusch, St. Louis Car Co.
Charles C. Peirce, General Electric Co.
Howard F. Martin, Pennsylvania Steel Co.
James H. McGraw, McGraw Publishing Co.
John W. Nute, St. Louis Car Wheel Co.
Frank C. Randall, National Electric Co.
Newcomb Carlton, Westinghouse Electric & Manufacturing Co.
William Wharton, Jr., Wm. Wharton, Jr., & Co.
W. H. Whiteside, Allis-Chalmers Co.
E. M. Williams, Sherwin-Williams Co.

Mr. George Keegan was re-elected secretary of the association and the chairman of the executive committee will be chosen at its meeting today.

The Manufacturers' Association is to be congratulated upon the success with which its first exhibit has been handled and thanks are especially due to the chairman, Mr. Daniel M. Brady, whose marvellous power for organization and untiring energy have been so largely responsible for the successful manner in which this organization has fulfilled its function. The membership now includes 254 manufacturers, of which 183 are exhibitors at this convention.

FIVE DOLLARS REWARD.

I will give Five Dollars ($5.00) and ask no questions, if the party who took the aluminum coupler models from my exhibit will return them. W. T. VAN DORN.

"BABES IN THE WOOD."

"Music hath charms." Not that the delegates to the various conventions and the supplymen are savage, but that the Manufacturers' Association is leaving nothing undone to make their idle hours pleasant, is the inference. A large majority of the delegates and their guests filled the new Lyric Theatre last evening to hear the magnificent musical spectacle, "Babes in the Wood." The performance was one of unusual merit and this diversity in the usual line of entertainments was indeed very acceptable and entertaining, and afforded excellent opportunity for the men who are this week solving the perplexing problems of city and interurban transportation, to throw off the cares and worries of the business of the day. This marks the second epoch in the week's entertainments, which is to be concluded Friday night by the vaudeville performance of the supply men.

NATIONAL ELECTRIC CO.

A most interesting exhibit of the products of the National Electric Co., Milwaukee, Wis., is to be found in spaces 11 to 18, section J. The well known Christensen air brake apparatus forms a prominent part of the display. This make of equipment is recorded as being used on 15,000 cars throughout the entire world. The National Electric Co. is also manufacturer of apparatus for generating and power transmitting use.

Mr. H. E. Troutman, of the Buckeye Engine Co., 1249 Marquette Building, Chicago, has been in constant attendance at the company's booth and it is doubtful if anyone has evaded the shower of bouquets that he has been pinning (not throwing) upon the coat lapels of delegates, supplymen and visitors. It is positive none of the fair sex have eluded him.

The John Simmons Co's. interests were looked after by the ubiquitous Captain Hurd, who represented the Crane Co., of Chicago, for so many years. The exhibit is a very novel one, showing pipe and fittings in position as seen in the engine room. Captain Hurd has a unique way of advertising. A button, with the following inscription, is very much in evidence: "Wear this button in plain sight so that the man can see it. He has something for you. Hunt him up." When the man was found he drew a superior quality of lemonade from the separator of his exhibit and by the way it was patronized it was evidently a winner.

Mr. Lewis E. Myers, president of the L. E. Meyers Co., is attending the convention of the American Street Railway Association as a delegate of the traction properties in which he is interested.

THE BRILL "GROOVELESS POST" SEMI-CONVERTIBLE CAR.

One of the most interesting exhibits at the convention is the new "grooveless post" semi-convertible system shown in the Brill section. The car in which it is to be seen is one of 200 being built at present at the Brill plant for the United Railways Co. of Baltimore. As the car exhibited is the first to be finished of this order and was not ready until just before the convention opened, we are illustrating this window system by the accompanying illustrations of one from a lot of 40 cars recently delivered to the Boston Elevated Railway Co for use on its South Boston surface lines.

BRILL SEMI-CONVERTIBLE CAR FOR BOSTON ELEVATED RY.

In general the car has the same appearance as the Brill semi-convertible type which has been widely used for a number of years in many parts of the country and is familiar to all street railway men. The term "grooveless post" is applied to the recent improvement of the method of sliding the sashes into the roof pockets. Formerly grooves or runways in the posts, and trunnions at the sash corners, were used for conducting the sashes into the pockets. A close scrutiny of the posts in the illustration of the interior of the car will show that the posts are without grooves and are only cut into for the window lock stops. A pair of bow-shaped steel guides in the pocket and a brass tongue-and-groove sliding connection between each pair of sashes now takes the place of grooves and trunnions, simplifying

INTERIOR BOSTON CAR.

the mechanism, making the operation of raising and lowering the sash easier, and reducing the width and depth of the pockets as well as securing to the posts the advantage of the strength of their full thickness.

The Boston cars measure 32 ft. over the end-panels and 43 ft. 3¼ in. over the vestibules. The platforms are 5 ft. 7⅝ in. long. The width over side sheathing is 8 ft. 4 in. The seats, which are of the builders' make, have step-over backs and are constructed with birch slats, both seats and backs. The seats are 35 in. long and so constructed that the bodies of seated passengers may extend over the ends without coming in contact with reversing levers and end plates. The aisle is 26 in. wide. Attention is directed to the fact that in this type of car maximum interior width is obtained by not having wall window pockets. It will be seen that with exterior width of 8 ft. 4 in., the seats and aisle are allowed 8 ft., as the side walls, or panels, are but 2 in. thick and each seat comes between a pair of posts, with the end against the side lining. Armrests are bracketed to the window sills as the sills are but 25 in. from the floor. Wire net window guards, in three sections to each side of car, prevent passengers' arms from projecting outside the window openings The bottom framing includes 4 x 7¾ in. side sills, with 12 x ⅜ in. plates on the inside, to which the bases of the posts are screwed. This plate takes the place of side trusses and is the standard construction of this type of car. The center sills are 3¾ x 4½ in., and the intermediate sills 2¼ x 4½ in. The platform knees are re-enforced with angle-irons, the center angles extending back to the body bolsters. The platform step is 17½ in from the railhead; from step to platform is 14½ in., and from platform to car floor 8⅛ in.

The operation of the vestibule doors is a novel and interesting feature of these cars. The vestibule ends are brought around to the sides sufficiently far to enclose the doors, which, instead of being hinged together in two leafs in the ordinary manner, slide one behind the other and are suspended upon a rail, or track, overhead, by grooved wheels. A gear wheel on one leaf is actuated by a bar with corresponding gears attached to the other leaf and doubles the speed of its movement, so that when the motorman pulls back the leaf nearest to him, the other leaf is entirely out of the door opening as quickly as the first. All the vestibule sashes are arranged to drop into pockets except the central sash which is double, in this window each sash is framed in brass and the upper sash slides down in front of the lower. The cars are mounted on Brill No. 27-E-1 trucks with wheel base of 6 ft. 2 in. and 33 in. wheels.

STERLING-MEAKER CO. EXHIBITS.

The Sterling-Meaker Co., manufacturer of electric railway supplies, 420-422 Ogden St., Newark, N. J., has two separate exhibits at the convention this year. In space 5, section G, the company has one large board showing the following registers: Nos. 1, 3, 5 (square), 5 (rod), 6, 10 and 11. A smaller board contains two No. 8 registers connected with a new center ringing device recently designed for the Public Service Corporation of New Jersey. This device affords a convenient method of operating two single registers side by side at one end of the car. It is almost a necessity for cars having cross seats, and it will be found much more convenient than the side operating devices in any car, as it avoids the necessity of conductors reaching over passengers to ring up fares. Another board contains register rod fittings and hand straps, and still another a large assortment of conductors' punches. Besides this samples of trolley wheels, trolley rope, register cord, cord couplers and pliers, door sheaves and glass cutters are attractively displayed. The register display also includes several varieties of printing registers manufactured by the Sterling-Meaker Co., which have demonstrated their utility.

In space 22, section L, are exhibited the "Sterling" safety brake and "Sterling" sand box mounted on a stand; a new power brake similarly mounted; a "Sterling" trolley base and pole; a "Sterling" fender, mounted, and also a new wheel-guard likewise attached. The Watson fender is also shown in connection with a structure exactly like a car platform.

The company is represented at the convention by R. T. Stowe. assistant manager; C. E. Gierding, superintendent; and George E. Willis and J. M. Yount, salesmen.

AN INVITATION.

The Egry Autographic Register Co., of Dayton, O., extends an invitation to all delegates to visit its exhibit at space 25, section D. to inspect the Egry train dispatching and Egry way-billing systems

Messrs. Bowers and Wampler, of the Peckham Manufacturing Co., as usual are "making good" with the ladies, this time by furnishing several automobiles to assist the fair guests in sightseeing and shopping tours.

Mr. Bell as director of exhibits is busy about all parts of the building completing the details of the booth ararngements.

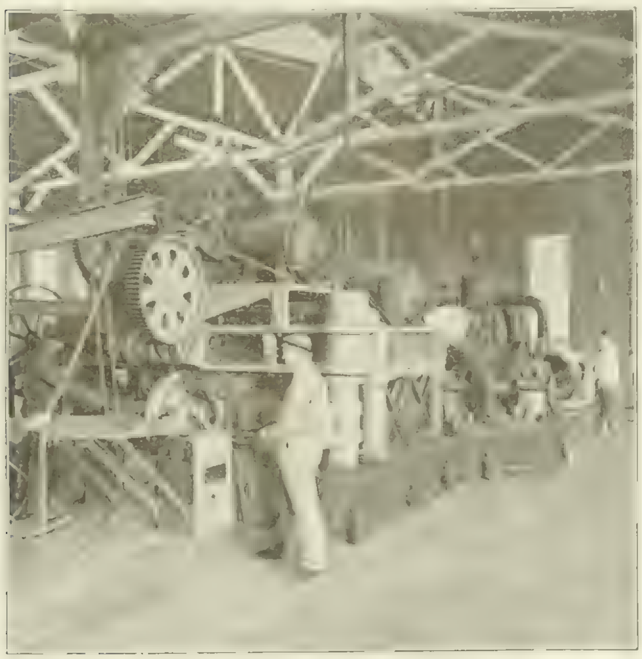
THE SCHOEN SOLID PRESSED AND ROLLED STEEL WHEEL.

A subject which is confronting the railroads at the present time and calling for the most serious consideration by managers and motive power men in all quarters, is how to obtain a perfect car wheel. Involving as it does the safety of passengers, not to mention the damages and delays which occur through the use of wheels inadequate for the service they are called upon now-a-days to perform,

PRESSING THE BLANK

the problem becomes more exacting daily as the capacities of cars, weights and speeds increase.

For a time there was little effort to strengthen the wheel proportionate with the increasing weight of car, axle, rail, etc., on account of the track standards established, and the special work specified in the cities. These conditions render it impossible on the majority of



ROLLING THE WHEEL

interurban roads to add more metal in the wheel at the point of greatest weakness, viz., the flange, and the only alternative must be the use of a metal having higher tensile strength than cast iron.

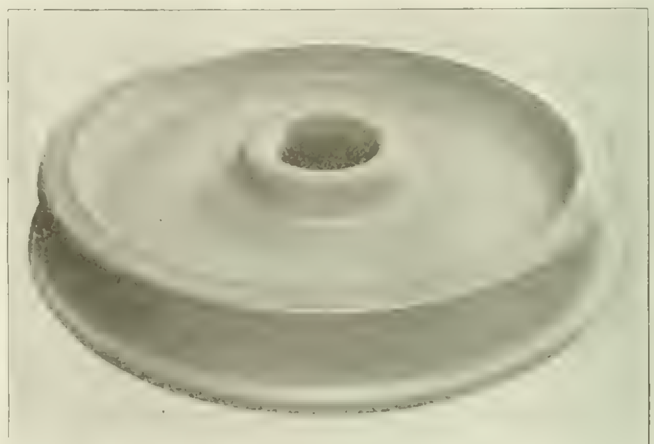
It is admitted that cast iron wheels are unsatisfactory in the heaviest modern service, but the use of steel tired wheels has been limited by reason of their cost and weight. To meet this condition the Schoen Steel Wheel Co. submits that the ideal wheel must then be of one integral piece of steel, homogeneous throughout, and possessing high tensile strength and great density; hard and durable, and yet no heavier than the chilled iron wheel.

Mr. Chas. T. Schoen, the inventor and manufacturer of the pressed steel car, became convinced shortly after the adoption of large capacity freight cars by the steam roads, that the necessity existed for such a wheel, and with the same energy and resourcefulness which characterized his efforts in developing that great industry, grappled with the proposition of making a solid steel wheel. After four years of labor, with a large expenditure of capital, the results are apparent in the plant now being operated by the Schoen Steel Wheel Co. at McKees Rocks, Pittsburg, Pa.

The hydraulic forging presses, of special patented design, have a capacity of 1,000 tons, 5,000 tons, and 7,000 tons pressure each, insuring, by such forging, solidity in every part of the wheel blank.

The patented rolling mill, in which the wheels are finished, is a massive structure, and a splendid accomplishment both in design and construction. This machine occupies a floor space of 22 by 40 ft. Some idea of the amount of the final working the metal receives in this mill may be conveyed by the statement that a pair of reversible engines of 1,000 h.p. are required to drive the machine, while three powerful electric motors feed the six rolls.

The first cost of Schoen solid pressed and rolled steel wheels is less than for steel tired wheels, but is higher than the first cost of cast iron wheels, the advantages of greater safety, of less weight and of more mileage, being presented to offset this difference in first costs, and show considerable economy in favor of the Schoen wheel.



THE FINISHED WHEEL

In the patented process of making the Schoen solid pressed and rolled steel wheel the best grade of tire steel is employed.

Physical and service tests have been made to prove that the working which the steel receives in the series of operations through which it is put to produce the wheel is such as to impart to it a high tensile strength, besides giving it great density and uniformity of structure

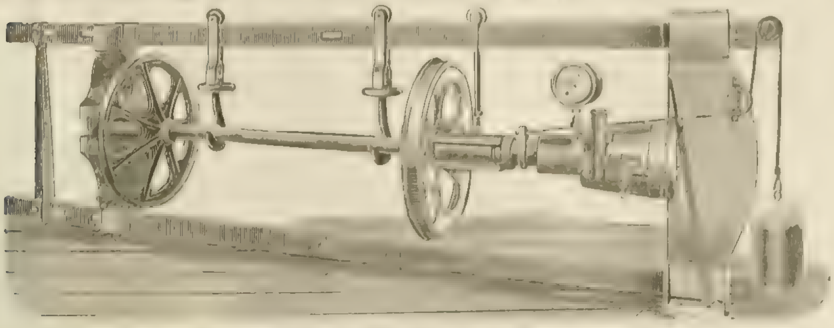
The Schoen steel wheels have been supplied in considerable quantities to railroads all over the country, and are reported as showing most gratifying mileage with slight wear, the wearing surfaces showing bright and smooth, with no trace of roughness or shelling out.

Many new and intricate mechanical problems have presented themselves in the perfecting of this solid wheel, and have been overcome in the development of the enterprise which is looked upon as a worthy addition to the great industries of Pittsburg. The originality of the invention, the amount of time and money invested, the safety of life and property assured, and the economy promised the railroads, were considered of sufficient importance to warrant the award of the gold medal (the highest award on car wheels) to Mr. Chas T. Schoen by the Universal Exposition of St. Louis, in 1904.

American genius, finance and courage have led the world in cheapening the cost of transportation and rendering travel safe and luxurious, and railway interests will appreciate the efforts to solve this difficult problem, relating as it does to the very foundation of transportation.

HAND-POWER HYDRAULIC WHEEL PRESS.

The wheel press illustrated is designed for use in street and interurban railway shops where the amount of work does not necessitate an engine driven tool. Several improvements are embraced in this latest type of press, which is manufactured by the Watson-Stillman Co., New York City. The hydraulic part is designed similar to the large car and bridge jacks manufactured by this company.



HAND-POWER HYDRAULIC WHEEL PRESS.

At the press end of the machine is a pumping lever, which works horizontally at right angles to the line of the press, thus placing the operator in a position where it is easy for him to watch the work. The valves are large, perpendicular and are placed where inspection and repairs can easily be made. The piston is entirely enclosed to prevent grit and foreign material getting into the pump and damaging the parts. A fixed or stationary beam furnishes a solid bearing for the cylinder of the press, which is made of crucible steel. The movable beam has rollers fitted in its base to lessen the friction when it is moved along the lower bar on which it rests. In the movable beam are recesses so that in them may be placed blocks of sufficient thickness to act as templets in forcing on car wheels. At the press end a chuck is suspended from a traveler so that it can be placed against the ram, thus acting as a templet for the other end of the axle. A pull-back weight for the ram has its connecting rope passed over two sheaves, one on the fixed beam and the other on the upper bar. This arrangement [illegible] away with the necessity for a pit.

The type of [illegible] in size from [illegible] the former [illegible] press for 36-in. wheels weighs about 2,500 lb. For export, a 60-ton press for 30-in. wheels is built after a special design so that the heaviest pieces do not weigh over 225 lb. This is known as the "mule-back" pattern.

THE F. BISSELL CO. TRADE MARK.

The [illegible] and that this is realized is shown in the numerous attractive and ingenious designs used by the leading manufactures and railway companies throughout the country. The F. Bissell Co., Toledo, O., has recently adopted the design shown in the accompanying engraving, which will hereafter be used in all the advertising of the company and on all its manufactured products.

STANDARD AUTOMATIC LUBRICATOR CO.

Spaces 14 and 16 of section K, are occupied by the Standard Automatic Lubricator Co., the Durkin Controller Handle Co., and the American Ferrofix Brazing Co., all of Philadelphia, where the products of these companies are well displayed. These include the "Star" automatic oiler for armature and axle bearings, which are made in different sizes to fit any style of standard motor. These companies are controlled by the same interests and are represented by G. B. Kirkbride, John Durkin and E. W. Baird.

CHICAGO PNEUMATIC TOOL CO.

A very interesting display of the products of the Chicago Pneumatic Tool Co., Fisher Building, Chicago, which are of especial interest to the electric railway field, is made at space 9, section K. The company is showing a complete line of electric drills of various sizes and capacity, electrically driven air compressors, a complete line of pneumatic tools adapted to street car repairs, air jacks, automatic oiling devices, speed recorders, etc., as well as "Little Giant" storage batteries. These storage batteries, contained in cells of the Duntley washable type, or plain rubber or glass cells, are adapted for automobiles, central station plants, isolated power plants, lamps, railroad signals, telephones, telegraph, train lighting and all work of this character. The principal feature of this battery is the Duntley washable cell which may be thoroughly cleaned without disturbing the elements, the device which permits this being extremely simple and effective. The company is represented by G. A. Barden, manager Philadelphia office, and Howard Small and Julius Keller, engineers.

THE A. C. STILES ANTI FRICTION METAL CO.

The A. C. Stiles Anti Friction Metal Co., 222 Boulevard, New Haven, Conn., which is represented at the convention by George W. Smith, general manager, and H. W. Toothe, manager babbitt department, is showing a full line of babbitts and railway brasses at space 20, section K. A recent invention of the company is the A. C. Stiles patent self-oiling bearing, the object of which is to provide a bearing which may be lubricated throughout substantially its entire surface, and by which the lubricating material will be equally distributed, all of which have been incorporated in the design of this bearing. The company manufactures a special bronze metal for this bearing, which requires no babbitt and which has been used and thoroughly tested for several years.

The Carnegie Steel Co. is represented at the convention by W. P. Siebert, general manager of sales; J. B. Bonner, manager of sales; N. M. Hench, manager track appliances; William Summers, salesman.

"SHAWMUT" BONDS.

In the early days of electric conductors, any form of a mechanical joint was used to connect the ends. After a time the advantage of soldering these joints became so apparent that it was considered very important to take especial pains with the soldering. So in electric railway work the soldered bond for track circuits was a development

The pioneer soldered bond, known as the "Shawmut", was put into use a little over five years ago and has since been steadily gaining in favor. The durability of these bonds has been amply demonstrated the past five years. The original form of bonds with slight modifications is still retained, while to this type have been added others to meet the ever increasing demand of track conditions.

The "Shawmut" soldered bond consists of copper laminations, separately tinned at each end, for the length of the foot, where they are surrounded by a wrapper and firmly soldered together. The bonds are made in various and efficient forms to suit the various rail joints. The latest improved form, known as C-1, is used for bonding on the ball of the rail. The loop of the bond is offset ⅛ in. to clear the plate. At the middle of the loop is a narrow copper wrapper used to prevent the spreading of laminations in service, the breaking of them by teams, and the consequent loss of copper cross section. The length of copper used has been reduced as much as ample flexibility will permit to give an economical as well as an efficient bond.

NEW YORK ELECTRICAL SHOW.

Arrangements are now being made for an electric show to be held in Madison Square Garden, New York City, December 11th to 23rd, inclusive. At this season of the year New York is at its best, as well as having a transient population estimated at 750,000. A competent advertising department has been established by the directors of the show to acquaint the public with the attractions of scientific and popular interest which are to be seen at the Garden. Dr. George F. Lever, of the department of electricity of Columbia University, has been appointed director of exhibits and he has already secured enough exhibitors to insure an attractive and successful show. While considerable exhibit space has been reserved, some of the best positions are available and any manufacturer seeking this opportunity to acquaint the public with his products, may secure further information and reserve space by communicating with the New York Electrical Show or Dr. George F. [illegible] St., New York City.

GREEN'S ECONOMIZER.

While the Green Fuel Economizer Co., of Matteawan, N. Y., has no exhibit at the convention it is ably represented by William Downs, J. H. Barron and A. H. F. Viehl. The products of this company are well known, one of [illegible] follows: Saves 10 to 20 per cent in fuel; gives 20 to 40 per cent more steam; prevents excessive expansion and contraction of boilers; prolongs the life of boilers; enables firemen to keep an even pressure of steam; purifies the feed water; saves handling of a large amount of coal and ash; and keeps a great volume of water at the evaporative point, ready for immediate delivery to boilers in case of sudden demand for extra power.

O. M. EDWARDS CO.

The O. M. Edwards Co., Syracuse, N. Y., is represented at the convention by O. M. Edwards, E. T. Chaffee, and G. G. Norris, and the exhibit of the company is made in booth 12, section A. Especial attention should be called to several new designs of window fixtures now being manufactured by this company, two important features of which are simplicity of application, moderate first cost and minimum cost of maintenance. The new platform trap doors manufactured by the company are being used extensively by electric interurban railways throughout the country, having been adopted by the Schenectady Railway Co., for its suburban lines, and the Lackawana & Wyoming Valley Electric Railway Co. A complete line of tin rollers for car curtains is also being shown by the company; these are manufactured in two designs and several sizes, the regular pawl type roller and the Edwards ratchet roller. The exhibit is attractively displayed and is so arranged that the design and operation of the various appliances may be understood with but little investigation.

DAILY STREET RAILWAY REVIEW

7TH YEAR, NO. 4 — SEPTEMBER 29, 1905. — SERIAL NO. { VOL. XV, NO. 9 D

THE SINGLE-PHASE RAILWAY SYSTEM.*

BY CHAS. F. SCOTT.

It is the purpose of this paper to present some of the salient features of the single-phase railway system which may be of particular interest to the members of the American Street Railway Association.

The questions which a railway manager is apt to raise with regard to the single-phase railway concern its suitability for his particular conditions, its present practical status and its cost. The answers which apply in one case may be misleading in others, so that the discussion of the subject must be general rather than particular.

There are two other questions which have been asked so often that they deserve a passing comment. Will the motor start with good torque and accelerate rapidly? Will it commutate? Suffice it to say that the single-phase motor of the variety which I am considering does start and accelerate and commutate. It is not the motor itself but the single-phase system which the motor makes possible that is of prime importance. And the system is of commercial value only as it is able to operate electric railway service more effectively and economically than is practicable by other means.

Single-Phase and Direct Current Systems Compared.

The single-phase system accomplishes the same results in car movement that may be obtained by direct current equipments but in many cases with less first cost, less operating expense, increased flexibility and greater simplicity.

The radical difference between railway systems using direct current motors and those using single-phase motors is not so much in the car or the power house as it is in the circuits connecting them. In the first place the high voltage used on the trolley wire does away with expensive feeders and it also enables the current to be carried to a greater distance from the power house or from the sub-station. Second, the sub-station employed in the single-phase system requires simply a lowering transformer. The sub-station for supplying a direct current railway requires the rotary converter and a set of lowering transformers. Third, the number of sub-stations for a single-phase road is less than is required for direct current and these do not require the attendance which is necessary for the operation of rotary converters. It is these characteristics that peculiarly adapt the single-phase system to interurban and long distance railways.

Constituent Parts of Single-Phase System.

The motor is the feature which has received particular interest and comment, for it has been conceded that if a single-phase motor be available the other elements would follow as a matter of course. No one has questioned the adaptability of control apparatus, transformers and high tension line construction to the requirements of the single-phase railway system. This simply involves the application of well-known apparatus and methods to the particular requirements of railway operation. But a perfected motor does not mark the completion of development work. Control apparatus for handling alternating current must be devised and constructed. It must be suitable for hand control for small cars and it must be adapted for the multiple unit operation of heavier equipments. Still other forms must be suitable for operation interchangeably on either direct or alternating current. Transformers, line switches and other auxiliaries must all be combined into a workable equipment. Forms of trolley and overhead construction must be developed suitable for the new conditions of current and voltage. The announcement of a commercial single-phase motor made in the paper of Mr. Lamme before the American Institute of Electrical Engineers three years ago this month was necessarily the beginning rather than the end of the development of the system as a whole in all its details.

Advantages Proved by Service.

In how far have the advantages claimed for the single-phase system been realized? Among the important features are the following:

A high voltage trolley construction has been developed and has proved to be simple, strong and thoroughly practicable. Thirty-three hundred volts has been used and has proved to be safe and reliable.

A sliding contact device which does not require reversing when the direction of the car is changed is found more satisfactory, especially for high speed operation, than the trolley wheel. Its wearing surface lasts longer than trolley wheels operating lighter cars on direct currrent.

Transformer sub-stations suppply current satisfactorily without feeders and without station attendants.

The car equipments show simplicity and effectiveness in the control apparatus. Less than half the controller notches required for direct current give equally smooth and as rapid acceleration with alternating current. Platform controllers are simpler as no magnetic blow-out is required. The unit control system is readily adapted for the operation of single-phase motors and is in some points simpler than the control of direct current motors.

The operation interchangeably by alternating current and by direct current is a feature of an important road which operates large equipments on direct current in the city and on alternating current across country.

Motors of four or five sizes have been built and show excellent commutating features. The commutators take a good polish. The motor windings are such that there is a practically balanced magnetic pull, even if the armature be slightly out of center. Although the armature speed is higher than in corresponding direct current motors, the advance criticism has proved ill founded as there have been no bearing troubles. The oil lubrication has proved highly satisfactory.

The foregoing features, which are the important elements upon which the claims of the single-phase system are based, have been shown by actual operation to be entirely feasible and practicable, and such as to inspire confidence.

Difficulties have been met which have been annoying and vexatious. The difficulties, however, have usually been due to some error in the general engineering features or to some specific point of weakness in the insulation or construction of some part of the apparatus. In other words, the troubles have not been fundamental and inherent in the single-phase system, but have been incidental and capable of ready remedy. Some particular difficulties will be taken up further on in this paper.

Leading Features of Single-Phase System.

As a guide to determine the conditions under which the adoption of the single-phase system is advantageous, it will be useful to review briefly some of its features which are particularly concerned in its installation and operation.

The Motor.—A motor which is protected from the trolley voltage and lightning disturbances by an intervening transformer winding, which has only 200 to 250 volts across its terminals, which may have its brushes grounded or short circuited without "flashing" or "bucking" and which may have full voltage thrown on its terminals without disaster to itself is essentially a safe motor. The armature has a bar winding on sizes of 30 horsepower and upward. The increased current required at low voltage necessitates brush capacity equivalent to that on a direct current motor of twice the output.

The Control. One usually thinks of the direct current street railway motor as a variable speed motor. Yet it is, in a sense, fundamentally a one-speed motor, for with definite applied voltage, weight of car and grade, the motor soon attains a definite speed at which it continues to run until there is a change either in the voltage applied or in the load. If two motors be operated in series there is a second definite speed, which is about half of the speed when they are in parallel. Other speeds are obtained by lowering the voltage on the motor by means of resistance, but this is inefficient and is admissible only in starting.

Certain results follow. The speed of the car depends upon the trolley voltage. If the voltage be low, the speed is low. The efficient speeds are fixed by the trolley pressure and not by the motorman. The relation between speed on level and the speed on grade is fixed by the inherent characteristics of the motor. A given motor

* Read before the American Street Railway Association, Sept. 28, 1905.

with definite gear ratio has its one definite speed depending upon train resistance and electro-motive-force. There is no range of adjustment like the throttling of an engine without the introduction of the wasteful rheostat. In a series motor the current determines the torque and the electro-motive-force determines the speed. Hence, for speed control there must be voltage control. In the direct current system efficient voltage control is not attainable, but with alternating current it is easily secured. The simplest method of variable voltage is by means of taps from the transformer winding. The low voltage required for starting is obtained from a low tap and the successively higher voltages for increasing speeds are secured from successively higher taps from the winding. As there is no rheostat the motor may run efficiently from any tap, thereby giving the motorman a control over his car movement which is not possible with direct current. If there be a tap giving a voltage higher than that required for normal running it is available for giving a higher speed for making up lost time, or for supplying normal voltage to the motor when the line pressure is low. The car can run at any time at the pressure needed.

The number of points required on the controller for smooth acceleration is much less with alternating than with direct current. The whole control system in fact is simply half a dozen taps from the transformer to the controller by means of which any one of them may be connected to the motor. An intervening preventive coil enables the controller to pass from one point to the next without opening the circuit or short circuiting the two taps. The controller may consist of a drum of ordinary form on the car platform, or of unit switches placed under the car and operated by a master controller. The latter type is used in heavy equipments and also when several cars are to be operated in the multiple unit system. An effective form of switch with magnetic blow-out has been developed for heavy currents. The switches are assembled in a compact group, thoroughly protected and easily accessible.

Trolley Voltage. Twenty years ago the electric railways of the United States as measured either in miles, in cars or in kilowatts comprised less than one per cent of what they do today. In this enormously rapid growth two features of the electric railway have remained unchanged, although other elements have been greatly modified. These two features are: first, the series motor; second, the use of direct current at approximately 500 volts. During this time the generating plant has changed from small belt-driven to large direct connected units and then from direct current to alternating current. High tension transmission circuits with rotary converter sub-stations have been common. Motors have increased in size and have been improved in design and in reliability and the multiple unit system of control has been introduced for larger equipments. The trolley voltage, however, has been limited to approximately 500 volts on account of the limitations of the direct current motor and the inability to transform direct current on the car from a high voltage to a low voltage. The general trend of electrical engineering has been toward alternating current at high voltage. Many can remember the time when the use of 1,000 or 2,000 volts was decried as impracticable or unsafe and when 5,000 or 10,000 volts was the limit to laboratory experiments. Progress has been made in design, in construction and in materials until voltages, which not long since were impracticable, are now operated with greater reliability and safety than were the lower pressures a few years ago. Safety is very largely a question of mechanical excellence. In railway motors and control apparatus, in the mechanical equipment of heavy and high speed cars, in overhead construction and in power house equipment, reliability is primarily dependent upon mechanical excellence.

While any considerable increase in voltage may not be safe on existing trolley lines, it is practicable by an increase in mechanical strength to offset the higher pressure and produce a high voltage trolley system of greater reliability and safety than the present construction for low voltage affords. Such a construction has been developed into a commercial form in the catenary suspension of the trolley wire. An auxiliary steel cable with a moderate sag at the center of spans supports every few feet of trolley wire which is thereby maintained at a uniform height. It is adapted for high speed running and it possesses a greatly increased strength. The excess cost of the catenary construction over the cost of poles and overhead construction of the ordinary type is moderate and in a large measure is justified by the gain in mechanical reliability quite aside from the question of voltage.

The Sub-station. To one familiar with an ordinary rotary converter sub-station interest will center chiefly in the negative characteristics of the single-phase sub-station. There is no rotary converter—a most essential link in the old system, one which behaves remarkably well when all is favorable that is inclined to be fussy and obstreperous when the conditions are not to its liking. There is no synchronizing, no sparking, no flashing, no dropping out of step. The transformers are arranged not in banks of two or three little ones, with polyphase switches and auxiliaries in primary and in secondary, and the direct current switchboard has disappeared entirely.

So much for what it is not. In its simplest form the sub-station is a single transformer with its primary nd secondary connections. Additional transformers, switches, lightning protection, and instruments are added as circumstances require.

Short circuits have lost much of their terror. The alternating current on short circuit is limited by the self-induction of the circuit, and a transformer is not disturbed by a "short" as is the commutator and the speed of a rotary converter.

The difference in the effect of a short circuit on direct current and on alternating current is well illustrated in the underground circuits in New York City. In a 11,000 volt cable system a fault in the cable causing a short circuit is usually confined within the cable and merely burns out a few inches of the conductor before the circuit breaker opens. On a low tension system, however, the currents are very large and considerable lengths of the conductor may be melted before the current is cut off. In an alternating current system the normal current on a circuit delivering a given amount of power is less in proportion as the voltage is increased and, as the increase of current above normal is not as great on account of the self-induction of the circuits and apparatus, accidents are less liable to be destructive.

Operation on Direct Current. If the single-phase road is to be an extension of an existing road it may be desirable to run the single-phase cars over the tracks which have a direct current trolley wire. While single-phase cars can be arranged to operate from a direct current trolley wire, it handicaps in some measure the single-phase equipment. The addition of resistances to the car equipment and the extra switches and the like for enabling the change to be made in the current supply are obviously objectionable. It is best, therefore, to keep single-phase equipments free from operation on direct current if it be practicable to do so. When it is found necessary for single-phase equipments to operate from direct current trolley wire, the motors are connected two in series for 500 volts, and if there be four motors the two pairs are connected first in series and then in parallel as in ordinary series parallel control. The transformer is cut out, and the control apparatus and motors operate in substantially the same way as those on an ordinary car.

Source of Power.

The standard frequency for the single-phase motor is 25 cycles, (3000 alternations). Generators may be wound for single-phase, or direct current may be taken from one phase of a two-phase or a three-phase generator. Current from the several phases of a polyphase generator may be used for operating different divisions of the railway.

If power is to be taken from a power house which generates a higher frequency it cannot be applied directly but must be changed to 25 cycles. This may be effected by a motor-generator set. A polyphase motor taking power equally from each phase of the high frequency circuit may drive an alternator, either single-phase or polyphase for furnishing current to the single-phase railway. The converting outfit may be located in the main power house or in a sub-station as may be found most convenient.

The Field for Single-Phase Railways.

The development of a new and more efficient method for accomplishing a given result often leads on and opens new fields which had not been commercially practicable before. Such is the case with the single-phase railway. The direct current interurban railway has its limitations. If a region be sparsely settled the available traffic will not show a profit on the cost of circuits and rotary converter sub-stations. There is a material reduction in the investment and operating expense incident to the single-phase railway that will enable it to be built and operated with a profit in cases where the traffic would not support a rotary converter system.

On the other hand, in heavy service the direct current has not made much headway, being handicapped by the heavy cost of sub-stations and of conductors. Heavy and relatively infrequent trains

are the hardest loads for sub-stations. For example, if sub-stations be eight miles apart each will supply eight miles of track. A train running forty miles per hour will receive current from a given sub-station for 12 minutes. In order that a sub-station may be continuously supplying current to trains in one direction they must have a headway of 12 minutes. If they be an hour apart the current from each sub-station is used but one-fifth of the time. Trains in two directions will double the sub-station output, but as the peak load is considerable when two trains pass near a sub-station the load factor is extremely low. It is evident that some of the sub-stations could be omitted and those remaining would have ample capacity to supply the requisite current at a high load factor provided the current can be efficiently and economically transmitted from sub-station to car. But the cost of conductors for direct current at 500 or 600 volts when sub-stations placed further apart soon becomes prohibitive; hence, the otherwise superfluous number of sub-stations with apparatus running with low load factor are necessary. But the single-phase equipment by reducing the size of conductors enables the sub-stations to be more widely separated. This possibility in the reduction in the number of sub-stations and in the aggregate capacity of sub-station equipment, as well as the elimination of rotary converters and their attendants makes practicable the operation of long distance roads which could be equipped for direct current only at an excessive cost.

These examples show that the high voltage trolley brings into commercial practicability a class of long distance, infrequent, heavy service for both passenger and freight, which has not been reached by the direct current.

The single-phase system therefore decreases the cost of installation and operation for the kind of interurban service which has been successfully developed by the direct current, and it extends the field of commercial operation to include, on the one hand, rural roads with relatively light traffic, and on the other, a heavy, infrequent, multiple unit or locomotive service for passenger or for freight approximating steam railway conditions.

Single-Phase Railways in Operation.

The single-phase railway which shows the most extensive operation as measured in car miles is that of the Indianapolis & Cincinnati Traction Co. Operation was begun over a short length of track January 1st and on April 1st 37 miles were covered. Since July 1st a regular schedule has been maintained over 41 miles, 37 miles of which is under alternating current trolley and the remaining 4 miles is under direct current trolley in the city of Indianapolis. The company has 10 cars, each equipped with four 75-h.p. motors. A maximum speed of 60 and 65 miles per hour is secured and the cars are not only the heaviest but they operate upon the fastest schedule of any of the numerous suburban roads radiating from Indianapolis. Some defects have developed in the equipment, which, however, have been incidental in character. It was found that the natural ventilation under the car was insufficient for the transformer and a ventilating motor was added. A weak point developed in the armature insulation when the cars which had been running for some time by alternating current were first run regularly over the direct current lines into Indianapolis. One feature of the new condition was the opening of the circuit with four motors in series, the motors having laminated fields which give greater field discharge than solid poles. The remedy was obviously the strengthening of the insulation. This brings out the interesting fact that operation on alternating current at 3,300 volts with an intervening transformer is less severe upon the motor than operation on direct current at 500 volts. Experience showed wherein the control apparatus, suitable for both alternating and direct current, could be simplified and the apparatus reduced in quantity. The result is a control system which is relatively simple and compact, although suitable for operation interchangeably between alternating current and direct current. The best verdict upon the working of the system has been given by the operating company. It is found in the contracts which have been placed for extending the present line a distance of 16 miles; also in extending the single-phase operation to the Shelbyville line, both to the 26 miles which have been operated by direct current and for a 20 mile extension. The length of track is therefore to be increased from about 40 to 100 miles; the number of cars will be double the present number and all equipments will be similar. It is significant that a company which has been operating two substantially similar suburban lines, one by single-phase current and the other by direct current, should see fit to throw out the direct current and substitute single-phase alternating current. It may be noted that this course was taken, although the reverse was easily possible, as provision was made in the original contract for the single-phase apparatus by which it would be exchanged for direct current equipments if its operation proved unsatisfactory.

Other single-phase roads which are operating Westinghouse equipments show a variety of conditions, some having exceptionally sharp curves and steep grades. On the road between Derry and Latrobe, in Pennsylvania, 30 ton cars are started on a 10 per cent grade. The cars have platform controllers and are equipped with four 50-h.p. motors. In some cases the initial operation has been handicapped on account of incompleteness, or through the use of temporary apparatus either in the power house or on the car. In its fundamental elements, however, the operation is proving perfectly satisfactory.

Some New Roads.

The extension to long distances will soon be shown in the carrying out of the contract which has been closed by the Spokane & Inland Railway Co. for 150 miles of railway running south from Spokane, Wash. The equipment will consist of 15 motor passenger cars each with four 100-h.p. motors, 6 motor freight cars, each with four 150-h.p. motors and six 40-ton freight locomotives. The engineer of this road has been intimately connected with the installation and operation of the single-phase road at Indianapolis.

The most notable recent event in electric traction is the purchase of Westinghouse single-phase locomotives by the New York, New Haven & Hartford Railway Co. The passenger trains on this road which enter Grand Central Station in New York run over the tracks of the New York Central Railroad for about 12 miles. As steam locomotives cannot enter the new terminal station and as the New York Central is equipping its track for direct current it is imperative that the New Haven trains be handled over 12 miles by direct current power. Instead of changing from electric to steam locomotives for all local and through trains at the end of 12 miles it was decided to extend the electrification and to do it, not by extending the direct current, but by changing to alernating current. The single-phase locomotives will be designed so that they may operate interchangeably from direct current or from single-phase alternating current.

The adoption of the single-phase system by one of the leading railroads of the country for its heavy and important passenger service is all the more noticeable, first, because its officials are already familiar with electric traction matters through the operation of many important city and interurban railways in New England, and second, because the obvious thing to have done would have been to follow the example of the New York Central by adopting direct current locomotives. Probably this is the turning point, and the coming electrification of heavy railways will follow the conspicuous example set by the New York, New Haven & Hartford Railroad Co. by adopting the single-phase system.

THE MONARCH TRACK CLEANER.

A product of the Ohio Brass Co. exhibited at the company's booth in section D, that is worthy of special attention is the "Monarch" track cleaner. The "Monarch" track cleaner has been carefully designed to embody simplicity with substantial construction and light weight, combining mechanical strength with flexibility, and a ready means of adustment to adapt it to all conditions of service.

Each of the scraping blades is pivoted near one end, which enables it to be set at any angle with the track, thus adapting it to varying conditions of track or pavement. When once properly adusted, the blades may be clamped rigidly in the position. Two powerful, flat steel springs are provided between the rocker shaft and the scraping blades. These springs provide a means whereby the blades can be held to the track under tension—a very essential feature in removing ice or sleet from the rails. In addition, these springs prevent damage to the cleaner by allowing either of the blades to raise independently of the other in case it strikes an obstruction too heavy to be removed. Additional means of adjustment are provided by which the cleaner may be adapted to different sizes of cars, so that it may be readily changed from one car to another, if desired. Attached to each blade at the scraping (or wearing) point, is a small metal shoe, which takes all the wear which otherwise would come on the blades. This shoe can be replaced, when worn out, at a very slight expense, and in a few moments' time. In this way the expense for repairs, due to wear and tear, is reduced to a minimum.

NOTES ON THE DESIGN OF LARGE GAS ENGINES WITH SPECIAL REFERENCE TO RAILWAY WORK.*

BY ARTHUR WEST.

The following remarks, as the title indicates, are applicable to large size gas engines only. The smaller sizes are unsuited to important electric railway installations on account of first cost, multiplicity of parts and greater expense for attendance, etc. The tendency of the modern plant is constantly in the direction of large size units. This is indicated by the rapid increase in the size of steam turbines installed in modern stations. Similar reasons will, it is believed, cause a demand for large size gas engines for electric railway work in conjunction with producers to operate them.

One of the most important considerations in the design of large gas engines is the arrangement of the cylinders. In a single cylinder, single acting four cycle engine an explosion takes place once in every two revolutions. In order, therefore, to get the same rotative effect as with a double acting steam cylinder, it is necessary to work four single acting cylinders on the shaft or two double acting gas cylinders tandem on one crank pin. With this arrangement four explosions are obtained in two revolutions, or an explosion every 180 degrees of crank angle. In case of a misfire or premature ignition due to bad gas, the crank can only move one-half a turn before another explosion takes place. In a single cylinder single acting engine the crank must move two whole turns before the next explosion, while with two single acting cylinders opposed to each other or one double acting cylinder the crank may be required to move one and one-half turns before the next explosion. The relative evil effects of a premature or misfire are, therfore, in the following ratios:

Two double acting cylinders	1
Two single acting cylinders, opposed type	3
One double acting cylinder	3
One single acting cylinder	4

Gas engines and producers to be commercially successful must be designed to be run with the same class of help as is employed on corliss engines and boilers. This being the case, misfires and prematures are liable to occur occasionally, and the designer must minimize their possibilities for evil. These considerations, as well as the capacity for caring for heavily swinging railway loads, have caused our adoption of tandem double acting cylinders for railway work.

It is sometimes argued that cylinders so arranged are inaccessible. If, as is the practice of the Westinghouse company, ample space is arranged between the cylinders, and if the inlet and exhaust valves are not located in the heads, but in the cylinder body and entirely above the floor level, such a gas engine is as accessible as a tandem compound corliss engine or as a corliss engine driving an air compressor.

The speed of a gas engine must be adapted to the kind of generator to which it is to be directly connected. In a general way, its speed will usually somewhat exceed that of a corliss engine of the same cylinder dimensions. In my experience, the speed of large steam engines is limited by the inertia and consequent wear and tear of the valve gear rather than by the inertia of the reciprocating parts themselves, which is absorbed by the compression. Inasmuch as in a four cycle gas engine the valve gear only moves at half the speed of the engine, somewhat higher speeds are permissible than would be the case with a steam engine having the same dimensions of cylinders.

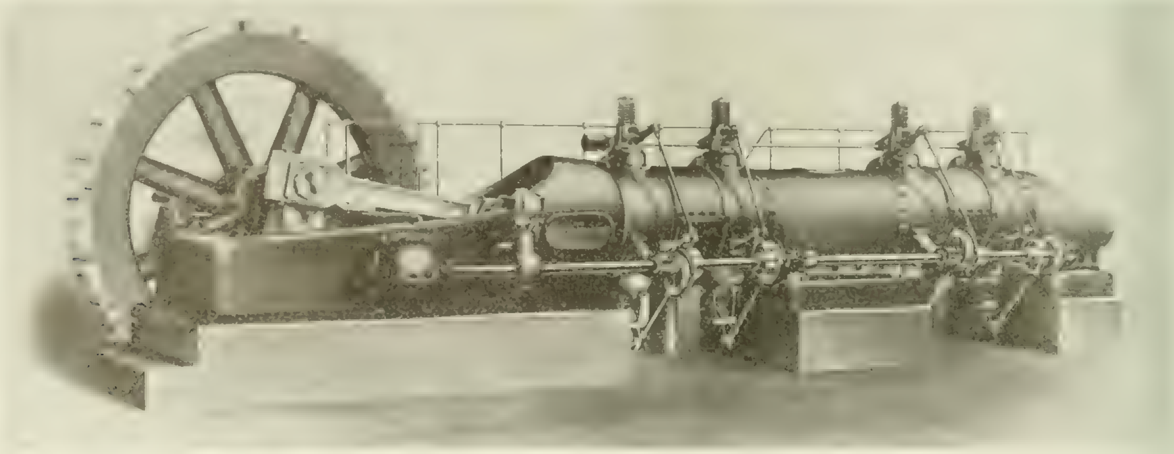
The speed regulation adopted for large Westinghouse gas engines is especially suitable for generator driving in that no conditions of changeable load or variable friction of valve gear affect the regulator. Our gas engine regulator governs the speed by means of a relay cylinder, and, therefore, produces results similar in type to those obtained with the relay governor used by the Westinghouse Machine Co. on steam turbines. The advantage of such relay governor with the gas engine is that the varying friction of valves with different qualities of gas does not affect the sensitiveness of the governor. Without a relay cylinder the only way in which this result can be accomplished on large gas engines is by some form of a drop cut-off controlling the gas. This is objectionable on a gas engine, as any slight change in the speed of the dash pot very seriously affects the mixture of gas and air, with corresponding bad effect upon the regulation. Such small changes in speed of dash pots are frequent in a corliss engine, where they cause no bad results. The Westinghouse arrangement employs no releasing gear of any kind, but secures all the advantages of regulation without its use.

The question is frequently asked as to whether large gas engines will drive alternating current generators successfully in electrical synchronism or "parallel". This has been done for several years past in Germany with entire success, and it has also been done in a number of instances very successfully by our company. We have at the present time orders for several such plants on our books, one of which is to drive an electric railway from Warren, Pa., to Jamestown, N. Y., which we expect will be in operation some time during the autumn.

It is sufficient for our purpose to observe here that the cyclic variation, that is, the degree of departure from absolutely uniform rotation, is sufficiently small to conform with the design of generators now built for steam driving.

The European designer of gas engines has allowed himself an amount of complication in valve gear which would not be permissible under American operating conditions. The successful American machine must be as nearly "fool proof" as is the large corliss engine. If it is not, it will fail to be a success from the purchaser's point of view—no matter what thermal efficiency may be claimed by the builders—as a consequence of such complication as the European engineers have been prone to adopt. In the designing of valve gear for large gas engines, wide range of quality of gases must be considered. In this respect the design of the gas engine is very different from that of a steam engine, inasmuch as the steam used has practically constant characteristics, differing only in such minor points as pressure and superheat. With the different kinds of gas to be met with, however, the proportions of air and gas, and sometimes of compression, are radically different, and no gear can hope to be a universal success which does not provide for meeting the widely varying conditions to be encountered in the market.

We are frequently asked, "What is the overload capacity of your gas engine?" A clear understanding on the part of the purchaser of the limitations in this direction is very desirable, from the point of view both of the buyer and the seller. A gas engine and producer is thermally very much more efficient than a steam engine and boiler. It is, perhaps, not amiss to say that, with a well designed producer



[illegible] H. P. WESTINGHOUSE GAS ENGINE, UNION TRACTION COMPANY OF KANSAS

* Read before the American Street Railway Association, Sep. 28, 1905.

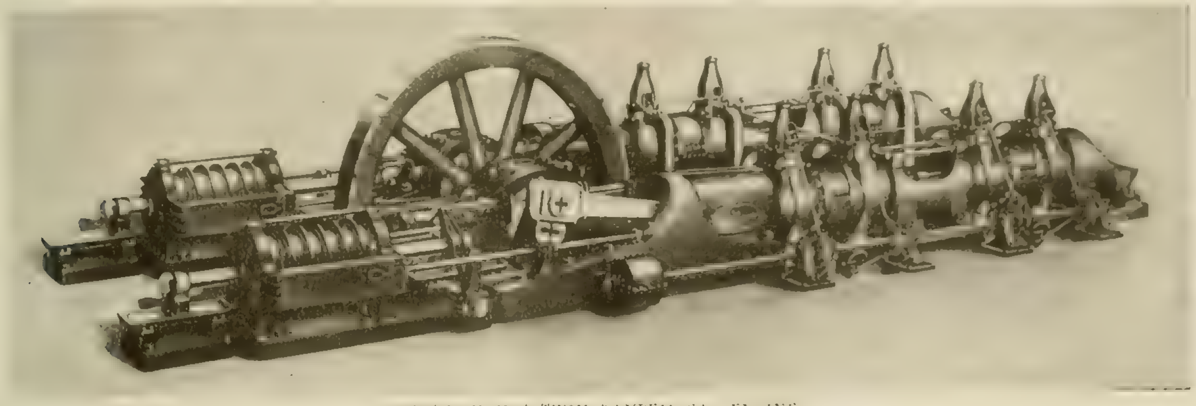
and gas engine plant, a horse power can be delivered with one half the cost of fuel that is possible with a well designed steam engine plant. The power of the gas engine, however, is limited by the total volume of explosive mixture which can be drawn into the cylinders during the suction stroke, compressed and finally ignited. This condition sets a limit which does not allow of a large temporary increase of the power, such as obtained with the Westinghouse steam turbine by the automatic operation of the secondary admission valve. Such overload capacity is, of course, convenient for the purchaser, but it is unobtainable on the gas engine, unless the engine is largely underrated, and the purchaser should consider that this is one of the prices that he pays for the enormously increased output obtained with the gas engine per pound of coal. The overload capacity is, therefore, simply the amount which the builder rates his machine below its ultimate capacity. It has been our practice to rate our gas engines in such a way that they would have a safe overload capacity of 10 per cent. Our machines are ordinarily good for somewhat more than this, but conservative engineering requires that there be a margin of power in order that overloads may not materially reduce the speed. The above remarks on overload furnish a general guide which may be of service in selecting suitable generator capacity for a gas engine. For ordinary cases the overload capacity of the generator and that of the gas engine should be about equal, although the gas engine will indefinitely carry its overload while the generator will not, in all cases, unless it is bought with that understanding.

The mechanical efficiency of a large gas engine is very much greater with a four stroke cycle than with a two stroke cycle, this being one of the arguments against the two cycle engine. It is no uncommon thing to see two cycle engines which do not realize as brake horse power more than 60 per cent of the work actually done by the combustion in the cylinders. The efficiency of a four cycle engine varies considerably, but it may be said in a general way that a well designed engine will deliver about 85 per cent of the gas indicated horse power in the form of brake horse power. This 15 per cent of power lost is not exclusively composed of frictional resistance of journals, crosshead slides, etc., as is the case in a steam engine. The four cycle engine has, of course, to draw in its own mixture of air and gas and compress the same, and its functions, therefore, combine those of a pump, a compressor and a motor. It is the pumping and compressing work which causes the mechanical efficiency of the gas engine to be somewhat lower than that of a steam engine. The actual friction of the working parts need be no greater than with a well constructed corliss engine, viz., 90 to 95 per cent. In order to keep down the friction and increase the reliability of the machines, it is the practice of the Westinghouse company to design large gas engines with provisions for attaching a continuous return oiling system. The large amount of oil put through the journals increases the safety, requires less attendance and keying up, and washes out dust if the engine is required to operate in an atmosphere which is not clean.

The thermodynamic efficiency of the gas engine varies so much with different kinds of gas that it is hard to say just what the average value would be. It is probably not far from the truth, however, that its thermal efficiency is about 25 per cent, though in favorable cases gas engines have obtained efficiencies well over 30 per cent.

There is an impression rather prevalent that a gas engine is uncertain and hard to start. A properly designed engine, supplied with fairly decent gas, can be started as easily as a steam engine. Large Westinghouse horizontal gas engines are started by means of compressed air, the only operation required being, (1) open the main gas valve; (2) close the igniter circuit; (3) open one compressed air valve, similar in construction to an engine throttle. The compressed air puts the engine in motion, which draws the charge into the cylinders and compresses the same, after which the first explosion takes place. Air is shut off and the engine is in full operation. We find no more difficulty in starting our gas engines than a steam engine of comparative size. I desire to emphasize this point, as one of the stock arguments against the gas engine is that it is difficult to get into operation.

With certain kinds of gas, inspection of the interior parts of the cylinders is often desirable at regular intervals of, say, a couple of months. This is especially the case with blast furnace gas, and also with producer gas made from certain kinds of fuel. We have taken particular pains to arrange our cylinders so that no parts of the valve gear or valves are below the floor. The inlet valves being located directly on the top of the cylinder, easy access can be had to either end of either cylinder by removing the inlet bonnets. The exhaust valves are also a part of the engine which need occasional attention for regrinding. Especial care has been taken to render these quite easily removable. The cylinders are, therefore, directly accessible from the top through the inlet openings and from the bottom through the exhaust openings. The fact that all the valve parts are entirely above the floor line renders these operations much easier than if a large part of the valve gear extended downward into foundation parts. It is not necessary to remove the cylinder heads, except to examine the piston rings themselves, which is not often required. Inasmuch as clean gas cannot always be secured, the importance of such easy entrance to the gas cylinders cannot be overestimated.



WESTINGHOUSE TWIN TANDEM GAS ENGINE

The general type of engine commented on above is shown in the two accompanying engravings. The first shows the type of two engines being built by the Westinghouse Machine Co. for the Union Traction Company of Kansas, Independence, Kan., one being of 500 brake horse power and one of 1,000 brake horse power. The second engraving shows one of two twin tandem furnace gas blowing engines now under construction for the Edgar Thomson plant of the Carnegie Steel Co. For electric railway work, no change would be made except to omit the blowing tubs. As electric units these engines would have a capacity of about 3,500 brake horse power each.

The large size gas engine has come to fill such an important place in Europe, and has there proved itself to be so reliable and serviceable, that there is no question about its being adopted in this country in the near future, in a form suited to American operating conditions.

It is hoped that these general observations will be found of interest to intending users of gas power in large quantities.

"CONSOLIDATED" HEATERS.

The Consolidated Car-Heating Co. is exhibiting its standard heaters and switches and also its panel and truss plank heaters especially arranged for use where connecting wires are carried in conduit. This arrangement permits the connection to the heater coils inside of the heater cases, the conduit being clamped inside of the heater. The Consolidated company also shows heaters and switches specially finished, which it is furnishing Chicago City Railway Co. for 655 cars; also switchboards for Brooklyn Elevated cars and several types of heater switches which are furnished with a lock.

ELECTRIC RAILWAY EQUIPMENT.*

By W. B. Potter

The annual meetings of the American Street Railway Association are not only occasions for the exchange of ideas between the operating companies, but they also afford an excellent opportunity for engineers concerned in the selection or development of the various appliances to study the present and future requirements in their broader aspect.

Recent years have witnessed such radical changes in many details of electric railway equipment, that it is advantageous to occasionally review the modifications made to meet the requirements of modern railway practice. Numerous changes are made each year, and while the general trend is toward improvement, the ultimate degree of perfection is only attained though the experience resulting from a thorough trial of the new ideas under operating conditions. In this respect the designing engineer and manufacturer owes much to the operating company, an obligation which should be, and I believe is, fully recognized.

The limits of this paper will permit only a reference to a few of the features relating to the development of the past few years.

No more prominent example can be found to demonstrate the rapid march of progress, than the introduction and successful operation of the steam turbine, of which there are several types now on the market.

The extent to which the reciprocating engine is being superseded is indicated by the sales during the past three and one-half years of one type of turbine alone, which amount to over 500,000 kw., of which about one-third are for electric railway service. These figures are mentioned for the purpose of emphasizing the recognized importance of the steam turbine as a prime mover.

As compared to the reciprocating engine there are several important advantages generally known, but perhaps not appreciated at their true value. The steam economy of a turbine at full load is at least equal and frequently higher than that of an engine of similar capacity and at fractional loads the degree of economy is decidedly in favor of the turbine. This is owing to the relatively more efficient utilization of the steam at partial load and also the lower frictional losses. As the load factor of a prime mover is commonly less than full load, the resultant relative economy of the turbine is considerably higher than if it were judged only by a comparison of the steam consumption of both the turbine and engine at full load—a comparison at one-half load would more nearly represent the average operating performance of a railway power station. The turbine has also the advantage of a better maintained operating economy as it is not dependent upon the setting and fit, of admission and exhaust valves, the derangement and leakage of which may reduce the initial economy of the engine 15 per cent or even more, depending upon the degree of attention which the engine receives.

The attendance and maintenance, as would be expected from a comparison of the mechanism, of the turbine and engine is in favor of the former. The reliability has also been proven by extended runs and further by the accidental admission of water, which although harmless to the turbine, would have caused serious injury to an engine.

Tests of the performance of a 2,000-kw. Curtis turbine at different loads and under various steam conditions show characteristically high economy at the fractional loads.

The higher economy secured by superheating does not altogether represent an equivalent reduction in fuel, as a certain additional amount of coal is required to produce the superheating. The net result, however, shows a saving in favor of superheating.

While the larger sizes of turbines have been more generally applied to driving alternators, they are adapted for direct current railway generators, and turbine sets of this character have been built up to 2,000 kw.

The turbine certainly gives great promise of being the only steam driven prime mover of the future for producing electric power and its usefulness is by no means limited to that particular field.

Each year bears evidence of the growing popularity of electric traction and the increase in traffic has naturally affected both the size and weight of the cars and the schedule speeds.

The more onerous conditions imposed on the electric apparatus to meet the ever increasing demand for larger and heavier equipments and the demand for greater seating capacity on systems already operating at 500 to 550 volts, has led to an increase in the generated voltage. We have been accustomed to consider 500 to 550 as the standard direct current voltage but 600 volts is now being used to such an extent that it has really become the standard for the power station.

The role of the manufacturer is to design and construct such apparatus as will best meet the conditions of the operating companies and it is, therefore, the requirements of the operator that should be studied rather than the development of any particular idea.

The direct current railway motor has been greatly improved and has undergone more changes in detail than is perhaps generally appreciated. The old troubles of sparking and flashing at the commutator have been practically eliminated. Previously it was considered advantageous to short circuit a turn on the field winding to reduce the sparking at the brushes and in the controller, the idea being to restrain the rapidity with which the magnetism of the motor changed, but several years ago it was found that while this provision decreased whatever troubles occurred due to opening the circuit, that it was a positive cause of flashing in case the current was interrupted and suddenly applied. For example this trouble would occur on passing a section insulator with the controller on, and more especially when operating with sleet on the trolley wire or running over a third rail with an uneven surface.

The field coils as now made not only have no short circuiting turns, but where metal spools are used, it is customary to split the spool and introduce an insulation into the shell to eliminate every feature of a short circuited turn.

The armature revolutions of a motor as affecting the peripheral speed of the commutator have also an effect on the sparking and wear of the commutator. The armature revolutions further affect the performance of the bearings and while it would be possible to build a lighter and cheaper motor at higher armature speeds, a maximum of 1,500 r. p. m. appears to be the highest desirable limit as indicated by experience.

To meet the requirements of the higher voltage now more commonly used, and to further insure the stability of the motor as regards flashing, it is now the practice to provide a greater number of commutator segments; that is, the voltage difference per commutator bar has been reduced to a lower figure.

The commutator being a revolving switch, it is important if sparking and flashing are to be avoided that the brushes should maintain good electrical contact with the copper segments. The commutator being built up of alternate sections of copper and mica it sometimes happens that the mica does not wear evenly with the copper. In such cases the sparking becomes more pronounced and there may even be serious trouble from flashing; the most effectual remedy in such a case is to groove out the mica betwen the commutator segments to a depth of about 1-32 in. below the surface of the commutator. Many cases of troublesome commutation may be wholly cured by this expedient.

The performance of a motor for any service may be limited by its commutation or as is more commonly the case by its heating. The heating of a motor is affected by the losses in both the copper and iron, but the relative heating effect of these two elements is quite different. The copper losses predominate during acceleration and the iron losses when running at the higher speeds; the effect of the iron losses is, therefore, to limit the capacity of the motor for continuous running. Although the service in which motors are now commonly used does not call for a continuous run of many hours at full speed, without occasional acceleration, the iron losses are, nevertheless, of importance, and more care than formerly is now exercised in the selection of the iron for the armature. The principal cause of these iron losses are the eddy currents in the iron and to eliminate these a special study has been made of annealing and japanning the laminations.

While the temperature of a motor under given conditions is proportional to its internal losses the actual temperature rise may be greatly influenced by ventilation to assist in dissipating the accumulated heat. Forced ventilation by means of a blower, similar to those used with air blast transformers, may be employed. By this means the temperature of the motors in any particular service may be very much reduced, but the complication is such that it does not seem well adapted to the ordinary electric car. Forced ventilation is, however, well suited to locomotive work where the blower may be

* Read before the American Street Railway Association, September 2?, 1905.

carried in the cab. As the motor commonly used depends upon its own rotation for ventilation, the arrangement of the ventilating passages must be carefully studied, not only to secure the best cooling effect, but also to prevent depositing brake shoe and carbon dust or other injurious material upon conducting surfaces of the motor which cannot be conveniently cleaned.

For this reason it is inadvisable to provide ventilating ducts just at the back of the commutator ears for any accumulation of conducting dust at this point is sure to produce burn-out. It has also been found advisable wherever ventilating ducts are provided through the core head to extend the slot insulation of the armature coils for some distance beyond the end of the core.

The use of oil in preference to grease for the lubrication of motor bearings seems now to be universally favored. Of the various methods which have been tried, a waste packed journal with an oil well, similar to the journal box of a car truck, has given the most satisfactory results. Nearly all the larger motors at the present time are designed for this method of lubrication.

The mechanical injury to motor armatures usually results either from the armature striking the pole pieces or the mechanical weakness of the armature binding. The former, where resulting from the wear of the armature bearing linings or loose cap bolts can be avoided by a proper system of inspection, but the latter is a question of motor design.

The strains to which the armature bindings are subjected, particularly if the car is speeded above the normal, by driving it with power down grade, are not ordinarily appreciated. As an illustration, the weight of the armature coils in a 125-h.p. motor is less than 200 lb. and yet the radial centrifugal strain of all the coils at 1,500 r. p. m. is about 48 tons, giving a resultant strain of over 15 tons on the binding wires, and even if these wires are strong enough to hold the coils without breaking, they may stretch enough to permit a considerable movement of the coils in the armature slot, resulting in an abrasion of the insulation. An armature should be so bound that there will be no evidences of weakness at 50 per cent above the maximum normal speed, and the ultimate strength of the binding or bursting speed of the armature should be at least double the maximum normal speed to insure the proper margin of safety.

The field coils of a motor, although subject to less potential than the armature, by reason of their location in the motor, are more subject to injury from occasional water. A distinct improvement has been made in the construction of the field coils by immersing them in a bath of hot compound under vacuum. The effect of this process is to thoroughly fill all air spaces with compound which not only renders the coil more water-proof but also makes it more solid and less liable to injury from mechanical vibration.

More attention is being paid to the fit of commutator and oil well covers, which, being frequently opened, are now provided with machined seats in order to insure a better fit for the exclusion of dirt and water.

With the increased capacity of the motors the strains on the gearing have very much increased, particularly on the pinion teeth which are of weaker section than the gear teeth. To meet these more severe conditions a very high grade of steel is required both with respect to ultimate strength and elastic limit. The grades of steel commonly used five or six years ago would by no means answer for the pinions of the larger motors built today. Not only are the strains severe, but owing to the over-hang of the pinion, the face of both the gear and pinion teeth when new and doing heavy work are not in contact across their full width. The strain is borne principally by the end of the teeth nearest the motor, with the result that a shearing action takes place which will sometimes break out a part if not the whole of a pinion tooth. As a pinion wears the teeth become thinner on the side toward the motor so that a pinion which has been in service until its teeth match with the gear across the full face, may prove stronger under stress than a new pinion.

The solid axle gear is to be preferred to the split gear, and, were it not for the inconvenience of removing the car wheel, would doubtless be more generally used. The objection to removing the car wheel for the reason that its fit on the axle is impaired, may be overcome by the use of a wheel with an extended hub, on which the gear is shrunk, as proposed by Messrs. Doyle and Brinkerhoff and in use on the Interborough, New York.

The more severe demands of present service have also necessitated changes in the older type of controllers, as well as the development of new types of control and control appliances. The cylinder controllers have been improved by making the arc deflectors of a more vitreous material, less affected by the arc and productive of a much smaller quantity of condũcting gas when opening the circuit under abnormal conditions.

For the control of equipment aggregating [illegible] h.p. and over, the Type-M control, consisting of electrically operated contactors or switches, is recommended and is being very generally used. It is not only possible to handle heavier currents and a higher voltage by contactor switches, but a further advantage lies in the fact that the master controller occupies considerably less space than a cylinder controller handing the full motor current.

Whether the cars are operated singly, or in trains as the Sprague-General Electric multiple-unit system, the control may be either hand operated or automatic in its action; in the former case the handling of the master controller is similar to the ordinary cylinder control, and there are controller notches coresponding to each rheostatic step and the series and parallel running points. In the automatic control there are only three positions of the handle, the first one giving slow movements to the car for switching; the other two points being the series and parallel running positions. The intermediate rheostatic points are actuated automatically by a series relay on each car of the train. The automatic form of control is well adapted for services where the rate of acceleration may be predetermined and need not be dependent upon the judgment of the motorman.

For automatically protecting the equipments from the results of accidental short-circuits it was the early practice to provide fuses consisting of a composition of lead and tin; and although magnetic fuse boxes were used, their action with this type of fuse was not always satisfactory. It was partly for this reason and because of the time required to replace fuses, which with the older types of equipment were more frequently blown, that the automatic circuit breaker came into quite general use. On the larger equipments, however, where the circuit breakers had to be set for 1,000 amperes or more, it was found difficult to provide space for them in a position where the arc resulting from a short circuit, would be free from danger of grounding to some part of the car. As a substitute for the circuit breaker in this heavier class of work, many different forms of fuses have been tried, but none have proved thoroughly reliable with the exception of a fuse composed of thin copper ribbon enclosed in an insulating chute and surrounded with enough iron to provide a magnetic field. This copper ribbon fuse has been quite generally used on the larger equipments for the past few years and has given excellent satisfaction. The same type of fuse is applicabell mouths or other provision to avoid abrasion of the wire, the car perior to the circuit breaker, as its reliability is a strong point in its favor. A circuit breaker should have frequent inspection and in case of several repeated short circuits it may be so injured as not to finally extinguish the arc without an amount of flame that may alarm the passengers.

It is a matter of favorable comment that the car wiring is now receiving much more attention than formerly. Those familiar with the character of work formerly done, will readily testify to the advantages secured by eliminating the dangerous practice of attaching the wires by staples or other means to any convenient place on the under side of the car and often without regard to the movement of the brake levers and compression of the springs of the loaded car. The best recognized practice is now to install all wiring in iron conduit and if properly done with the ends of the pipes fitted with mouths or other provision to avoid abrasion of the wire, the car wiring should prove the most safe and permanent part of the electrical installation.

The suggested improvements in wiring apply with even greater force to the lighting and heating circuits, as these circuits have generally been given less attention than the motor circuits. As a source of fire, the lighting and heating wires are dangerous on account of their location in the roof or sides of the car, their inaccessibility for inspection and the fact that current is often left on these circuits when the cars are in the car barn.

While many of the preceding remarks have been based more particularly on the experience with direct current apparatus, the essential principles apply equally to the alternating railway equipment.

During the past year there have been several installations of alternating railway equipments and the outlook is very promising for this class of equipment under conditions advantageous to its use. Considered wholly from a technical standpoint there is no question but that alternating current motors can perform any service now

done by direct current apparatus, but the choice, as between alternating and direct current should not be made without a full consideration of the direct and indirect expense incident to either type of equipment.

As the street railways and the steam railroads are now becoming so closely identified, a reference to some of the recent tests of the New York Central electric locomotive will not be out of place. This locomotive has now run over 21,000 miles with trains of varying weights. The maximum speed attained with a train weighing 278 tons, including the locomotive, was 71 miles per hour in a distance of about 4 miles. With the locomotive alone the maximum speed was 85 miles per hour, with the probability that the speed would have been 100 miles per hour had the run been twice the length.

[With Mr. Potter's paper were presented diagrams showing the results of tests made for the purpose of checking the results obtained from the speed-torque characteristics of the motor. The comparative steadiness of the pull of the electric locomotive is very marked.]

The total weight of this locomotive is 97 tons, of which about 70 tons is on the drivers. The nominal rated power is 2,200 h.p., although the output during acceleration has often exceeded 3,000 h.p.

The locomotive with an eleven car train attached gives weight 433 tons.

In conclusion, I would call attention to the benefits that may be derived, both from an operating and manufacturing standpoint, from a record system covering the mileage of parts and detail cost of maintenance of the car equipment. The records of the power and sub-stations which are more easily kept, seem to be fairly complete, but of the car equipment the records do not seem to be generally available in such form as to permit a comparison of the relative merits of any particular method of operation or quality of material. If a uniform system could be standardized and the records submitted at each association meeting, they would be a valuable source of information and a further incentive to improvements in the design of apparatus and the methods of operation.

WHY WE ARE HERE.

Some of our readers may not know why they came to Philadelphia this fall, but the following from the Chicago Tribune of Aug. 14, 1905, will explain it all and some more besides.

TROLLEY COMBINE MAY BE FORMING.

Eight Hundred Manufacturers to Attend Conference in Philadelphia

Rivals Join Interests.

Westinghouse and General Electric Company Each to Have 30 Delegates There.

Philadelphia, Pa., Aug. 13.—[Special.]—Eight hundred of the heads of the largest firms in the country engaged in the manufacture of trolley cars have engaged rooms at the Bellevue-Stratford for the second week in September for a convention, which possibly will be the forerunner of one of the greatest consolidations of recent years.

J. C. McQuinton, superintendent of the Westinghouse Electric company, and F. H. Gale, president of the Westinghouse's former bitter rival, the General Electric company of Schenectady, each have engaged thirty rooms. The National Air Brake company has thirty rooms, and dozens of firms that appear as competitive bidders in making the body of trolley cars have secured adjoining apartments.

Members of the J. C. Brill company of this city, one of the largest manufacturers of car bodies in the world, decline to discuss consolidation rumors, but it is an open secret that members of this firm have held numerous conferences during the last six months with representatives of other large car concerns, and that by absorbing the works at St. Louis and Elizabethport a beginning, at least, has been made towards a general consolidation.

Among the other firms that have engaged more than ten rooms for their officers are the Blaine-Scholt company, the Loraine company, the Massachusetts Chemical company, the Consolidated Heating company, the Diff Manufacturing company, the Standard Paint company, and the Louisville railroad company.

Good rules (in a leather case) for those interested in electric railway supplies and machinery are being set forth by Jerry Hayes, of the Frank Ridlon Co.

FORMER CONVENTIONS A. S. R. A.

City.	Presiding Officer.	Year.
Boston	*Moody Merrill (Chairman)	1882
Chicago	H. H. Littell	1883
New York	W. H. Hazzard	1884
St. Louis	*Calvin S. Richards	1885
Cincinnati	Julius S. Walsh	1886
Philadelphia	*Thomas W. Ackley	1887
Washington	Charles B. Holmes	1888
Minneapolis	George B. Kerper	1889
Buffalo	Thomas Lowry	1890
Pittsburg	Henry M. Watson	1891
Cleveland	John G. Holmes	1892
Milwaukee	D. F. Longstreet	1893
Atlanta	*Henry C. Payne	1894
Montreal	Joel Hurt	1895
St. Louis	H. M. Littell	1896
Niagara Falls	Robert McCulloch	1897
Boston	Albion E. Lang	1898
Chicago	C. S. Sergeant	1899
Kansas City	J. M. Roach	1900
New York	Walton H. Holmes	1901
Detroit	H. H. Vreeland	1902
Saratoga Springs	W. Caryl Ely (Vice-President)	1903
St. Louis	W. Caryl Ely (President)	1904
Philadelphia	W. Caryl Ely (President)	1905

*Deceased

THE ARMSTRONG JOURNAL OILER.

The problem of properly supplying oil to the journals of a city or interurban car is a much more difficult one than that of furnishing oil to the bearings of a stationary machine. The loads on the car journal are continually shifting, the speed is seldom the same for more than a very short period, the bearings are subject to a racking motion on curves and when crossing special work, and the short distance between the journal boxes and the street or a dusty roadbed assures the presence of dirt in case any opportunity is offered for its admission to the journal box. From these causes the journal oiler field has been a tempting one for the exercise of inventive ability. One of the recent oiling devices which has been found to meet the demands of car journal oiling in a satisfactory way is illustrated. This shows the oiling device manufactured by the Armstrong Oiler Co., Philadelphia, Pa., in use in a standard M. C. B. journal box, a portion of the side of the box being cut away to give a view of the journal in its working position.

The oiler consists of a framework of elastic metal so designed that it adapts itself to the outlines of the journal box and the under side of the journal, the metal being held at a set distance from the journal by a number of wooden buttons in the metal framework which buttons rest against the surface of the revolving axle. With the exception of these buttons the elastic metal framework has its upper surface covered with a specially woven pad of cotton and wool fiber. Because of the buttons the loosely woven pad is not pressed tightly against the journal and therefore the packing material does not become incrusted with a metallic covering and tend to cut the journal but the pad rubs lightly against the under surface of the revolving axle, thus at all times keeping it evenly oiled. A large bunch of wicking material hangs from the lower side of this pad so that it is well immersed in the oil at the bottom of the journal box, and by capilary attraction climbs to the padding thus keeping the journal well lubricated.

The Armstrong journal oiler is made for many different styles of steam and electric journal boxes, it is simple and can easily be cleansed by soaking in hot water whenever the truck is being repaired. To assist in making the good qualities of this oiler more generally known, the manufacturer offers to send for 60 days' trial a sample set of oilers to fit the journal boxes of standard equipments. By reason of economy in oil and maintenance and the thorough way in which they oil the bearing, lessening the number of hot boxes these oilers have been adopted as standard by a number of electric railways, and unless otherwise specified they are fitted to all standard equipments manufactured by the J. G. Brill Co.

While the Watts & Uthoff Supply Co., of St. Louis, has no exhibit, it is ably represented by Otto W. Uthoff, president, and George E. Watts, secretary and treasurer.

NINTH REGULAR ANNUAL MEETING

STREET RAILWAY ACCOUNTANTS' ASSOCIATION

Philadelphia, Pa.—Sept. 28-30, 1905.

THURSDAY AFTERNOON.

The first session of the Accountants' convention was called to order at 2:40 p. m., September 28th, with President W. G. Ross in the chair.

The first business was the—

ADDRESS OF PRESIDENT ROSS.

In his annual address Mr. Ross carefully reviewed the discussion relative to the reorganization plans for the street railway associations, and incorporated the remarks of himself and Mr. Henry at the joint conference held in New York last February.

A graceful tribute was then paid to the work of Mr. W. B. Brockway, and his successor the present secretary, Mr. Elmer M. White.

The matter of an "International Form of Report" was reviewed, regret being expressed that the personal representation planned could not have been had at the conference in 1903; he believed, however, that things were now moving in the right direction and that substantial progress might be expected.

Reviewing the work done by the Accountants' Association, Mr. Ross said:

"Since the organization of the Association brought about by the suggestion of our late and able Secretary, Mr. W. B. Brockway, and the action of our good friend, Mr. H. H. Windsor, then editor of the "Street Railway Review," the history of the association has been one of unparaleled success. At the organization meeting called by Mr. Windsor and held in Cleveland on Mar. 23 and 24, 1897, there were 25 companies represented and enrolled in the membership. Since that date the membership has steadily increased notwithstanding the numerous consolidations, till it now numbers 150. To my mind this alone shows that the earnest, persistent and effective work done attracted the attention of the companies throughout the Continent, otherwise the membership now in the association would not have reached this large number."

After referring to the important work done in formulating the "Standard Classification of Accounts" and "Standard Form of Report" and the indorsement of these standards by the National Association of Railroad Commissioners, Mr. Ross proceeded to outline some of the things that can now be taken up to advantage.

"In connection with the various forms and records; one of the important matters still to be followed up and dealt with, is the taking up of these forms and records with the departments they affect, and as new associations are formed, such as the Mechanical and Electrical and Claim Agents' the committee of our Association appointed for this purpose should follow this matter up vigorously so as to endeavor to arrive at a standard set of forms that can as far as possible be used by all companies.

"Another question that should be given serious thought is the one of depreciation. This matter has been mentioned by previous presidents, especially by Mr. H. C. Mackay. Whether any conclusion can be arrived at or not as to the fixed amount necessary to provide for such a fund, it is difficult to say, owing to the various conditions existing with the different companies, but it is a question well worth our best thoughts, especially when we note the collapse of numerous companies within the last year or so.

"There is another matter which perhaps might well be taken up by the committee on Standard Forms of Reports and Accounting, that is, enlarging to a considerable extent the statistical information for our monthly and yearly reports. It seems to me that statistical information is of the very greatest importance to every road, not only on its own comparisons but for comparisons with other companies.

"I would call your attention to the valued and important services rendered the Association by our esteemed retired Secretary, Mr. W. B. Brockway. Those who have been in the association since its organization and those who have joined [illegible] that to a very great extent the success of the association has been due to his untiring efforts and effective work, and I know all feel deeply grateful and thankful to him for his great services, and although the executive committee registered a hearty vote of thanks to him at the time he retired, I am sure this meeting through its committee on resolutions, will endorse it by another one."

Secretary White reported that 13 new members were reported for the year and that the total membership is now 152.

Concerning the Department of Blanks and Forms the secretary said there had been sent out nearly 50 collections with something over 800 blanks, which those receiving them reported to have been of great assistance.

Messrs. W. F. Ham, P. V. Burington, J. S. Simpson and Irwin Fullerton were appointed a committee on nominations, and Messrs. P. S. Young, A. S. Wilde and C. S. Clark a committee on resolutions.

The new Constitution and By-Laws adopted for the American Street and Interurban Railway Association were read and after some discussion laid over for further discussion today.

The Question Box was then taken up and Questions Nos. 1 to 11 discussed.

Adjournment was then taken until 10 a. m. today.

FORMER CONVENTIONS ACCOUNTANTS' ASSOCIATION.

A list of the meeting places of the Street Railway Accountants' Association and of the presiding officers is as follows:

Cleveland	*Morris W. Hall, Chairman	1897
Niagara Falls	C. N. Duffy, Vice-President	1897
Boston	H. L. Wilson, President	1898
Chicago	J. F. Calderwood, President	1899
Kansas City	C. N. Duffy, President	1900
New York	W. F. Ham, President	1901
Detroit	H. C. Mackay, President	1902
Saratoga Springs	Henry J. Davies, President	1903
St. Louis	F. E. Smith, President	1904
Philadelphia	W. G. Ross, President	1905

*Deceased.

SHERWIN-WILLIAMS CO.

The Sherwin-Williams Co. is represented at the convention by E. M. Williams, H. E. Billau, western representative, and F. A. Elmquist, eastern representative to the street railway trade. The booth is one of the most attractive in the hall and is located at spaces 21 to 24, section D.

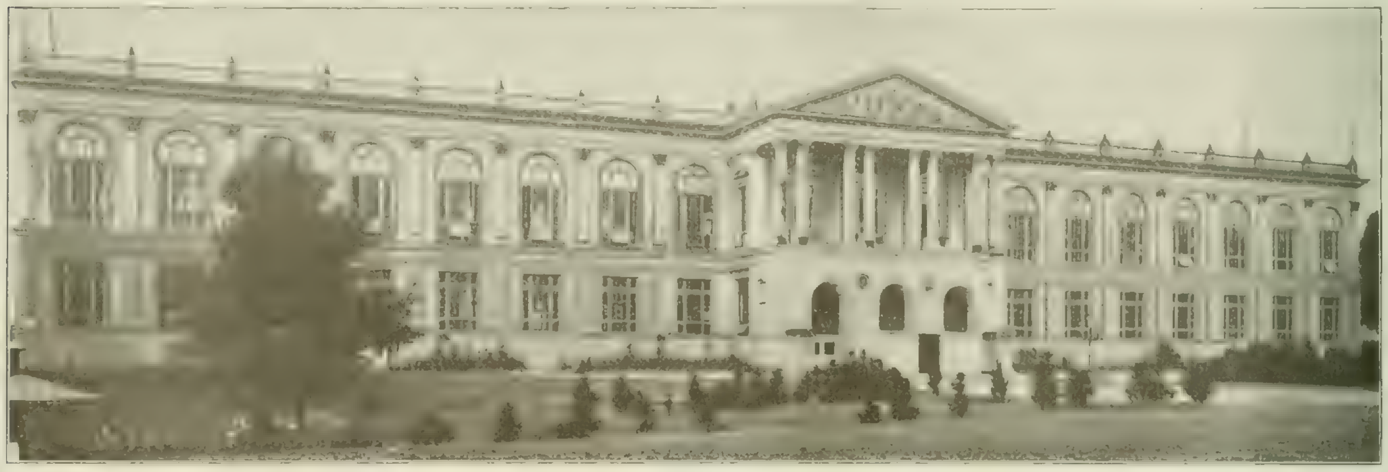
The exhibit illustrates a full line of the company's railway specialties; sections of car sides, showing the operation of the Sherwin-Williams system of car painting; sets of panels, representing the color combinations of representative street railways; a complete line of material for painting buildings, bridges, poles, power house machinery, etc. A very handsome set of photographs illustrates the extent of the company's business, which includes a large number of factories and warehouses in the larger cities in the United States. An interesting fact in connection with the company's business is that it owns its own zinc mines and smelters, operates its own steamers between Duluth and Cleveland, and has complete control over the supply and transportation of its raw material. The chamelion souvenirs at the Saratoga convention are displaced by watch fobs, but the little animals are used for decorating the noveau art posts, which adorn the booth.

THE PHILADELPHIA COMMERCIAL MUSEUM.

The origin and work of the Philadelphia Commercial Museum, in whose spacious buildings the street railway associations have the privilege of holding this convention, is of great interest and this occasion is an appropriate one for briefly setting forth the scope and success of the Museum. The Philadelphia Commercial Museum was organized under an ordinance of the City Councils, approved by the Mayor June 15, 1894, and a board of trustees was created at the same time to direct its affairs. This board is composed of the governor of the state of Pennsylvania, the mayor of the city of Philadelphia, the presidents of the select and common councils, the state superintendent of public instruction, the state commissioner of forestry, who are ex-officio members, and 14 representative citizens as life members.

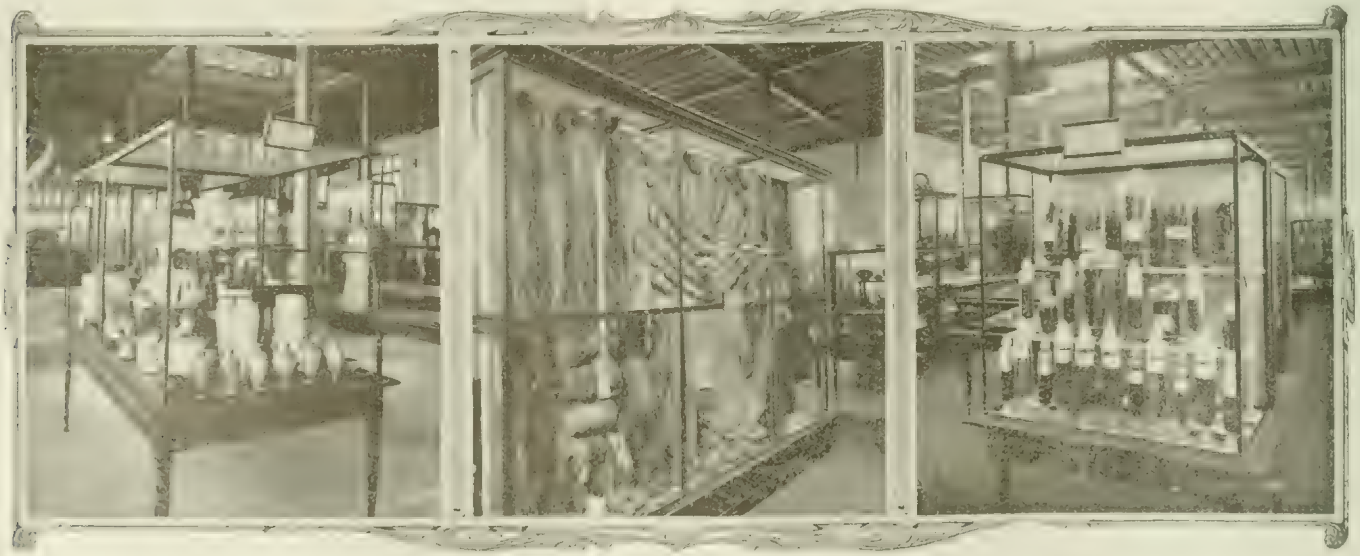
The resources of the institution are dependent upon an annual appropriation from the city of Philadelphia, an occasional state appropriation and an additional income from membership subscriptions. Having no private ends to serve and not being dependent in any sense on profit making for its maintenance, the amount received from manufacturers and others making systematic and continued use of its services is applied directly to enlarging the scope of its work and perfecting its facilities. The buildings of the institution include its business offices, library and executive branch, which occupy a large building on Fourth St., near Walnut. Here are also displayed many samples of raw products and type samples of foreign manufactured articles, collected in foreign countries for the purpose of instructing American manufacturers as to the demands, requirements, and supply of many important markets. Located on the banks of the Schuylkill River, near South St., in West Philadelphia, the institution has 56 acres of ground, of which 16 have been developed and on which are large and imposing buildings, completed and in course of construction. The one in which the convention is held has been finished sufficiently to permit the installation of a magnificent collection of material.

The Philadelphia Museum, when completed will comprise a group of museums planned and developed to illustrate commerce and industry, education and the arts and sciences, of which the Commercial Museum has attained the broadest and most rapid development. Comprehensive collections have been presented to the museum by nearly every country in the world whose products we import and to whose markets we send our manufactures and among those displayed are those from Japan and China, Indo-China and Siam, Australia and New Zealand, Oceania, British India and Burmah, the various colonies of Africa, the West Indies, Mexico, Central America, the Argentine Republic, Chile, Peru, Venezuela and other republics of South America. A magnificent collection from the Philippine Islands, comprising the first choice of the Philippine exhibit at the Louisiana Purchase Exposition, has been presented to the museum and is now being classified for installation. These collections are of special interest to the business men of the country as illustrating the customs and resources of the various foreign peoples with whom they deal and offer to the student and the public an opportunity never before enjoyed of studying at first-hand, subjects heretofore accessible only in text-books. With the present position that this nation has taken among the nations of the world, our constantly increasing imports and exports demand a practical and intelligent working-knowledge of other lands, of the people that inhabit them, the products they can furnish for our comfort and convenience and the markets they afford for the products of our farms, mines and factories. To this end, the further development and perfection of the facilities offered by the Philadelphia Museum are directed.



PHILADELPHIA COMMERCIAL MUSEUM

The means employed for disseminating the information concern-



PHILADELPHIA COMMERCIAL MUSEUM

ing foreign countries and their resources are through the Museum library and its membership service. The library, which is open to the public, contains more books, pamphlets, periodicals and official reports of recent date relative to foreign trade and commerce than are gathered together in any other commercial library in the world. This valuable collection of trade literature includes statistical reports of all foreign governments issuing such documents, official government gazettes, reports of trade bodies, custom-house regulations and custom tariffs, handbooks and yearbooks descriptive of many foreign countries, consular reports from all countries publishing such reports, and special works regarding trade, commerce, agriculture, mining and general conditions in foreign countries. Foreign and domestic trade papers, as well as many daily and weekly papers from nearly all parts of the world are filed in the periodical rooms adjoining the library, while in a room by themselves are placed directories from all countries, including city and special trade directories.

The service to members includes lists of foreign importers, dealers and large consumers; reports on trade condition, business opportunities and new enterprises; special investigations in foreign markets in the interest of members; replies to all inquiries regarding foreign commercial matters or foreign business houses; suggestions as to the establishment of agencies and assistance in securing reliable agents; prompt notification of all inquiries from foreign merchants desiring to purchase American goods; and translation of business correspondence. The trade lists furnished do not include a mere list of names but give full details as to the nature of the business of each firm and are prepared after a careful search of all available records; they are selected lists, not indiscriminate copies of directories. The steady inflow of valuable information which is received from foreign sources is not allowed to grow old and stale but is placed in the hands of members as soon as it is received, in the form of typewritten reports, special publications or personal letters. A staff of competent men, familiar with the needs of American exporting houses, make frequent visits to foreign trade centers and conduct active campaigns in the interest of American trade, at the same time familiarizing themselves with the opportunities of introducing American products and securing definite information concerning the local reputation and business methods of the principal importing houses. The services of these men for any special investigations are at the disposal of the members of the Museum. Through the medium of a bulletin, issued weekly, all members are kept posted regarding inquiries from foreign firms for goods in their respective lines. These bulletins also include notices of firm changes, alterations in the tariff of foreign countries, warnings of the activity of fraudulent firms, etc. For the purpose of answering inquiries from foreign firms regarding American products, the Museum maintains complete and carefully indexed records of all lines manufactured by members. The translation bureau is efficient and prompt, undertaking only the translation of business correspondence.

The institution has in course of preparation an exceedingly valuable work, giving a full treatise on the commercial conditions of foreign countries. It is being issued in sections at present, each section covering some one country, but will probably be published eventually in complete form. This work includes a full statement of the extent and value of each country, its population, physical and political features, climate and rainfall, banking methods, weights and measures, cable rates and shipping facilities, describing each city of commercial importance and gives some particulars as to customs duties, patent and trade-mark laws, etc. It also shows how the courts are constituted and describes means of internal communication, gives a carefully prepared and detailed analysis of the imports, concluding with an estimate of the resources of each country. Members receive all parts of this work already completed and such new sections as may be issued.

LORD ELECTRIC CO. DINNER.

The representatives of the Lord Electric Co. attending the convention were the guests of Mr. F. W. Lord, president of the company, at dinner last evening at the Bellevue-Stratford. Those who enjoyed the sumptuous feast and the theatre party at the New Chestnut St. Theatre, were H. M. Shaw, manager New York office; E. R. Hudders, New York; G. W. Smith, and H. R. Wallace, Baltimore; W. R. Garton, Chicago; G. E. Watts and O. W. Uthoff, St. Louis; Edward W. Hamlin, general manager.

PUBLIC SERVICE CORPORATION BLANKS.

In connection with [illegible] and forms of the Street Railway Accountants' Association, the Public Service Corporation of New Jersey has prepared a complete set of the blanks and forms [illegible] Gen-eral Office Blanks, Railway Department Blanks, Electric Department Blanks, and Gas Department [illegible]

General Office Blanks:

- Executive Offices.
- General Manager, Gas Department.
- Commercial Agent, Gas Department.
- General Manager, Electric Department.
- Commercial Agent, Electric Department.
- Treasurer's Department.
- Purchasing Agent's Department.
- Real Estate and Tax Department.
- Advertising Department.
- Comptroller's Department.

Railway Department Blanks.

- Income "A," Reports of earnings, etc.
- Income "B," Tickets, passes, register readings, etc.
- Labor "A," Applications, references, examinations, etc.
- Labor "B," Time cards, pay rolls, summaries, etc.
- Material, requisitions, orders, inventories, etc.
- Maintenance, requisitions, shop orders, etc.
- Transportation "A," Time tables, delay reports, etc.
- Transportation "B," Instruction to trainmen, etc.
- Vouchers.
- Monthly and Annual Reports.
- Claim Department Blanks.

Electric Department Blanks.

- Production.
- Transmission.
- Distribution.
- Commercial.
- New Business.
- Meters.
- Storeroom.

Gas Department Blanks.

- Manufacturing.
- Distribution.
- Commercial.
- Meters.
- Storeroom.
- Coke Plant.

The value of a collection of the blanks and forms of such a corporation, whose organization is so complete and the scope of which is so great, can hardly be estimated and the association is to be congratulated upon having among its members one so interested as to devote the time and attention required for the collection and arrangement of so complete a set of blanks.

THE PENNSYLVANIA SPECIAL.

Western delegates who arrived Tuesday evening on the Pennsylvania special from Chicago have spoken very highly of the manner in which they were taken care of en route. A special representative of the passenger department accompanied the party and saw to it that the travelers to the city of Brotherly Love had all the comforts of a home. The larder and ice box of the dining car supplied with all the delicacies of the season and an efficient corps of waiters and porters assuaged the hunger and thirst of the travelers. The trip was made as scheduled and the daylight ride from Pittsburg to Philadelphia was very delightful, the line passing through a most productive part of the State of Pennsylvania.

Here and there at the convention hall and at headquarters Mr. A. K. Downs is greeting old friends and making numerous new ones, meanwhile talking Weber rail joints to all.

Berry Brothers, who make and sell railway varnishes, are also generous hosts and the ladies who smile at the Berry representatives in the proper way will be amply rewarded with some dainty favors. Neither do they forget the delegates who call.

TWENTY-FOURTH ANNUAL MEETING

AMERICAN STREET RAILWAY ASSOCIATION

Philadelphia, Pa.—Sept. 27-28, 1905.

THURSDAY MORNING SESSION.

Vice-president Beggs called the meeting to order at eleven o'clock, and stated President Ely was engaged on other business in connection with the affairs of the Association.

The first paper was that of Mr. Arthur West, entitled "Notes on the Design of Large Gas Engines with Special Reference to Railway Work," which will be found on page 700.

The paper by Mr. J. R. Bibbins on "The Application of Gas Power to Electric Railway Work," which will be found on page 714, was then presented so that the two might be discussed together.

Mr. C. O. Mailloux, of New York City, said there was too much meat in these papers to be discussed in detail, but there were one or two points which showed in themselves the progress the gas engine is making. He had called attention last year to the fact that the data which we had and the discussions which had been made, the evidence went to show that for any value of coal corresponding to about two dollars per ton, the steam plant and gas plant were about equal. This year Mr. Bibbins gives a diagram where these two lines cross at one dollar per ton. He thought this very significant. It showed that the cost of the gas engine power must have been greatly reduced in some way; either by reducing the cost of the machinery itself, or the cost of its maintenance, or by increasing its efficiency, and it would be very interesting to him if the author would give the reasons which has brought this about.

Mr. Bibbins replied that he did not quite understand to what diagram Mr. Mailloux referred, whether it was to a paper presented by Mr. Bibbins to the Ohio Gas Light Association?

Mr. Mailloux said he had reference to the lecture on the subject given by Mr. Ralph D. Mershon, before the New York Electrical Society.

Mr. Bibbins said he was not quite familiar with the assumption taken in the paper by Mr. Mershon, but assumed that Mr. Mershon worked up his diagram for an electric lighting plant, in which the load factor on the system is barely 25 per cent, usually lower than that. If reference were made to his assumptions in the last sheet of his report, it would be found that he had taken a load factor corresponding to an average plant, which is 66 per cent. That is really the greatest factor in determining the exact crossing of these two lines. He was not familiar with the prices which Mr. Mershon used in preparing his diagram. The costs he had used are also shown in the assumptions and they are quite recent. It will be noticed on the diagram that the lowest set of figures referred to the cost of fuel only. There, of course, the gas plant has a great advantage. In the second set of figures the cost of fuel is represented as added to the cost of operating.

Mr. Charles Hewitt, of Philadelphia, said that he well appreciated the difficulty of preparing diagrams such as those shown, as he had attempted on several occasions to prepare similar papers. He did not, however, think that these should be accepted without some question and some comment. He was not prepared to question Mr. Bibbins' line of cost for the gas plant but the line showing the cost per kw. h. for the steam plant seemed to him to be open to question; whether the diagram represented the comparison between two particular plants or not, he could not say, as he had not had an opportunity to read the text of the paper. If it did, all that he could say was that the steam plant end of the diagram is very uneconomical. Anthracite buckwheat coal runs between 11,000 and 12,000 heat units per pound. Reference to the diagram shows this to mean 7 to 8 lb. of coal per kw. h. The poorest plant which he was personally familiar with showed better results than that. He was familiar with plants running non-condensing which showed 4.5 lb. of coal from years end to years end. It will run as low with good coal as 4¼, seldom over 4¾, and the average for the year 4.4 to 4.5. Running condensing with the same quality of coal it is perfectly possible to run at 3.5 lb. of coal.

Mr. Hewitt further said that referring again to Fig. 11, the difference between the cost of operating the steam plant and the cost of operating the gas plant, it seemed to him was somewhat magnified. Taking coal at $2.50 per ton following that up to the cost for the steam plant, brings the cost of operating that plant over 9 mills. He was perfectly familiar with plants which are running at 6 mills with buckwheat anthracite coal, including all operating costs, not the interest on the plant, but all operating costs, including repairs. It is a very uneconomical plant that will run the year through at one cent. If the diagram in question is intended to represent the average results throughout the whole country it is very high for the steam end of it, and therefore magnifies the difference between the two lines, assuming the cost of the gas plant is correct.

Mr. Bibbins said that as regards Fig. 11 he had been somewhat apprehensive that it would be mistaken and, therefore, had taken pains to mention that it referred to a non-condensing plant. The equipment at St. Louis consisted of the three cylinder vertical gas engine belted to a generator and an engine of similar capacity. It could not be expected to get the same economy out of these two plants as out of the large central station. Not from the fact that the equipments were not equally comparable, but it must be borne in mind that the results were obtained with a non-condensing plant. He thought it was safe to say that the relative coal consumption between steam and gas plants would be about two to one; in the present case they are higher, being a non-condensing plant.

Mr. Bibbins said further that as to the diagram showing the comparative costs of steam and gas, he had probably erred in the matter of assigning a cost of .5 cent for the three items, labor, supplies and repairs. That, however, did not affect the relation between the two and he preferred to assign that equal value, in order that any particular quantity might be applied to other data. It could readily be seen if any advantage could be obtained in the gas plant, that the power gas line would be lower and consequently the intersection of the two would be nearer the cheaper grade of coal.

Mr. Mailloux inquired if Mr. Bibbins was able to give any information as to whether a change in the size of the plant would have an effect on the relative arrangement of these lines.

Mr. Bibbins said that the small gas engine will show an efficiency quite comparable with the large one, and therefore, the choice of the larger engine is determined mainly by the capacity necessary in the plant running with the ordinary view of obtaining ordinary high economy. He did not see any reason for the change in the relative costs of these various items in the smaller plant, provided the same number of units were used. The number of units, of course, has an immediate bearing on the operating cost.

Mr. Mailloux said he had intended to add to his remarks that the question of cost of installation, it seemed to him had quite an important bearing on the upper line of total costs, and he would presume that the smaller plant would have a much higher cost per unit than the larger plant, as is found to be the case with steam plants, at least within certain limits, and in the present connection he would like to ask whether the cost per kilowatt of gas engines had not been considerably reduced within the last year.

Mr. Bibbins replied that he agreed with Mr. Mailloux that the smaller plant would cost more per unit, even though the same number of units were installed; and at the same time the relative economy of the steam plant will increase much more rapidly, which might readily more than balance the increased capital cost.

The producer in smaller sizes is much more efficient than the boiler, and the same way with the engine, although it is impossible to tell whether the same relation will hold, as that must be taken

into account. He did not think he was in position to give Mr. Mailloux any correct data as to whether the cost of gas engines had been reduced in the last year; that was something which was not in his field.

Mr. Mailloux suggested that the floor should be given to Mr. L. C. Marburg, representing the Allis-Chalmers Co.

Mr. Marburg said regarding Table No. VII, he would inquire if the overload capacities had been taken into account in comparing the relative cost of the seam engine and the gas engine. He thought from the price given for the steam engine plant that it is evident that a reciprocating steam engine could be obtained which would have a 50 to 100 per cent overload capacity momentarily. He understood from Mr. Bibbins that th[illegible] he rated the gas engine is on the basis of 10 per cent overload capacity only. That might explain the point brought up by Mr. Mailloux as to the relative cost per unit in the case of the steam engines and gas engines as given in the paper.

Mr. Bibbins replied that the gas engines were rated at a 25 per cent overload capacity. The steam engine would have a greater overload capacity.

Mr. Marburg answered that that naturally would explain why on the curve given as to the relative costs for steam engine plant and gas engine plant the advantage is in favor of the gas engine at such a low cost of coal as given.

Mr. Bibbins stated that Mr. Marburg probably misunderstood the matter; that the Table No. VII applies to the tender in the European plant, and it has no bearing on the diagram he had prepared. The diagram was prepared from the assumption shown in the appendix, No. 6, at the end of the paper.

Mr. Marburg said that on that table the price of $40.00 per brake H. P. was given again. It would naturally be of interest to know what the overload capacity was.

Mr. Bibbins replied that the basis for a overload capacity in the case of the gas engine was 10 per cent. It was possible to assign an overload capacity in the same way on the steam engine. Simply take the steam engine at such capacity that it will give its best economy at about 90 per cent load, as is normally the case. That has a bearing on the subject, yet it was also true that if we take as a basis of comparison of steam engines up to 10 per cent, that is rating the machine at 10 per cent below its maximum, the economy would be very considerably above that which he had taken. He had taken the engine so that it would give its best economy at the average load of 75 per cent of the full load. Taken on the basis of 10 per cent below its maximum, the steam consumption would be high.

Mr. Marburg remarked that it would seem impossible to obtain a load factor of 66 per cent if the overload capacity of the machine is so small; 66 per cent is a good load factor for a reciprocating steam engine.

Mr. Mailloux said that the point which Mr. Bibbins made, it seemed to him was largely influenced by the form of steam motor used and its efficiency curve. One could see at once that it would be quite different in the case of steam turbines which have a notoriously flat efficiency curve, and it seemed to him that if the comparison were made with the steam turbine he would find in the first place that the line of cost for steam power would be much flatter, and in the second place the line would go further up. In the case of the comparison of the gas plant predicated as the basis of the calculations of the steam turbine plant, the line at which the two would cross would be more nearly at $2.00.

Mr. Bibbins asked if Mr. Mailloux were assuming only 10 per cent overload in the two cases.

Mr. Mailloux said that he did not think it would be necessary to make an assumption in the case of steam turbine because the efficiency curve is so nearly flat for three-quarters of its range. That if it were assumed that the normal capacity was 10 per cent of the stalling load, that the comparison would be still more favorable to the turbine, and force the point of intersection between the two curves at some point at least as high as $2.00 per ton.

Mr. Bibbins replied that he could not agree with this, because at the average load, as obtained from the load curve, was 84 per cent of its normal rating. The whole question got down to this—that if you increase the rating of your steam engine, you are going to increase the steam consumption of the steam plant very largely at the average load.

Mr. Mailloux said that he had been [illegible] at the steam turbine and that had an [illegible] normally.

Mr. W. E. Winship described a gas engine plant installed for the Gould Coupler Co., Depew, N. Y., consisting of three Westinghouse gas engines rated at [illegible] gas system. With coal [illegible] the coal consumption was 2.26 lb. per kw. h. [illegible] load factor of 70 per cent [illegible] days when the load factor was [illegible] per kw. h. for one 24-hour day [illegible] load factor.

In regard to the reliability of [illegible] been fully as reliable as any [illegible] been put in. They had only had the valves in the engines ground once, with the exception of one valve which they ground twice. They used the splash lubrication.

There are two points worthy of attention in any gas engine installation. There is a criticism which could be made in regard to the admission of the engines, especially where it is electric ignition. Some means should be provided for changing the igniters when the machine is in operation. The speaker did not know of any engine in which this is provided. Another need is for some rough indicating instrument for determining the heat content of the gas. Of course, there are calorimeters by which the heat content of the gas may be determined, but there is no rough and ready instrument to put in the gas producer house. The need of such an instrument is especially desirable for bituminous gas plants where the color of the flame does not give any idea as to the heat content of the gas. There ought to be such an instrument and it did not seem to be such a hard problem but that one could be designed.

Mr. Hewitt remarked that it might be of interest to some of the members to know the latest results in steam turbine plants which he had received only a few weeks ago from New England. As opposed to the 2.26 lb. which the last gentleman gave as the average for 30 days, their results show 2.4 to 2.6 lb. per kilowatt-hour with bituminous coal. The average is 2.5 for turbines as against 2¼ for gas engines. One of these plants has five units of about 1000 kw.; the other has two units. He thought in the latter there were about 1,500 kw. using superheated steam.

Mr. Bibbins stated in regard to changing the igniters, there is a system in vogue now which makes possible the changing of an igniter when the engine is running. In the plant in Philadelphia each cylinder is equipped with an igniter plug, which has two contacts, and either one may be thrown in or out by a little switch. There are four different sources of current for supplying the igniters and each cylinder is provided with a double set of igniters. If one of the igniters gets into trouble the other can be quickly cut in. If any of the gentlemen present were sufficiently interested he would be glad to go to the pumping station with them and show them the gas engine in practical operation.

The committee on nominations made its report at this point. Mr. John B. Parsons, Chairman, presenting the following list of nominees:

For President, W. Caryl Ely, of Buffalo.

For First Vice-President, John I. Beggs, of Milwaukee.

For Second Vice-President, Calvin G. Goodrich, of Minneapolis.

For Third Vice-President, James F. Shaw, of Boston.

(Under the new plan of organization the executive committee is made up of the officers and the presidents of the allied organizations. At a later period in the meeting President Ely announced the following members of the Executive Committee: Mr. H. H. Adams, of Baltimore, president of the Mechanical and Electrical Association, and Mr. S. L. Rhodes, of Philadelphia, on behalf of the Claim Agents' Association. As the Accountants' Association had not yet elected a president for the ensuing year, the name of the member of the executive committee representing the accountants' association cannot be given.)

On motion the report of the committee on nominations was accepted and the secretary authorized to cast the ballot of the association for the gentlemen named, which was accordingly done.

In response to calls for a speech, President Ely remarked that if he should say that the action taken by the association in electing him again to the presidency was not pleasing to him, to his feelings, he would not be telling the truth, but when he said that he had devoted a great deal of time to these matters for the last year and considerable time the year before, and that he could see that there was

a lot of work to be done during the coming year, to be commenced immediately and that the members should have selected some other person as President to go ahead at the present time, for several reasons, he would also be telling the truth. He said that he had grave doubts and expressed them to his friends who had come to him and said very nice and very pleasant things, that he had grave doubts about whether they applied to him or not and whether he really deserved all that had been said. He had said to these individuals that it seemed to him to be a time to put in a new man. The association had agreed upon a form of organization, and as he was not conceited he thought there were a lot of men available from whom a selection for President could have been made, but it seemed to him that he had been caught with the goods on and could not get away and, of course, he would stand. But there is a great deal of work to be done, and the new plan of organization cannot succeed unless hard work is put upon it and unless that work is participated in by all the leading members of the association. Everybody in the association must be called upon to co-operate.

President Ely believed that if every member of the association did his duty that the organization which would result in a few years would be so big and so useful to every member that the common sense of all connected with the association would lead them to say, "Why did we not inaugurate this ten years ago? What were we doing?" He expressed his appreciation of the honor conferred upon him, and said he would do his best with the assistance of the members, which assistance he trusted they would all give, and in conclusion he desired to say that he appreciated the action of the association as a very great honor.

The chair spoke briefly of the marked ability of the three vice-presidents and added that there were many gentlemen who were very much interested in the work who had been during the past year freely called upon, who had given very freely of their time and made most valuable suggestions. At some proper time in the future proper recognition should be paid them.

The president in conclusion said that if the members worked wisely and well, taking good advice and following it and all co-operated that in a year's time he believed the association could make an amazing stride.

The association then took a recess for luncheon.

THURSDAY AFTERNOON SESSION.

President Ely called the meeting to order at 2:15 o'clock. At the afternoon session the papers on "The Single-Phase Railway System," by Mr. Charles F. Scott, and on "Electric Railway Equipment," by Mr. W. B. Potter, were read.

[Mr. Scott's paper will be found on page 697, and Mr. Potter's paper on page 702.]

There was a lengthy discussion of the papers which will appear later.

It was voted that the thanks of the association be extended to the authors of the very excellent papers presented.

It was voted that hereafter all standing committees consists of three members.

The resolution with reference to the services of Mr. Penington which appears on page 712 was then offered and unanimously adopted.

It was voted that a committee be appointed to present the claims of elective railways for larger compensation for handling Government mails. Messrs. John I. Beggs, G. Tracy Rogers and P. F. Sullivan were named as this committee.

The committee on standard rules, consisting of Messrs. E. G. Connette, W. E. Harrington, Robert McCulloch and John J. Stanley, reported that the rules recommended for city roads had been generally adopted, but that the rules adopted by the steam railroads were recommended for interurban roads.

The report was adopted and Messrs. E. G. Connette, Richard McCulloch and E. C. Faber appointed as a new committee on standard rules.

Messrs. H. J. Davies, E. W. Olds and T. C. Penington were appointed as a committee on insurance.

Messrs. C. Loomis Allen, John A. Rigg and W. A. Smith reported from the committee on resolutions, expressing the thanks of the association for courtesies extended to:

The American Street Railway Manufacturers' Association.

John B. Parsons, president, and the officers and heads of departments of the Philadelphia Rapid Transit Co.

Officers of the Philadelphia & West Chester Traction Co.

Passenger Railroad Association.

Dr. W. P. Wilson, director of the Philadelphia Commercial Museums.

The Engineers' Club.

The Manufacturers' Club.

The Southern Club.

Mayor Weaver, the local press, the local committee, etc.

The association then adjourned until the close of the Accountants' convention on Saturday, September 30, 1905.

PEERLESS RUBBER CO.

The representatives of the Peerless Rubber Co. include W. J. Courtenay, manager railway department; F. O. Donnell, assistant manager railway department, and J. L. McGilvray, sales agent. The company exhibits at space 8, section B, a full line of packing, belting, trolley dodgers, treads and rubber hose. The company is manufacturing a hose claimed to stand 8,000 lb. pressure per square inch, which has been adopted for use by the construction company building the Pennsylvania, New York and Long Island tunnels.

NATIONAL CAR WHEEL CO.

The representatives of the National Car Wheel Co., Sayre, Pa., include John H. Yardley, sales agent, Philadelphia; A. H. Strickland and E. H. Chapin, New York; A. T. Chapin, Rochester, and George C. Morse, Taunton, Mass. The company has an exhibit of steel tired wheels at space 19, section K, where its representatives will be glad to explain the merits and advantages of these products.

STANDARD RAILWAY TRACK APPLIANCE CO.

The Standard Railway Track Appliance Co., Kalamazoo, Mich., heretofore known as the Merrill-Stevens Manufacturing Co., has an exhibit of track and car jacks, steel and wood cattle guards, and a new hand, collapsible, self-feed, track drill at space 4, section C. Mr. Eugene Cook, treasurer of the company, is its representative at the convention.

SPEER CARBON CO.

A full line of the well-known products of the Speer Carbon Co., St. Marys, Pa., is exhibited at space 4, section C, and the company is represented by Mr. John Speer, president and general manager, and G. P. Fryling, secretary. The carbon brushes of this company are made especially for railway motor work, of very fine texture, self-lubricating, and do not split or break under most severe conditions. The Speer graphite brushes are made from pure graphite by a special process, in two grades; one tempered to a medium hardness and the other much softer, conforming to the regular hardness of graphite. The company carries in stock brushes for elevator and crane motors, in addition to a full line of lightning arrester carbons, circuit breaker contacts, compressor contacts, battery plates and in fact everything made from carbon.

THOMAS PROSSER & SON.

This firm's exhibit in space 27B, Section I, included a Krupp steel-tired car-wheel. This wheel which is designed with thread and flange for trolley operation has a heavy steel tire fitted and locked to a cast iron center. Thomas Prosser & Son are also selling agents for many other of the Krupp products.

The Parmenter Fender & Wheel Guard Co., 84 State St., Boston, is exhibiting both its fenders and wheel guards at space 12, section L, and is represented at the convention. Mr. George A. Parmenter, general manager.

The Electric Railway Equipment Co., Philadelphia, is represented at the convention by its officers: A. S. Vane, president; M. Herman Brill, vice-president, and W. H. Heulings, secretary and treasurer. It has an exhibit at section J, space 22, where a full line of electric railway supplies carried by the company are displayed.

NATIONAL ELECTRIC CO. PRODUCTS.

An interesting exhibit of the products of the National Electric Co., Milwaukee, Wis., is to be found in space 11-18, section J. Here are shown some machines and apparatus of late design. An auto-starter for 200 h. p. induction motor, with transformer, switch points and connections enclosed in an iron case; a new type of 10 h. p., 230 volt direct current motor designed to run at 850 r. p. m.; a 7½ h. p. motor-generator set of late design; a motor compressor set of 16 cu. ft. capacity with its framework built to enclose all the working parts thus doing away with the necessity of a cage, accompanying this set are the new type-3 governor and an entirely new design of engineers valve designed with the parts to operate with a sliding instead of a revolving motion thus lessening trouble from wear; a single-phase motor-compressor designed to operate either on 500-volt direct or 240-volt alternating current circuits, and several other types of generators and motors lately designed and now being placed on the market by the National Electric Co.

JOLT LUBRICATORS.

Jolt lubricators have been given a most exhaustive test for over a year by the Rhode Island Co., Providence, R. I., and have been found reliable and efficient. They have satisfactorily and economically solved the problem of applying oil directly and automatically to motor and axle bearings, in place of grease. This company has over one thousand in use at the present time, and is putting them in service until all cars are equipped with them. The exhibit of the Jolt company is at space 32 a, section I.

The smiling face of Mr. W. R. Kerschner, 39 North 15th St., Allentown, Pa., has been very much in evidence during the convention. Mr. Kerschner has a large supply of second-hand electrical machinery at Allentown, which he would like to dispose of.

Mr. W. A. Dutton, treasurer of the Van Dorn & Dutton Co. and the Van Dorn-Elliott Electric Co., Cleveland, O., reports a very pleasant and successful visit to the convention.

Mr. W. H. Wilkinson, representative of the passenger equipment department of the Pressed Steel Car Co., 24 Broad St., New York City, is in charge of the new all steel car built for the Metropolitan Street Railway Co., which is on exhibit in the convention hall.

The Niles Car & Manufacturing Co. is represented at the convention by J. A. Hanna, of Cleveland, O., who was erroneously quoted as representing the Jewett Car Co. Mr. Edwin Besuden is representing the latter company.

The Trolley Electric Vehicle Co., of America, 737 Drexel Building, Philadelphia, is represented by the company's general manager, G. W. Goddard. The company is exhibiting its vehicles at the convention, and John M. Lansden, jr., president of the Lansden Co., Newark, N. J., who makes these wagons, is also in attendance.

M. A. Berg and E. R. Mason, of Porter & Berg, Chicago, are circulating among the delegates and distributing attractive aluminum match boxes.

The exhibit of the W. R. Garton Co., Chicago, is included in that of its eastern sales representatives, the Mayer & Englund Co. Mr. W. R. Garton, president, is personally looking after the company's interests this week.

Mr. P. Albert Poppenhusen, president of the Green Engineering Co., manufacture of Green traveling link grates, is among the representatives of those companies who are not exhibiting at the convention.

Messrs. Chubbuck and Fischer, managers of the McKinley Syndicate properties of northern and central Illinois are with us. A telegram today advises that Congressman W. B. McKinley has returned from his foreign trip with General Taft and will reach Chicago Sunday next.

PERSONAL.

Mr. George D. [illegible], [illegible] of the Rochester Railway Co., Rochester, N. Y., resigned September [illegible] to engage in other business.

Mr. Frank P. Fosgate, [illegible] of the Boston & Maine R. R. at Concord, N. H., has been appointed [illegible] superintendent of the Portsmouth Electric Railway Co., succeeding Mr. Arthur F. Howard, who has been appointed assistant to the chief electrician of the Boston & Maine R. R. Mr. Fosgate has had an experience in steam railroad work extending over a period of 15 years.

Mr. Charles E. A. Carr, who for ten years has been manager of the London Street Railway Co., London, Ont., has resigned, to accept a more lucrative position elsewhere.

Mr. O. A. Honnold, operating engineer of the Utah Light & Railway Co., Salt Lake City, has been promoted to the position of chief engineer of the company, succeeding Mr. A. H. Hayward, resigned. Mr. Honnold is a graduate of Purdue University, since which time he has been engaged in electric railway work. He was first connected with the Detroit United Railway Co. as assistant superintendent of construction, and was later employed by the Lachine Rapid Power Co., of Montreal, Canada. He has been in the service of the Utah Light & Railway Co. since 1896.

Mr. J. F. Witmer, of Buffalo, N. Y., has been engaged by J. G. White & Co., and will assume charge of special work for this company bearing on hydraulic engineering in foreign fields. Mr. Witmer has had an office as consulting engineer at Buffalo for several years and had designed and superintended the construction of a large number of water works systems throughout the United States.

BRILL AND ALLIED COMPANIES.

The exhibit of the J. G. Brill Co. and allied companies, the American Car Co., the G. C. Kuhlman Car Co. and the John Stephenson Co., occupies spaces 4 to 20 of section H, and is 170 x 15 ft. in size. Apparatus exhibited by these companies includes the following: "Grooveless-post" semi-convertible car, "Grooveless-post" convertible car, all-steel car, centrifugal sprinkler, No. 21-E single-truck, "Eureka" maximum traction truck, No. 27-G short-base double-truck; three sizes, No. 27-E high-speed truck; solid forged side frames for the various trucks and car truck patented specialties.

The representatives of the J. G. Brill Co. at the convention are: Samuel M. Curwen, general manager; W. H. Heulings, jr., assistant secretary; Geo. M. Haskell, salesman New England states; J. Ellwood Brill, salesman supply department. The representative of the American Car Co. is George H. Tontrup, general sales agent. The representatives of the G. C. Kuhlman Car Co. are: Samuel M. Curwen, president, and D. B. Dean, manager sales department. The representatives of the John Stephenson Co. are: W. H. Heulings, jr., president, and E. J. Lawless, general sales agent.

Mr. George H. Miller, president of the Miller Anchor Co., Norwalk, O., has quite an extensive exhibit of Miller guy anchors and augers at spaces 18 and 20, section D. Among the companies using these products are the Bell Telephone Co., Detroit & Toledo Construction Co., Commonwealth Electric Co. of Chicago, Louisville Traction Co., Nashville Railway & Light Co., Lake Shore & Michigan Southern Ry., and the De Forest Wireless Telephone Co.

John J. Ruddick, electrical engineer, United States Electric Signal Co., West Newton, Mass., is shaking hands with his friends and telling new acquaintances of the merits of the company's signal.

The Harrison Safety Boiler Works, Philadelphia, has on exhibit at space 8, section K, its well-known Cochrane feed-water heater and steam and oil separators of the Sorge-Cochrane system. The company is represented at the convention by R. H. Eisenbrey and J. R. Hibbs.

The double interlocking recording block signal manufactured by the Baldwin & Rowland Switch & Signal Co., of New Haven, Conn., is being exhibited at the company's booth, section I, space 29b. Messrs. H. Rowland, R. A. Baldwin and G. A. Simmons are attending the convention and looking after the company's interests.

Mr. H. Lee Bragg, manager of the insulating material department of Emil Calman & Co., New York City, is looking after the interests of his company at the convention.

DAILY STREET RAILWAY REVIEW

PUBLISHED DAILY BY THE

KENFIELD PUBLISHING CO.,

1332-1338 Cherry Street, Philadelphia, Pa.

BRANCH OFFICES:

Chicago 45-47 Plymouth Court.

New York 39 Cortlandt Street. Cleveland - 302 Electric Building.

London 82 Fleet Street.

SUBSCRIPTION AGENCIES:

Austria, Vienna Lehmann & Wentzel, Karntnerstrasse.

France, Paris Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.

Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.

New South Wales, Sydney Turner & Henderson, 16 and 18 Hunter Street.

Queensland (South), Brisbane Gordon & Cotch.

Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

THE DAILY STREET RAILWAY REVIEW is published each year on the occasion of the meetings of the American Street Railway Association, the Street Railway Accountants' Association of America, and the American Railway Mechanical and Electrical Association, and contains the convention reports. This publication is separate from the *Street Railway Review*, published monthly at Chicago, Ill., but is in its nature supplementary thereto.

SUBSCRIPTION RATES:

In the United States, Canada or Mexico:

DAILY STREET RAILWAY REVIEW, (four or more issues)..$ .40
Street Railway Review (12 monthly issues) 1.75
Combined Subscription (DAILY REVIEW and *Review*) 2.00

In All Other Countries :

DAILY STREET RAILWAY REVIEW (four or more issues) .. .40
Street Railway Review (12 monthly issues) 2.75
Combined Subscription (DAILY REVIEW and *Review*) 3.00

Application made for entry as second class matter.

7TH YEAR No. 4 FRIDAY, SEPT. 29, 1905. SERIAL No. { VOL. XV. No. 9 D

SAVE THE "DAILY REVIEW."

Special attention is called to the fact that the "Daily Street Railway Review," published at Philadelphia, September 26th to 29th inclusive, this being the seventh successive year, is in its nature supplementary to the "Street Railway Review" published monthly. Notwithstanding the "Daily" is a separate publication it should be bound with the monthly for convenient reference and in order to facilitate this, the pages of the "Daily" are given numbers consecutive with those of the next preceding monthly issue. Reference is again made to this fact for the reason that very frequently the "Daily" is entirely overlooked by subscribers when sending the "Review" to be bound, and as soon as the binder discovers that 150 pages or so are missing we receive a request to furnish the missing numbers, which unfortunately we are not always able to do.

PRESIDENT ELY.

President W. Caryl Ely was yesterday re-elected president of American Street Railway Association, or rather he is to be the first chief executive of the American Street and Interurban Railway Association. This second re-election of Mr. Ely is an eminently proper recognition of his work for the last two years, and he is certainly the one who can do most towards realizing the plans so carefully outlined. In consenting to again accept the presidency of the association Mr. Ely makes serious personal sacrifices which will be appreciated by the entire electric railway industry.

A. S. R. A. TRIBUTE TO SECRETARY PENINGTON.

Mr. Thomas C. Penington, who has been secretary and treasurer of the American Street Railway Association for ten years past, having severed his official relation because of the determination of the association to establish headquarters in the city of New York and the necessity of continuous attention to its affairs by the secretary, therefore be it

Resolved, That the American Street Railway Association does hereby record a minute of its earnest appreciation of Mr. Penington's fidelity to its interests, his devotion to its welfare and the eminently honest and satisfactory manner in which he has discharged the trusts imposed upon him.

Mr. Penington's relations to the individual members of the American Street Railway Association have established friendships which will last through life, and they part with his services as an officer with the deepest regret and with a lasting appreciation of his kindly thought and attention to themselves and their friends during the many conventions which had been held under his able assistance.

THE ANNUAL BANQUET.

Last evening in the beautifully decorated banquet hall of the Bellevue-Stratford many delegates and guests enjoyed the delicacies and toasts at the annual banquet of the American Street Railway Association. The menus for the occasion were exceptionally pretty and unique in style. A cover design portrayed Benjamin Franklin holding the string to his kite in one hand and the key in the other. He was shown as standing on the roof of a modern interurban car lettered" A. S. R. A.—Philadelphia-San Francisco." the back of the menus bore a half tone reproduction of the immortal liberty bell. The menu was an especially fine one and very well served by the employes of this magnificent hotel. The toasts responded to by prominent members of the association and guests were splendid and much good fellowship prevailed throughout the evening.

Mr. John B. Parsons was toastmaster. The list of speakers included:

Hon. John Weaver, "Franklin's Day and Ours."
W. Caryl Ely, "The Association."
George Tate Blackstock, K. C., "Our Canadian Brethren."
Thomas N. McCarter, "Corporations and the Commonwealth."
John I. Beggs, "Street Railway Management."
Gen. Eugene Griffin, "The Trolley."
James Rawle, "The Ladies."

MAINTENANCE AND INSPECTION.

The work of the committee of the American Railway Mechanical & Electrical Association on "Maintenance and Inspection of Electrical Equipment," of which Mr. William Pestell is chairman, has been sadly hampered this year by the failure of members to whom forms were sent, to fill them out and return them. The work is to be carried on and the data requested and received will be incorporated in next year's report; and now that the reorganization has been made effective, it is to be expected that all members of the American Street and Interurban Railway Association will see to it that their mechanical and electrical departments co-operate in carrying out the work of the engineering association.

A WORD OF THANKS.

For prompt and excellent service in reporting the Philadelphia Conventions we are indebted to the services of Mr. T. E. Crossman, official stenographer of the A. S. R. A. and Accountants' Association.

The seventh issue of the "Daily Street Railway Review" has only been possible through the painstaking attention given to this work by our printer in Philadelphia, the Dunlap Printing Co. We wish to acknowledge our appreciat ion of the untiring efforts of Messrs. Morton B. Hirsh and James E. Johnson who had the general supervision of the work; also to the heads of the several departments, Frank Lorrilliere and Samuel Rodgers, in composing room, George W. DeWinton in the press room and William Oberley in the bindery.

Mr. George H. Sargent, vice-president of the Railway Appliances Co., 114 Liberty St., New York City, was seen shaking hands with his many friends among both the railway and supply men.

Under the stress of printing in a strange garret two statements which did not belong crept into the list of members of the Manufacturers' Committee, printed on page 692 of the "Daily Review" for Thursday. We do not think anyone has been deceived but make the correction in order to have the record clear. Mr. Frank C. Randall of the Manufacturers executive committte is general sales manager of the Allis-Chalmers and does not represent the National Electric Co. Mr. W. H. Whiteside of the Allis-Chalmers Co. is not now a member of this committee.

NEW YORK, NEW HAVEN & HARTFORD ADOPTS WESTINGHOUSE SINGLE-PHASE SYSTEM.

But a few years ago the alternating current system was adopted for the first electrical power development at Niagara Falls, and it has since become pre-eminent in the field of power transmission. During the past few weeks engineers have been investigating a problem of like proportions and equal importance, and the selection of the alternating current system for the New York, New Haven & Hartford R. R. is another victory for the alternating current and a demonstration of its success in the field of electrical transportation. These two orders for machinery indicate most important steps in the progress of electrical engineering; the one marked the commencement of the commercial development of electric power service, and the other marks the beginning of the electrification of our great transportation systems. These two orders were both placed with the Westinghouse Electric & Manufacturing Co. It is now perhaps safe to assume that the alternating-current system will soon become as pre-eminent in the railway field as in that of power service. Its flexibility, the economy introduced in line construction, the large radius of action from a single station, the elimination of the rotary converter sub-station and of electrolytic troubles, and the economical and exact speed control are factors of importance, the realization of which is due to the development of a thoroughly successful alternating-current motor suitable for railway work. Among the incidental advantages secured to the operating company by the adoption of the alternating-current system is the use of an overhead line in place of the more expensive third rail, as the high trolley voltage which can be used reduces the current to proportions easily handled by an overhead line and contacts.

The contract taken by the Westinghouse company comprises 25 locomotives for high speed passenger service, each of which will weigh approximately 78 tons and will be capable of maintaining a schedule speed of 26 miles per hour in local service with a 200-ton train making stops every 2.2 miles and reaching a maximum speed of about 45 miles per hour between stations. In express service a speed of from 60 to 70 miles per hour can be maintained with a train weighing 250 tons. To handle heavier trains two or more locomotives will be coupled together and controlled from the forward cab. The multiple control system which forms part of the equipment makes it possible for a single engineer or driver to operate several locomotives coupled together just as easily and accurately as he can handle one, in a manner similar to that with which we are familiar on electrically operated elevated roads. One of the important characteristics of Westinghouse single-phase alternating-current series motors is that they may be employed on either the alternating or the direct-current system. It has, accordingly, been possible for the officials of the railway company to adopt this system for the operation of its lines and at the same time accommodate the equipment to the direct-current system now being installed by the New York Central, as the New York, New Haven & Hartford utilizes the tracks of the latter company between Woodland and the Grand Central depot in New York City. Each locomotive will be equipped with four Westinghouse single-phase railway motors of the straight series gearless type and with the unit switch system of multiple control. The motors will be permanently connected two in series. On direct current the pairs of motors will be operated in series parallel and on alternating current by voltage control. The motors will be spring supported and connected by flexible drive in such a way that all dead weight will be taken off the axles. On direct current each motor will be capable of developing a rated output of 400 h.p.

The Climax Stock Guard Co., Title & Trust Building, Chicago, has a display of its products in the Mayer & Englund booth, which is being looked after by F. W. Stewart, general manager.

Mrs. A. Fenton Walker is representing the William C. Baker car heaters. The general offices of the company are at 143 Liberty St., New York City.

Mr. Charles H. Tomlinson, of Denver, Colo., inventor of the Tomlinson automatic coupler and manager of the Tomlinson Coupler Co., has a working model of his invention and is demonstrating and explaining its merits and operation at space 29, section I.

THE GLOBE TICKET CHOPPER.

The Globe Ticket Co., [illegible] Philadelphia, is manufacturing a [illegible] known as the "Globe" ticket chopper. This machine was developed to meet the demand [illegible] managers and others for a machine to effectually destroy the daily returns of tickets and transfers. [illegible] construction. Plate glass [illegible] cutting rolls, and the [illegible] tickets,

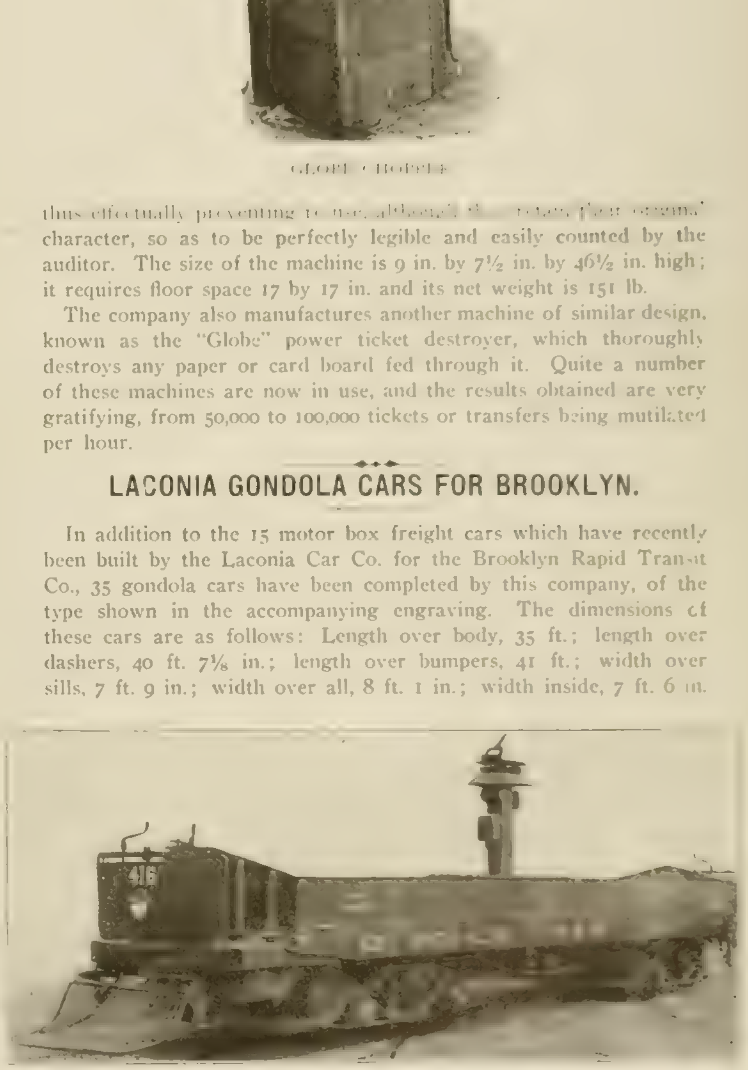
GLOBE CHOPPER

thus effectually preventing re-use, although [illegible] retain their original character, so as to be perfectly legible and easily counted by the auditor. The size of the machine is 9 in. by 7½ in. by 46½ in. high; it requires floor space 17 by 17 in. and its net weight is 151 lb.

The company also manufactures another machine of similar design, known as the "Globe" power ticket destroyer, which thoroughly destroys any paper or card board fed through it. Quite a number of these machines are now in use, and the results obtained are very gratifying, from 50,000 to 100,000 tickets or transfers being mutilated per hour.

LACONIA GONDOLA CARS FOR BROOKLYN.

In addition to the 15 motor box freight cars which have recently been built by the Laconia Car Co. for the Brooklyn Rapid Transit Co., 35 gondola cars have been completed by this company, of the type shown in the accompanying engraving. The dimensions of these cars are as follows: Length over body, 35 ft.; length over dashers, 40 ft. 7⅛ in.; length over bumpers, 41 ft.; width over sills, 7 ft. 9 in.; width over all, 8 ft. 1 in.; width inside, 7 ft. 6 in.



LACONIA GONDOLA CAR

The cars are fitted with M. C. B. bolsters and the platforms at each end are fitted with steel dashers. The cars are provided with drop sides made in two sections, of oak, with heavy wrought iron hinges bolted at the bottom. The ends of the car are provided with bulkhead 30 in. high at center and tapering at the sides. A 10 x 10-in. oak mast for supporting the trolley base, circuit breakers, etc., is placed in the center of the car. The car is fitted with Brooklyn Heights standard fenders, "Columbia" brake handles, "Reliable" sand boxes, "Sterling" safety brakes, Neal headlights, and Westinghouse air brakes.

THE APPLICATION OF GAS POWER TO ELECTRIC RAILWAY SERVICE.*

BY J. R. BIBBINS.

In bringing this subject before you, we do so with the conviction that the problem of ultimate adoption of gas power is a present and serious one. You may not be in entire accord with our present optimism. In fact, on few subjects does engineering and commercial opinion exhibit greater conservatism (possibly due to lack of direct experience with gas power or to the influence of adverse reports from small and inadequately equipped plants). Yet, we feel that the practical difficulties incident to the development of such an important power system have now been so far overcome as to warrant the fullest optimism. We have but to look abroad for complete vindication.

Primarily, our objective is to place before you, as fully as possible, results that have already been attained, leaving to your own judgment the soundness of our opinions upon the topics discussed in this paper.

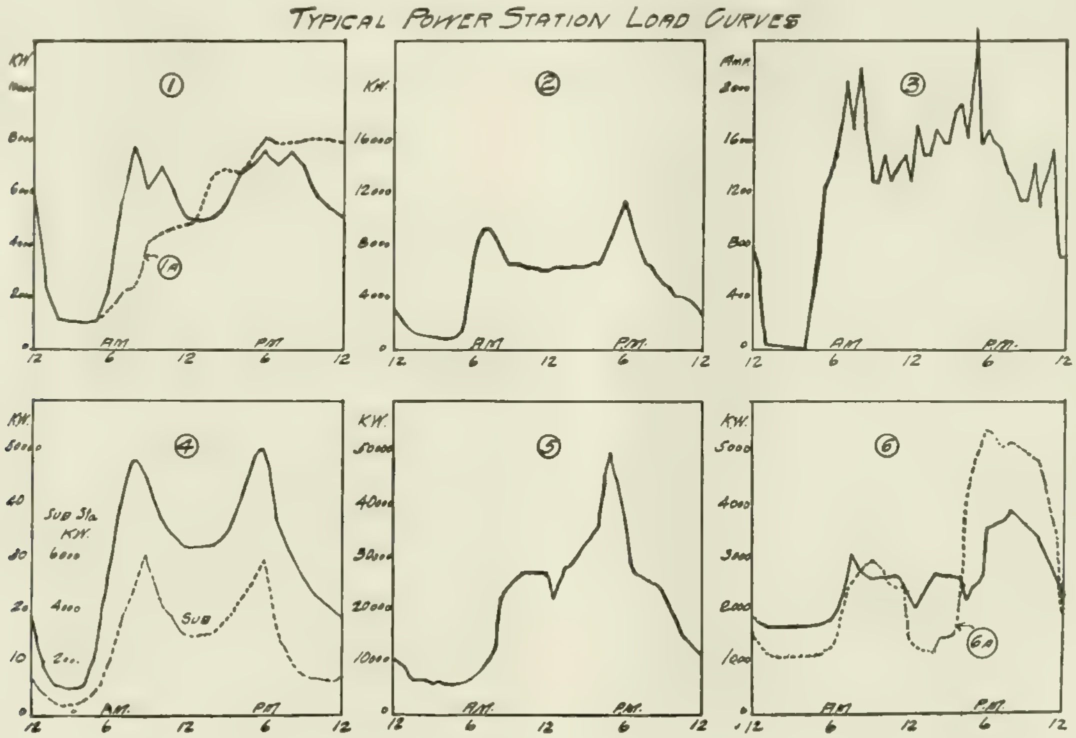
day fuel economy. This is admittedly a formidable list of requirements; yet we may not dodge the issue with gas power any more than with steam.

Adaptability of Gas Engine and Producer Plant.

Does gas power fulfill in every respect the conditions imposed? As the old and much abused saying goes, "The proof of the pudding lies in the eating thereof." This phase of the subject may best be approached through comparison, step by step, with steam power with which every one is familiar. This is done not for the purpose of discrediting the latter, but merely to obtain a clearer conception of the points involved.

The Gas Engine.

Primarily, the fitness of the gas engine for driving electrical machinery must be demonstrated beyond question. This has repeatedly occurred in practice, examples of which will be later cited. The paper by Mr. West has already treated important points in detail. He has observed that with certain cylinder arrangements rotative speeds, uniformity of turning moment and speed regulation are as well suited to both direct current and alternating current generator driving as the standard cross compound steam engine; that the gas



FIGS. 1 to 6.

Characteristics of Street Railway Service.

In a paper read last year before your association we considered steam turbines, in their special application to railway work. Three important characteristics for a prime mover were mentioned, viz., close speed regulation, considerable overload capacity and high economy over normal ranges of load. Although these qualifications are, indeed, most desirable, entire success may only be attained through the harmonious working of the entire plant, whether steam or gas; in fact, in the case of the latter successful operation may be attributed in almost equal proportions to the gas and power generating sections of the plant. Unfortunately, it is true that the faults of the one may all too readily be charged to the other; yet a careful study of practical operation shows the futility of such distribution of responsibility.

A perspective view of railway service, as distinguished from electric lighting service, may be had by examining the daily load curves from typical power stations. See Figs. 1 to 7 and appendix 1.

From the data presented it is obvious that, as a whole, a generating plant for railway service, especially for suburban and heavy duty work, must be unusually responsive to sudden power demands; to accomplish this the two sections of the plant must be peculiarly well fitted to operate together under normal load conditions. The plant should also be quick in starting, capable of standby for long periods without excessive loss of heat and, above all, should show high all

engine is as simple a machine to operate; that its efficiency as a mechanism is as high, and as a heat motor far higher; and that its overload capacity is largely dependent upon the dimensions of the customer's purse. Assuming, then, that the gas engine is already established in its position, we come to the gas generating plant, which, in many respects, is the crucial point of the system, except in special localities where natural gas is available at reasonable prices.

The Producer.

We believe ourselves conservative in the statement that the future of the gas engine in its general application depends largely upon the development of a producer gas system especially suited to the use of low grade bituminous coal. Anthracite producers have already reached a high state of perfection, are reasonable in price, simple to operate and are usually unencumbered with much auxiliary apparatus. They do not deteriorate rapidly, and generally show an efficiency considerably higher than the best steam boiler and furnace, viz., 75 to 80 per cent.

The ideal bituminous producer is yet to come, viz., one in which the volatiles are completely converted into fixed gases without serious loss and without complication of the operating system. There are a number of makes now on the market intended to be used with bituminous coal, but when the gas is to be used in engines they are attended with special, and often complex, cleaning apparatus for the removal of suspended impurities. The efficiency of bituminous

* Read before the American Street Railway Association, September 28, 1905.

systems is also generally lower than anthracite, not only owing to the fact that some of the valuable distillates are lost, but on account of the distillation of volatile matter requiring heat for its accomplish-

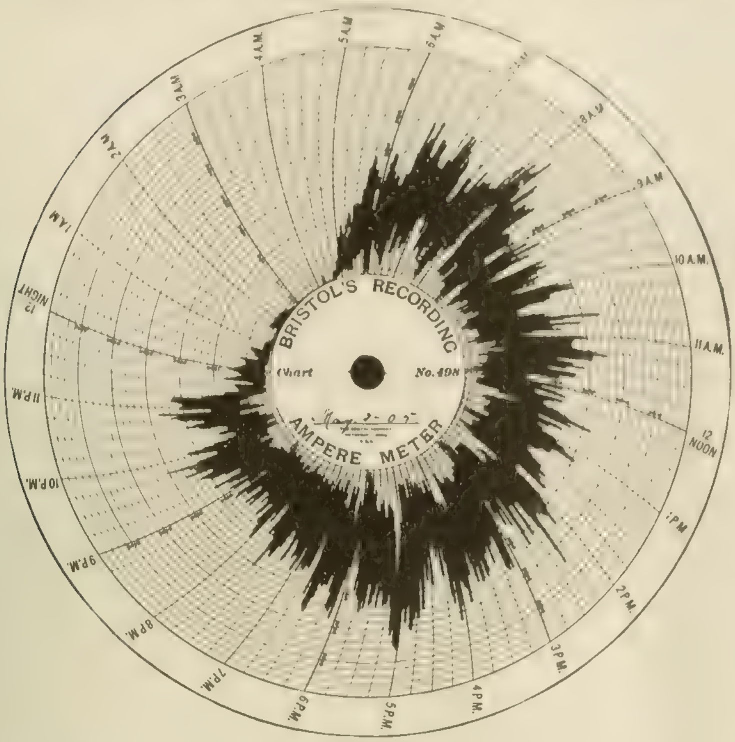


FIG. 7.

ment. Present types, however, sometimes exceed 70 per cent efficiency, which rivals that of the best boiler plant.

Fuel Economy.

In actual running, fuel consumption, gas power presents its most striking advantage over steam. It is difficult to obtain statistics truly comparative in every respect. Some data, trustworthy in the aggregate, are available from the tests conducted during the past year at St. Louis by the United States Government. Table 2 gives a resume of these tests, covering 17 different grades of coal, all of bituminous character. The most remarkable result is that the poorest grade coals and even lignites are entirely suitable for producer work. Thus, Montana, North Dakota and Texas lignites, averaging only 8,242 B. t. u. per pound (11,400 dry) yielded a gas of 169 B. t. u. per cubic foot, a gross producer efficiency of 66 per cent, and a duty of 2.5 lb. per kw. h. dry, or 3.6 lb. per kw. h. as fired. The best coals (West Virginia) gave an actual duty of 1.57 lb. per kw h., and the poorest 3¼ to 4½ lb. as fired. The average of the 17 tests showed a plant duty of 2.2 lb. per kw. h. dry, or 2.5 lb. as fired. Fig. 8 shows, in a general way, the rapid decrease in coal consumption with higher grade coals.

It is fortunate that the government extended these tests to embrace steam (non-condensing) as well as gas power. Fig. 9 shows the results of a comparative economy tests with practically the same size plant under identical conditions and with identical coal. Taking a common heat value for average bituminous coal, 13,000 B. t. u. per pound, we observe that the plant duty is less than 2 lb. per kw. h with gas and 5½ lb. with steam. Furthermore, the fuel consumption of the steam plant increases much more rapidly in the comparison with the poorer grades of coal. This is reasonable, owing to the greater difficulty in securing proper combustion. In this particular the producer has a decided and important advantage over the steam boiler.

Many more results might be cited which would strongly emphasize the high gross economy of the producer gas power plant; yet it is not the formal efficiency test at full load, but the long period test which reveals to the operating man the fullest economy of gas working.

The following results may be of interest, as obtained from a large gas power railway and lighting plant at Walthamstow, England, which will later be mentioned in further detail. Walthamstow is one of the largest suburban districts of London, having a population of 116,000, and served by a gas driven central station.

TABLE No. 3
RESULT OF 12 DAYS' OPERATION, WALTHAMSTOW, LONDON, JANUARY 1902

Average output per day in kw. h.	1,525
Average load in kw	64
Average load factor	35%
Coal (anthracite) per kw. h. in lb., including fuel for boiler and banking	1.78

A striking series of comparative observations (Campbell, Mechanical Engineer, Dec. 3, 1904) between a steam and gas station operated by the same company at Guernsey, England, is summarized in Fig. 10. With approximately the same load factor, which is high, owing to power supply, the gas power plant consumed about 2.25 lb. per kw. h., and the steam station 5.5 lb., although a much larger station and equipped with triple expansion high speed engines.

Responsiveness.

Passing to some of the practical points, a producer, if provided with an automatic blast control, may be made almost instantly responsive to variations in demand for gas. This is shown by the success which the suction producer has attained in small sizes; and in this respect the steam boiler is quite outclassed, owing to the more direct effect of the blast in transferring the heat content of the coal to the working medium—gas. In one type of producer familiar to us as possessed of this automatic feature the steam blast, and consequently the gas generated, is controlled entirely by the pressure in the delivery gas main and in inverse proportion. It combines this feature with the conservation of the sensible heat of gases leaving the producer. By this means steam is generated at a rate proportional to the demand for gas without requiring extra boiler equipment or fuel. This largely increases the producer efficiency. In some types of producer we recall that the fuel for steam amounts to as much as 15 to 20 per cent of the total coal gasified.

This producer is designed for use without a gas holder and has been successful in this particular. The especially severe conditions of heavy railway work, however, prescribes storage capacity at some

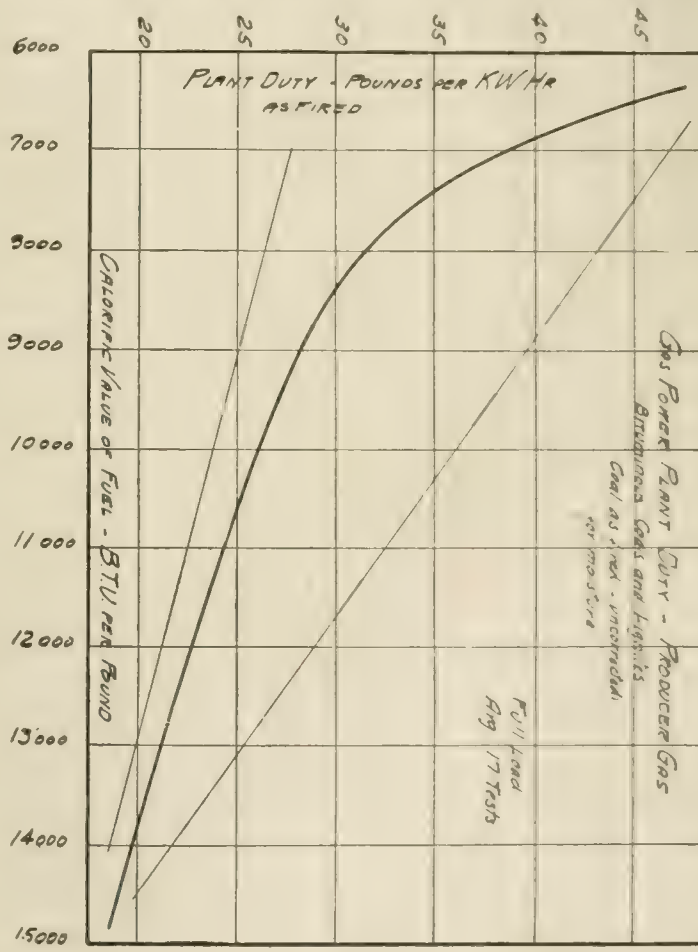


FIG. 8

part of the system. Owing to the limitations of gas engine capacity, dealt with in the preceding paper, electric storage is evidently the most desirable, as it relieves the machinery of the wear and tear of

fluctuating loads. There is ample precedent the world over for the use of a storage battery auxiliary in railway plants, and it should prove even more desirable in a gas power than in a steam power plant. In fact, gas storage is often to be desired in many plants where the gas demand varies greatly, simply as an insurance against poor gas, due to careless operation. This, however, simply relieves the gas generating equipment, while electric storage relieves the entire station.

Losses.

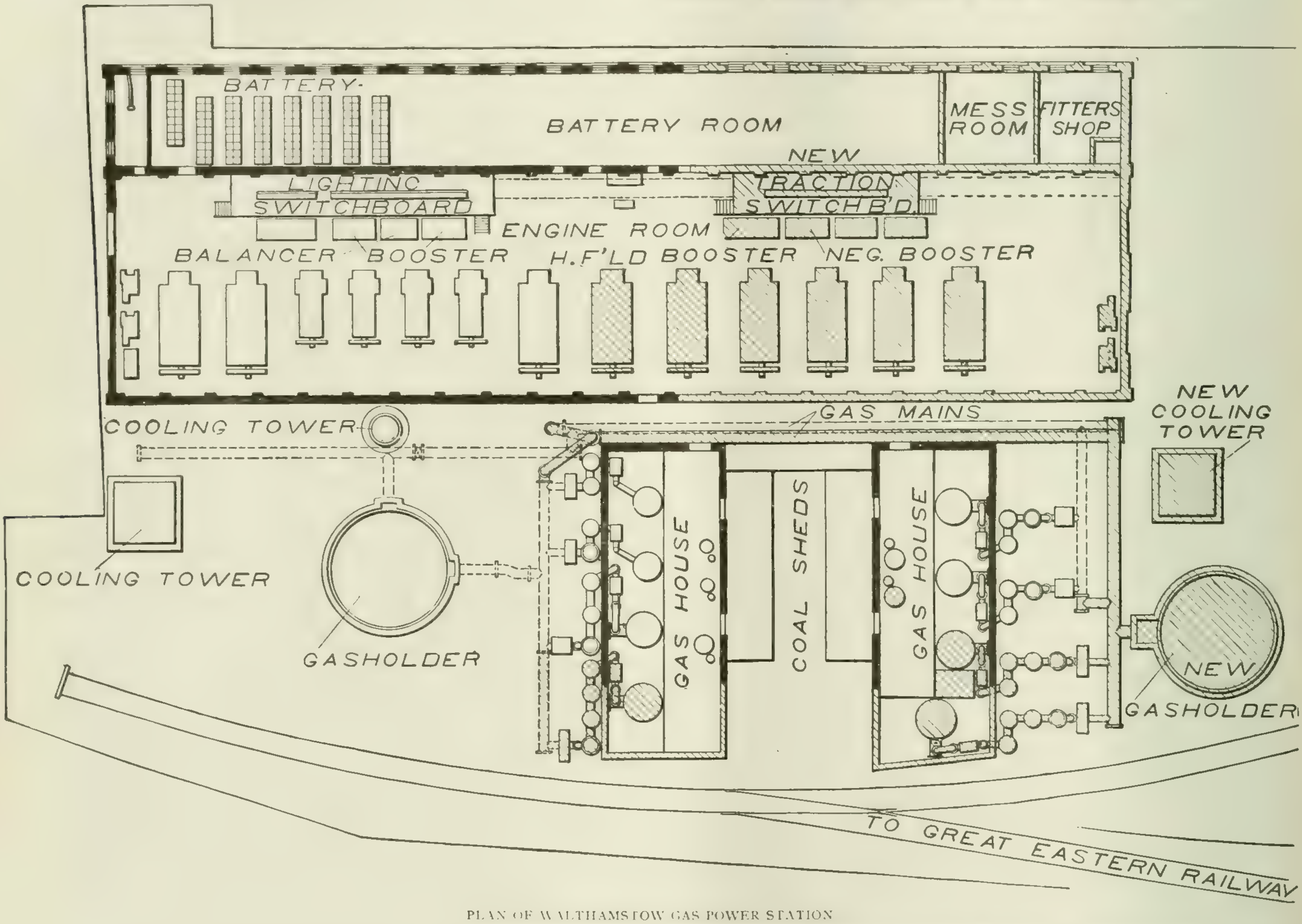
Standby losses in a steam power plant are an important source of inefficiency and difficult to determine accurately. Mr. Dowson has made some comparative observations (Journal of Institution of Electrical Engineers, April, 1904) with eight steam plants and several producer plants, averaging about 250-h. p. capacity. The actual standby fuel consumption of the boilers was 35 to 180 lb. per hour and of the producers 2 to 4 lb. per hour. Whether the exact ratio holds for larger plants is immaterial. We do know that the producer losses are almost inconsiderable, which is reasonable, owing to the great heat content of the fuel bed and small opportunity for loss of heat by radiation when the producer is shut off from the atmosphere. Running losses are evidently also much less. We may pipe gas for great distances with small loss. Not so with highly superheated steam under high pressure. When a gas engine plant is shut down the losses practically cease; with steam, condensation is uninterrupted.

Labor.

The comparative cost of labor and supplies for gas and steam plants is difficult to state in definite terms. With the same character of labor there should be no appreciable difference between the two. We have compiled table 4 (appendix 3) to show the operating costs of 11 London district stations, as compared with the gas plant at Walthamstow. These plants have been chosen, as they are located similarly in respect to accessibility of fuel. The table shows labor cost slightly in favor of steam, but it must be remembered that this is a comparison of one gas plant, having small units, against a number of larger steam plants, which might readily be more favorable in larger gas installations. With an up-to-date steam plant, using high pressure steam, superheaters, economizers, high grade condensing apparatus and the like, the labor item should, if anything, exceed that of a gas plant equipment of the same grade. At the two Guernsey stations referred to above the labor cost averaged very nearly the same for steam or gas.

It is true that a gas plant cannot be successfully operated by an ignoramus, any more than can a high grade steam plant, which, however, if allowed, results sooner or later in a swelling of the repair account. A fair comparison will not admit of any but intelligent labor in either steam or gas plants, so there is no reason why steam engineers, after proper instruction, cannot take charge of a gas plant, as has been proven in practice.

A very important point, however, is the personal attitude which engineers take toward gas machinery. The best plant will quickly depreciate in the hands of operators who have taken a personal dislike to the innovation. The inevitable result of such attitude cannot be truthfully laid to the door of gas power. But it is almost always the case that personal prejudice may be overcome by systematic educational methods. In many of our plants the old steam engineers and oilers have been retained and placed in charge of gas equipment, after a thorough coaching by competent erecting engineers. After this is done properly the invariable result is highly successful operation.



PLAN OF WALTHAMSTOW GAS POWER STATION

As the chief engineer operating a plant in northern Pennsylvania stated to the author recently, "I would rather throw up my job than go back to steam." He freely acknowledged his initial prejudice, which disappeared as he became acquainted with the gas engines.

Oil.

In well regulated plants, equipped with a continuous return system, the oil consumption should not much exceed, if any, that of a steam plant. Two 500-kw. gas plants at Franklin and Bradford, Pa., each consisting of five Westinghouse vertical enclosed type engine units, average through the year less than half a gallon per unit day, at a total cost of under seven cents (.0032 gallons per h. p. day). At another station, near Warren, Pa., using three vertical open type engines of 275-h. p. capacity each, the oil consumption averages under .9 gallons per unit day. This is certainly not excessive; in fact, we know of a large steam station in the Pittsburg district, equipped with several 1,600-h. p. cross compound engines, in which the oil consumption averages .0025 gallons per engine h. p. day, and has

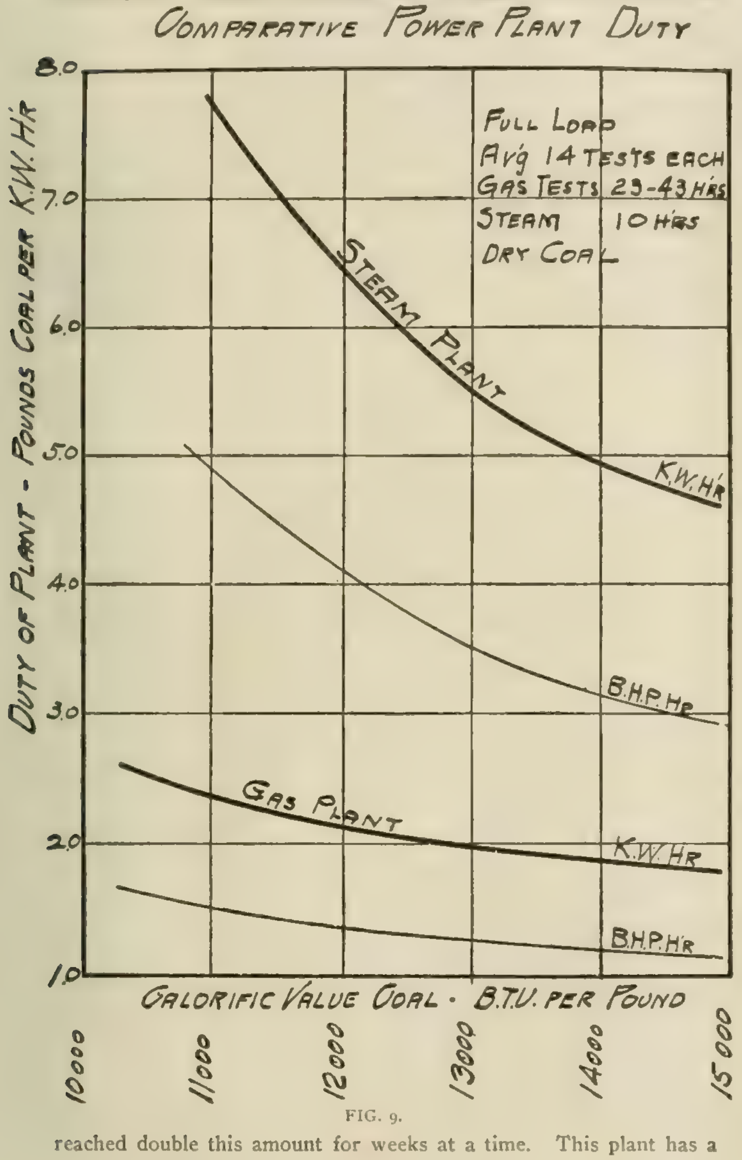


FIG. 9.

reached double this amount for weeks at a time. This plant has a return oiling system; the others have not.

Maintenance.

Maintenance expense is frequently thought to be excessive in a gas station. When this is so we may look for faulty operation or design of the plant. Recent data from the station at Bradford, Pa., shows what may be accomplished when the equipment is properly operated. The plant is in its seventh year of service; yet the average cost of repairs on the engines for the last two years was $92.70 per year, 11.6 cents per h.p. year, or .0125 cents per kw.h. generated. Returns for the last two years are shown in table 5 (appendix 4). As an example of the results secured, we may mention the following: After six years' service, averaging 18 hours per day, it is found necessary to inspect the engines only once in twelve months. This was formerly done in three months and later in six months. At each inspection a set of piston rings is replaced by new ones, whether worn out or not. Up to the present time no extensive repairs have been made on any of the engines, except a voluntary change, on the builders' part, from dry to water cooled exhaust valves. The present exhaust valves average one year's working without regrinding, and even then are not in bad condition. Some valves have run 15 months. Admission valves require no attention. Igniters average about nine months without repointing. By reversing the current each day electro deposition is entirely avoided, so that the points wear evenly.

In table 4 the repair costs at Walthamstow are much lower than the steam plants cited. In a 300-kw. manufacturing plant at Birmingham, using Westinghouse vertical engines and Mond gas, the typical year's expense for repairs and renewals was but 0.174 cents per kw.h. generated, incurred in the proportion of 65 per cent to the gas and 35 per cent to the engine plant.

A notable run was recently reported by the superintendent of a gas compressing station in central Ohio, where a [illegible] h. p. Westing-

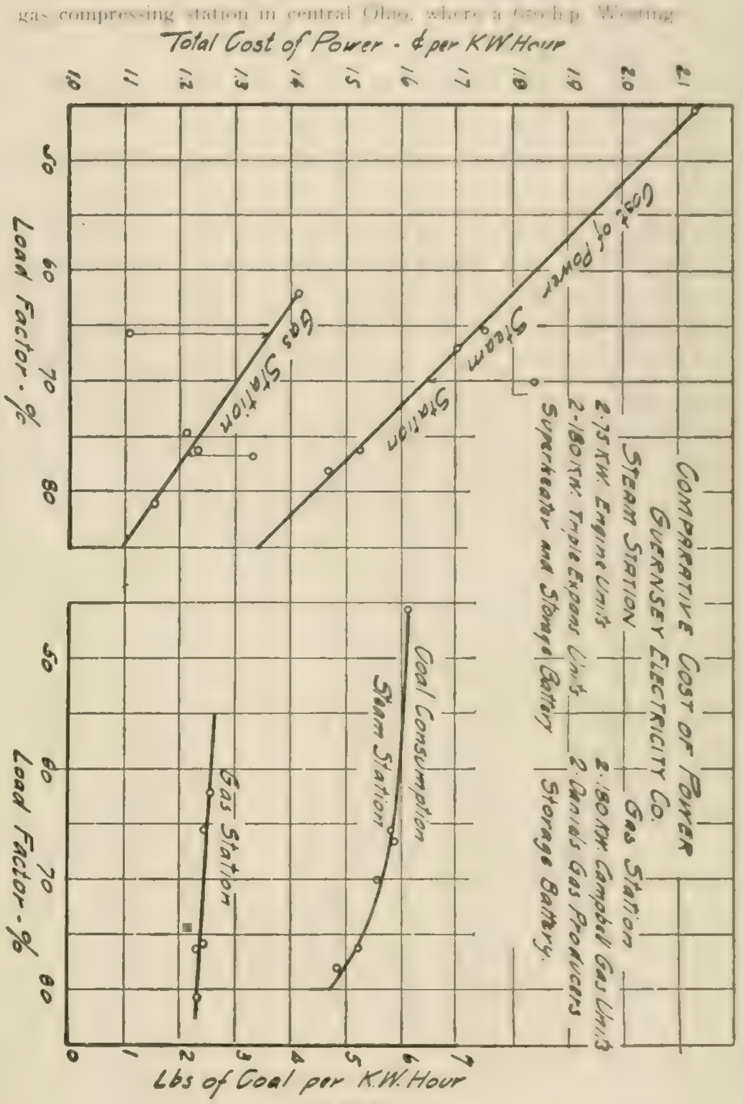


FIG. 10.

house vertical engine is at work. This engine was under maximum gas load continuously night and day for 40 days, without a misfire or mishap of any kind, and without incurring extra expense for repairs.

After running practically day and night for nearly 3½ years the total repairs on the plant have been:

One set of igniters.

Two sets of exhaust valves (one spare).

One admission valve (jammed accidentally).

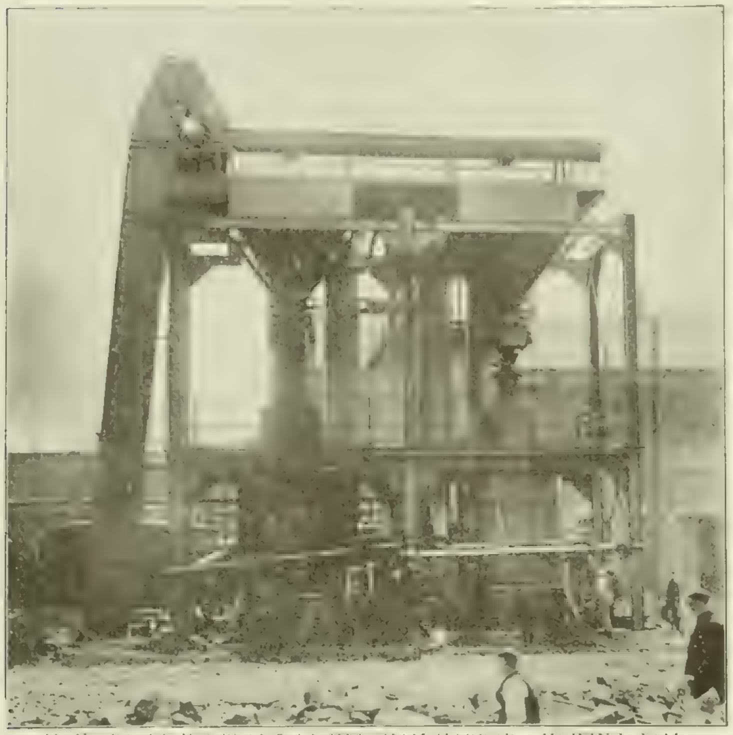
One cylinder head (cracked from mud deposits).

One intermediate gear.

Cost of Power.

Comparative plant economy is best brought out in figures expressing the total operating cost of power. The complete returns from Walthamstow are shown in table 6 (appendix 5). With a load factor of only 15½ per cent and coal at $6.75 per ton, delivered, the total

cost of generating current was 1.7 cents per kw.h.; or, based upon current delivered to consumer, 2.13 cents per kw.h., the average price obtained being 7.14 cents, and the net profit 9 per cent. Referring again to table 4, the summary shows that in the average borough steam plant of over three times the capacity and of higher load factor the generation cost is 2.2 cents. It is presumable that the



MOND PRODUCER PLANT AT HEYSHAM HARBOR SHOWING COAL HANDLING APPARATUS.

steam plants used cheaper coal; yet with gas coal at $6.75 a ton the saving in cost of coal alone was over 38 per cent in favor of the gas station. At this price the Walthamstow plant required throughout the year's run but slightly over two pounds of coal per kw.h. generated. Of the total operating cost, fuel represented 43 per cent., in the steam plant, 55 per cent; repairs, 5 per cent for gas, and 20 per cent for steam. At the Birmingham plant, mentioned above, the total operating cost was 1¼ cents per kw.h., of which fuel represented 26½ per cent and repairs 14 per cent; this on a load factor of 43 per cent average, and bituminous coal having 31 per cent volatile. The total coal consumption averaged 2.9 pounds per kw.h. through the year.

At the Bradford, Pa., station (see table 5, appendix 4), although handicapped with old type belted machinery, the average yearly gas consumption is less than 25 cubic feet of gas per kw.h. on a 19½ per cent load factor, and a total operating cost of power of about 0.8 cents per kw.h.

The station at Franklin, Pa., operating on natural gas of exceptionally high calorific value, gives experience of similar character. The engines regularly operate thirty hours to a run. With a load factor of 15 per cent to 20 per cent, as low as 17 cu. ft. of gas per kw.h. was recorded for the year 1904, at a total operating cost of under one cent per kw.h. In the cases of both the Bradford and Franklin plants building heating by natural gas is included in the gas charge for the engines.

Capital Cost.

Much of the prejudice against gas power is due to exaggerated statements regarding the comparative capital cost of steam and gas equipments. In some instances it has been stated that for the same character of equipment the gas plant costs double. This is not the case; in fact, in larger plants the two may be brought nearly to a parity, and the higher economy of the former will soon wipe out the difference in actual cost.

We cannot do better than cite the returns of tenders for one of the largest gas power stations in Europe, over 8,000 kw. in capacity and designed for both railway and lighting service. Tenders were invited for both steam and gas equipment complete, in every respect the best obtainable and with considerable spare plant. An approximate summary of the tenders received from over thirty of the most prominent European manufacturers is as follows, including erection, but not including transportation charges:

(For obvious reasons the names of the customer and manufacturers are withheld.)

TABLE No. VII.

CAPITAL COST GAS AND STEAM PLANT PER KW. CAPACITY.

	GAS PLANT		GENERATING PLANT		TOTAL
	$	%	$	%	$
Average tender.....	35.00	31.2	77.00	68.8	112.00
Accepted tenders...	24.00	24.5	74.00	75.5	98.00
	STEAM PLANT				
Lowest tender......					75.00
Highest tender.....					106.00
Mean tender.......					90.00
Recommended					92.00

TABLE No. VIII.

SUMMARY OF GUARANTEES.

GUARANTEE	PRODUCER PLANT		GENERATING PLANT ¾ Rated Load			POWER STATION	
	B. T. U. in Gas Per Lb. Coal	Eff'c'y with 12,000 BTU Coal	B. T. U. per K.W.H.	B. T. U. per B.H.P. Hr.	Kinetic Eff'c'y %	Kinetic Eff'c'y 12,000 BTU Coal	Duty * Lb. Coal per K. W. H.
Highest......	9,500	79.2	12,300	10,440	27.7	21.9	1.29
Lowest.......	7,000	58.3	18,000	15,290	19.0	11.1	2.57
Average......	8,729	72.7	13,876	11,775	24.6	17.85	1.59
Accepted.....	8,500	71.0	13,700	11,630	24.9	18.1	1.61

* Estimated.

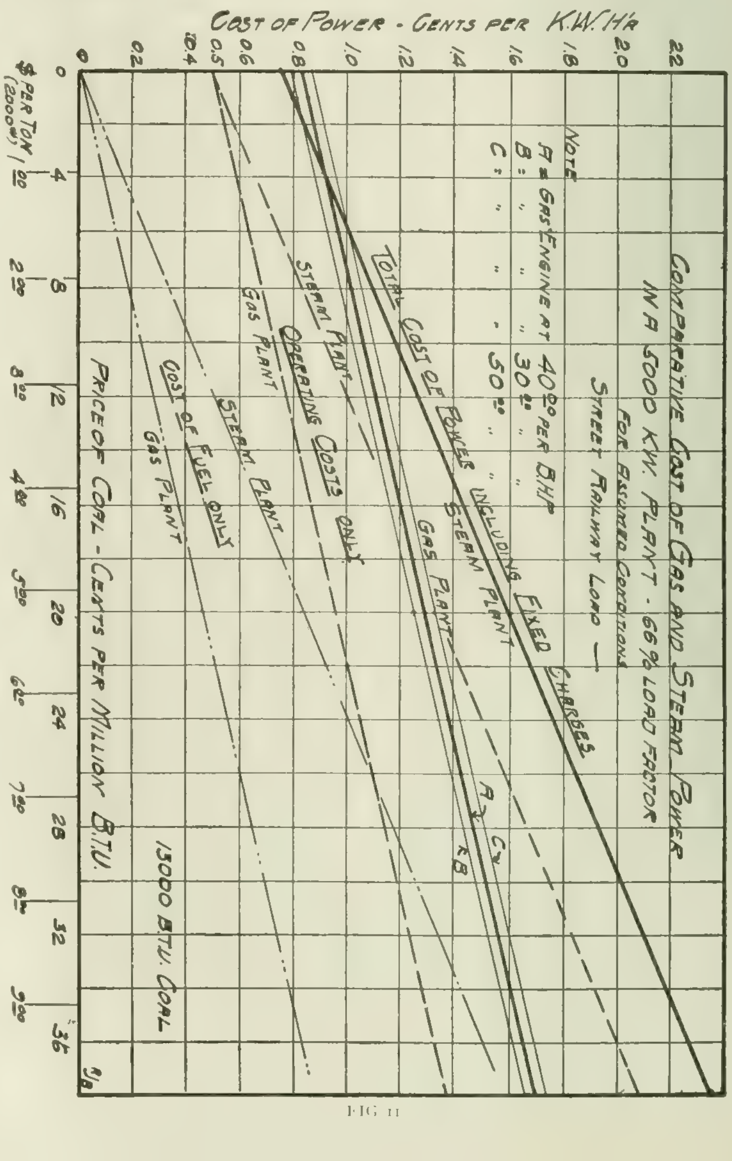


FIG. 11

The engineer's report on the accepted tenders shows a total excess cost of gas plant of 7.4 per cent actual, or 14 per cent with certain extras charged to the gas plant for additional ground and building requirements; yet the annual saving in operation is estimated sufficient to annul the excess cost of gas plant in less than two years. Capitalized at 5 per cent interest this annual saving represents a capital of $1,485,000, or considerably more than the original cost of the entire gas power station. In other words, the gas plant might have cost twice the actual amount and still realize a definite annual saving over steam power. Incidentally the efficiency guarantees are of interest. These are shown in table 8. The heat conversion efficiency of the generating equipment at two-thirds load is as high as 25 per cent, giving an overall plant efficiency of about 18 per cent. The average well equipped steam plant rarely exceeds 10 per cent.

The problem of gas versus steam power thus partakes of the nature of economics, rather than mechanics. In order to demonstrate more clearly, the diagram, Fig. 11, was prepared, which shows the relative cost of steam and gas power for different grades of coal. By expressing the cost of the latter in terms of million thermal units, the differentials in transportation are avoided. This diagram is based upon an actual load curve, Fig B, and the present approximate cost of power plant equipment, f. o. b. factory, but including erection. From the assumptions, appendix 6, you will observe that if we have erred it is upon the conservative side, favoring, if anything, the steam plant, especially in the matter of cost.

(In estimating the cost of labor, supplies and repairs, these three items are assumed to be the same for either steam or gas plants, as it is a reasonable assumption that any possible excess of cost of upkeep on the gas engine equipment would be balanced by the smaller expense of maintaining the producer equipment.)

In this diagram the shaded area represents reasonable range for

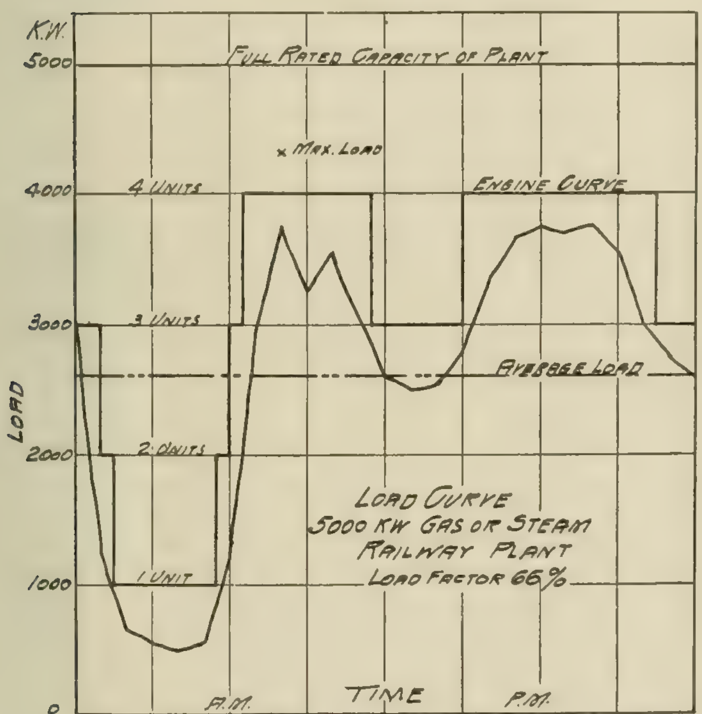


FIG. 11B.

capital cost of gas engine. You will observe that the diagonals for steam and gas intersect at the left of the diagram. The interpretation of this is that at this point, with coal costing 3.5 cents per million B. t. u., or about 90 cents per ton, both plants can deliver power at the same cost, or, in other words, we cannot afford to use gas plant with cheaper coal. Fig. 12 expresses this saving in per cent of excess capital cost of gas over steam plant. Thus, with coal at $3.50, the annual saving is 30 per cent of the original excess.

Upon the assumption of equal labor, supplies and repair costs. it is quite evident that any excess fixed charges on the gas plant will fix a definite economic limit of saving over steam, and it thus occurs that gas will be more effective where fuel is not dirt cheap. If, however, a gas plant can effect a saving in the cost of labor, supplies and repairs, as is the case at [illegible], be operated to advantage on [illegible] grades of [illegible].

Field Practice.

This subject may be [illegible], as it were, of the work that has already been [illegible] the American gas power field. To be sure, the application to railway service has in this country been limited; yet we find abroad many evidences of successful working. A prominent [illegible] reported in 1903: "Nineteen stations on tramway work, totaling 6,000 h.p. capacity. These include Barcelona, Tunis, Lausanne, St. Gallen, Poictiers, Orleans and Zurich, from 400 to 600 h.p., each working on either producer or town gas." As a result of the excellent experience with the Walthamstow [illegible] has been added to the plant for operating the new tramway system (length of line 9½ miles, 100-lb. girder rails, 32 double deck single truck cars, double trolley) recently constructed. At Buenos Ayres, South America, two plants, aggregating 2,240 h.p., are at work for the Buenos Ayres Great Western and Great Southern Railways. Both use Mond gas.

But, eclipsing in interest probably all former gas power railway undertakings is that of the Warren & Jamestown Railway system,

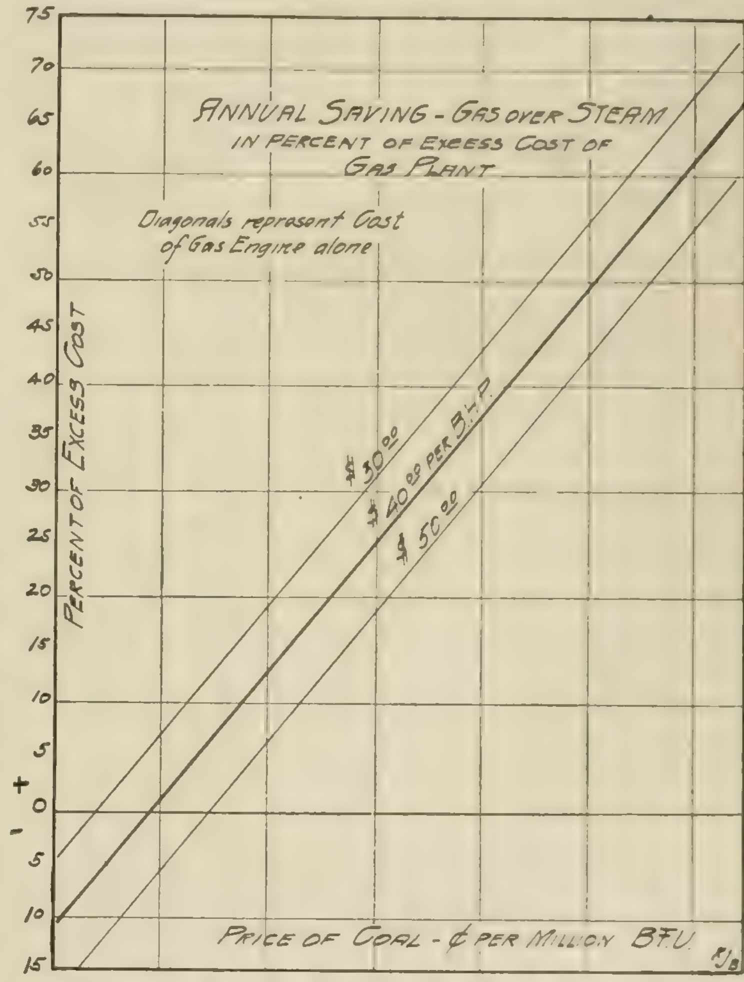


FIG. 12.

now under construction. As the details may not be entirely familiar to you, a brief review is appended (No. 7). This plant will practically inaugurate the use of the heavy duty type engine, in connection with single phase railway systems in America.

Following the precedent established by the Warren plant, the Union Traction Company, of Independence, Kan., has adopted double acting engines of the same size, type and design for railway service, using Kansas natural gas as fuel. The initial equipment will comprise single crank and double crank units of 500 and 1,000-h. p. each (sea level rating).

The new engine equipment for Warren, now nearing completion. consists of two 500-h. p. Westinghouse double acting engines of the horizontal tandem type (Dimensions of engines: Cylinder diameter,

LOAD CHARACTERISTICS.

TABLE No. I.

Appendix No. 1.

Fig. No.	Character	City	Load Factor % *	Ratio Loads Max. / Min	Max. / Avg.	Approx. Fluctuation %	REMARKS
1	Metropolitan	Pittsburg	68	7.7	1.48	10–15	300-400 cars at rush hours single and double truck part trailers. Storage battery at sub-stations.
1a	Metropolitan (Holiday)	Pittsburg	60	8.5	1.66		Fourth of July.
2	Metropolitan	Detroit	55.8	10.9	1.79	15–25	Cars max. Single truck and high speed interurban. Battery at main and sub-stations.
3	Interurban	Cleveland	56	100+	1.78	30–60	Double truck. High speed. Cars. No battery.
4	Rapid Transit (Elevated)	New York	60	9.7	1.67	40% at sub stas.	Multiple unit trains. Six cars. Battery at sub-stations. 1387 cars max.
5	Lighting	New York	47			Steady	Central and down-town district. Battery at sub-stations.
6	Lighting	Pittsburg	65.8	2.26	1.52	Steady	Central and down-town district. Avg. day cloudy. No battery.
6a	Lighting Max.	Pittsburg	46.7	4.85	2.14	Steady	Christmas, 1904.
	Railways	Pittsburg	66	7.44	1.52	Fluct.	Week ending July 1st, 1905.
	Lighting	Pittsburg	71.2	2.11	1.4	Steady	Week ending January 7th, 1905.

* Load Factor = Average Load. / Steady Max.

TABLE No. II.

Appendix No. 2.

SUMMARY OF RESULTS—PRODUCER GAS TESTS.

U. S. Government, St. Louis, 1904-1905.

175 kw.—235 H. P. Producer Gas Plant—Belted—Full Load.

Approximate Calorific Value Dry Fuel.	14,000	13,000	12,000	11,000	10,000	Summary
No. of Tests	4	5	3	3	2	17
Avg. Length in Hours	17½	32¾	22⅓	23¾	23¾	25
FUEL						
Name	W. Va.	Ind. Ill. Ala. Ky. Ind. Ter.	Ind. Ill. Col.	Mont. N. D. Texas.	Wyo. and Texas.	U. S.
Character	Bit. R. M.	Bit. R. M.	Bit. and Black Lig.	Lignite.	Bit. & Lig.	Bit & Lig.
B. T. U. per lb. Dry..	14,501	13,225	12,667	11,425	10,792	12,854
B. T. U. per lb. Actual	14,223	12,303	10,942	8,242	8,458	11,346
GAS						
Yield cu. ft. per lb. dry	66.4	51.06	50.5	31.9	32.7	49.0
B. T. U. per cu. ft....	145.3	154.6	153.3	168.5	160.4	155.3
Prod. Effcy.—%.......	65.4	64.9	70.8	65.9	62.1	65.9
PLANT DUTY						
Lbs. per BHP Hour, Actual	1.16	1.51	1.44	2.28	2.12	1.62
Lbs. per KWH, Actual	1.82	2.38	2.27	3.59	2.83	2.50
Lbs. per KWH, Dry..	1.79	2.21	1.95	2.52	2.55	2.16
B. T. U. per BHP Hr., Actual	16,498	18,580	15,755	18,780	17,920	18,375
B. T. U. per KWH, Actual............	28,890	29,295	24,838	29,600	23,915	28,350
B. T. U. per KWH, Dry...............	29,975	29,225	24,725	28,800	27,505	27,790

21 in.; stroke, 30 in.; speed, 150 r. p. m.), each direct connected to a 260-kw. alternating current engine type generator. These engines are both of the single crank type, but with the tandem arrangement, a power stroke is developed at each half revolution, as in the double acting steam engine. The gas units will operate in parallel on the electrical end, without the necessity of synchronizing the cranks (The cyclical speed variation and the governor regulation is sufficient to meet present alternating current generator specifications.) Owing to the absence of battery and the small number of cars, the plant will be subjected to the most severe test possible. It is estimated that one generating unit will take care of the present maximum demand with two cars starting and two running.

Natural gas fuel is entirely used in this territory, and at the present price and heat value will correspond with producer gas delivered

OPERATING COSTS.*

London Metropolitan Boroughs.

TABLE No. IV.

Year Ending March 31st, 1904. Appendix No. 3.

	Plant Cap'y kw.	Output Sold	Ratio Sold Gen't'd %	Load Factor %	Operating Cost—d per K. W. H. sold: Fuel	Supplies **	Labor	Repairs ***	Works	Total
Average of 11 Steam Plants.†	2,799	2,997,500	83.9	17.25	.597	.059	.214	.218	1.09	1.41
Walthamstow ..	810	1,019,326	80.0	15.45	.368	.152	.288	.048	0.856	1.05
Savings % (favor gas)					+38.4	††	-13.5	+78	+21.5	+25.4
Operating Expense Items—% Works Cost (Steam)......................					55	5.4	19.6	20	100	129
Operating Expense Items—% Works Cost (Gas).........................					43	17.8	33.6	5.6	100	123

* Data from "Electrical Times." Financial Reports.
** Oil, waste, water and miscellaneous supplies.
*** Includes repairs to buildings, electrical equipment and distribution system.
† Steam Plants—Hackney, Stepney, Poplar, Battersea, Hammersmith, St. Pancras, Fulham, Shoreditch, Southwark, Hampstead, Islington.
†† Artesian well not in service. Water paid for.

TABLE No. V.

OPERATING COSTS—800 H. P. GAS POWER STATION,

Bradford, Pa.

Appendix No. 4

	1904	1903
Annual output.,..........................K.W.H.	804,092	780,300*
Station load factor ....%	19.54	....
Gas Consumption.................... ....cu. ft.	20,056,000	18,162,000
Plant duty (including heating) cu. ft. per K.W.H.	24.9	22.4
Average price of gas ....cts. per M cu. ft.	12.32	16.5

Operating Costs—Cents per K. W. H. Generated.

Fuel (including heating)......................	0.307	0.384
Labor—Power station only....................	0.380	0.392
Supplies..	0.059	0.072
Repairs—Engine and Electrical Equipment....	0.079	0.050
Repairs—Gas engines only....................	0.010	0.013
Total Works................................	0.825	0.898

* Estimated from nine months metered output.

at a cost of about two cents per thousand cubic feet. The economy in operating with natural gas is striking. In the old gas plant it is estimated that the cost of power averages .75 cent per kw. h., including all items chargeable to operation, except repairs on building and battery; the corresponding gas consumption being [illegible] per kw. h.

Among gas power stations in America and British territory we find a large number up to 2,600 h. p. capacity operating on producer, natural and oil gas, and many with the alternating current system with generators running in electrical parallel. In fact, parallel operation by gas engines on a large scale was first accomplished in this country at East Pittsburg, with three cylinder engines of the vertical single acting type. In view of the success with this type of engine, it is evident that the tandem and twin-tandem double acting type should be even more suitable. In Great Britain 20 central stations, from 40 to 2,000 kw. in capacity, are in operation, mostly with producer gas.

In the field of electric lighting much has been accomplished. Outside of the Walthamstow station, already mentioned, an interesting plant is the 1,150-h. p. station of the Rockland Electric Co., at Hillburn, N. Y., equipped with Westinghouse horizontal double acting engines, operating on Loomis-Pettibone producer gas. As in several other industrial plants using this type of producer, most of the water gas generated [illegible] "air" or "blow" gas, too lean for other purposes, [illegible] the engine plant. In many respects [illegible] possible the commercial use of [illegible] the cheap "air" gas is rendered useful for generating power.

The utilization of waste products of manufacture has within recent years made great progress. [illegible] been put to use on a large scale [illegible] the use of the producer in its present or in modified form for utilizing all combustible wastes recoverable in manufacturing processes. Blast furnace gas applications are now more or less familiar; coke oven gas from by-product coke ovens has many notable applications in Europe (a small plant is in use at Camden, N. J.); and oil gas obtained by fractional distillation of [illegible] refining process) has lately been successfully applied in America.

Summary.

The large number of small plants that has come within our range of experience has not prevented us from obtaining similar experience from larger ones. The operation of close to 100 plants, from 200 to 2,600-h. p. in capacity, would seem to indicate that some measure of success has been attained. That one-half of the aggregate capacity operates on natural gas and but one-third on producer gas [illegible] emphasizes the value of this country's natural resources, rather than reflects upon the producer gas system, especially when one considers the comparatively short time that producer gas has been seriously taken up. About 10 per cent of the larger plants (above 200 h. p.) operate city and suburban railway systems. The remainder are devoted to many classes of service, such as light and power for

WORKING COSTS—GAS POWER STATION.

Walthamstow District Council.

"Garcke's Manual."

TABLE No. VI. Appendix No. 5.

Population 110,000. Supply commenced September 20th, 1901.
System—Three wire, D. C., 230 - 460 volts.
Capacity Station—2890 B. H. P.—2,000 kw.

Equipment:—
- Gas Generators—8-Dowson-Anthracite.
- Engines—4-115 B.H.P. Westinghouse 3 cylinder vertical engine type.
  - 3-250 " " " " " "
  - 6-280 " " " " " "
- Generators—Helios-Engine type.
- Batteries—Tudor-2 x 254 cells-1000 amp. hr. capacity.

SUPPLY RECORD (Year ending March 31st.	1904	1903
Number of lamps connected (16 c.p. equivalent)	21,000	16,070
H. W. Hrs. generated	1,019,326	659,796
K. W. Hrs. sold	814,187	542,423
Gross efficiency system ... %	80	82.25
Maximum load on feeders ... kw.	600	406
Average load on plant ... kw.	116.4	75.5
Load factor	15.45	15.25
Prices charged—lighting ... cts. per K.W.H.	8	8
(Discount) power ... " "	5 3	5–3
FINANCIAL RESULT.		
Capital expenditure ... to date		
Land and buildings	81,050	75,650
Plant, engines, machinery	198,000	179,600
Total expenditure	546,100	367,000
Revenue ... Total	63,000	48,380
Costs ... "	21,640	16,910
Profit ... "	41,360	31,470
Profit ... % to average capital	9.05	10.87
Sinking Fund ... " " "	2.66	3.20
Average price obtained ... cts. per K.W.H.	7.14	8.40
Per Cent. Working Cost to revenue from current	38.46	40.9

OPERATING COSTS.	Cts. per K.W.H. Sold (1904)	Cts. per K.W.H. Gen. (1904)	Cts. per K.W.H. Sold (1903)	Cts. per K.W.H. Gen. (1903)
Coal* and other fuel ... delivered	0.932	0.745	0.84	0.69
Oil, waste, water** and general supplies	0.383	0.306	0.46	0.37
Wages of workmen	0.738	0.590	0.82	0.67
Repairs and maintenance† ... total	0.081	0.065	0.24	0.19
Total works cost	2.134	1.706	2.36	1.925
Distribution, public lamps, rent, management, taxes, insurance, etc.	0.649	0.519	1.11	0.929
Total general costs	0.649	0.519	1.11	0.929
TOTAL COSTS.	2.783	2.225	3.47	2.854

† Cost of coal averaged $6 50 per ton in 1902 3; $6 75 in 1903 4.
** Artesian well not yet in service; water purchased.
* Including buildings, mechanical and electrical equipments, storage batteries and distribution system.

Appendix No. 6.

COMPARATIVE ESTIMATES—GAS vs. STEAM PLANT.

Assumption for Diagrams, Figs. 11 and 12.

GENERAL.	GAS PLANT	STEAM PLANT
Rated capacity	5,000 kw.	
Character of load	Street Railway.	
Load curve	Figure 1-B.	
Load factor, average	66%.	
Maximum mean load	3,750 kw.	
Load fluctuation	10%—normal, 15%—light loads	
Number or units (one spare)	Five 1,000 kw.	
Type	Horiz. tandem double acting, heavy duty.	Horiz. compound Corliss, condensing.
Overload capacity	10%.	
Average load	2,611 kw.	
Daily output	62,668 K.W.H.	
Daily engine hours	75-½.	
Average load on units	83% rating.	
HEAT CONSUMPTION.	10,000 B. T. U. per B. H. P. Hr.	14 lbs. steam per I. H. P. Hr.*
Overall efficiency unit	80.9%.	83.7%.
Auxiliaries	5%.	10%.
Producer efficiency	75%.	
Boiler—efficiency (13,000 B. T. U. coal)		60%
Plant duty, B. T. U	23,275 per K. W. H.	42,900 per K. W. H.
Coal consumption	1.8 lbs. per K. W. H.	3.3 lbs. per K. W. H.
CAPITAL COST.		
Generating plant	$ 77.20 per kw.	$43.60 per kw.
Boiler—producer plant	25.06	27.50
Buildings, coal storage and switchboards	16.50	18.00
Total	$118.76	$89.10
Excess cost of gas plant	$29.66 = 30%.	

WORKS OR OPERATING COST OF POWER.	CHARGED.
Fuel for all purposes	Pro rata.
Labor	Equal for gas or steam 0.5 cts. per K.W.H.
Supplies, including oil, waste, water, etc.	
Repairs (working repairs only, not betterments	

FIXED OR CAPITAL COSTS

Interest (6%).
Insurance and taxes (2%).
Depreciation (physical depreciation only).
Engine plant 6⅔%, boiler plant 7½%, producer plant 5%, buildings and switchboard 3%. Average for complete plants—gas 5.8%—steam 6.2%.
Total cost of power comprises Works and Fixed Costs.

* Steam pressure 125 pounds, feed temperature 180° F., evaporation 8.1 pounds from and at 212° = 7.5 pounds actual.

city and suburban territory, power for the electrical driving of industrial works, power for operating railroad terminals, gas compressing stations, water pumping plants and high service fire systems. A notable example of the latter is the 2,200-h. p. station in Race St., Philadelphia. Most of the prominent types of producers are represented, including the Mond, Loomis-Pettibone, Dowson, Taylor and the more recent Westinghouse systems. A few small plants are working on suction gas. This indicates that successful operation is not confined to any particular type of producer.

TYPICAL GAS POWER PLANT FOR COMBINED POWER AND METALLURGICAL SERVICE—ATHA TOOL COMPANY, NEWARK, N. J.

In conclusion we can but reiterate our premises:

1. That the gas engine has been brought to a state of development where it is capable of doing the same work as the steam engine, with far greater efficiency, and usually at reduced cost.

2. That the producer has been so far perfected as to be a reliable and more efficient generator than the steam boiler.

3. That the gas power plant "in toto" is entirely suitable for even the severe service incident to electric railway operation.

4. That its component parts, engine and producer are possessed of characteristics leading to harmonious co-operation.

5. That practical difficulties incident to gas power working have been so far overcome as to warrant commercial confidence.

6. That experience with gas power in almost every known line of modern industry has proven its general sufficiency for any power service.

Such data as have been obtainable are presented in the light of a record of past performance rather than in the nature of prophecies regarding the future. The future is believed to be already assured.

APPENDIX.

CHARACTERISTICS OF RAILWAY LOADS.

The various systems may be classified as follows:

Metropolitan: Light cars, many in number, small headway (one to five minutes), small load fluctuation—yielding a station load that may be readily predicted and closely followed up by the requisite engine capacity.

Urban: Light cars, few in number, medium headway (ten to fifteen minutes), station load fluctuating considerably.

Interurban: Heavy cars, few in number, large headway (30 to 60 minutes), high speed, moderate acceleration, heavy grades, load violently fluctuating, cannot be closely predicted

Rapid Transit: Heavy cars, multiple unit trains, small headway at rush hours, rapid acceleration, load fluctuating at sub-stations.

Specific examples may be found in the accompanying curves, which are explained in table No. 1. In all the city systems the morning and evening peaks are strongly accentuated and the daily average is high. Owing to the superposition of loads from various distribution centers or sub-stations, the fluctuations at power stations are not necessarily severe. With heavy service, however, sub-stations are subjected to severe fluctuations, for example, Manhattan sub-station No. 2, shown in Fig. 4, where the fluctuation is 40 per cent above and below the average load.

The interurban load presents less distinct peaks, but, although the average is high, the station is subjected to violent fluctuations. This may be appreciated from the recording meter chart, Fig. 7, corresponding to the load curve shown. Although the inertia of the instrument pointer has probably exaggerated the indications, it is safe to say that fluctuations of 30 per cent from the mean load are ordinarily encountered and with a reduced number of cars as high as 60 per cent.

The characteristics of electric lighting service, on the other hand, are quite different. Except in the case of occasional storms, the load may be closely predicted and followed up with necessary generating capacity, and rapid fluctuations are practically absent.

WARREN & JAMESTOWN RAILWAY SYSTEM.

The Warren & Jamestown railway is a high speed interurban road, approximately 21 miles in length, operating over a comparatively level and straight right of way between Warren, Pa., and Jamestown, N. Y., at the southern end of Lake Chautauqua. The population of the territory traversed is estimated at 50,000, with 11,000 tributary, not including a large summer population at the various lake resorts. Heavy high speed cars will be used, approximately 52 feet over all, and with a normal seating capacity of 54 persons, each car being equipped with four alternating current 50-h.p. motors on 33-in. wheels. Four cars will be operated at present, with two additional cars later on.

Power will be generated at the power house now operated by the Warren Street Railway Co. at Stoneham, four miles south of the city. For some time gas engines of the vertical single acting type have been used for operating the present city railway system, and it is due to the general successful experience from gas power that gas engines will be used for operating the interurban road.

A noteworthy feature of the new interurban system is that Westinghouse single phase apparatus is used throughout, with 22,000 volts transmission and 3,300 volts on the trolley, which is of the Westinghouse catenary construction. A step-up transformer station is located at the power house and two step-down sub-stations about one mile distant from both Warren and Jamestown. These equipments contain transforming, switching and protective apparatus alone. As no

direct current is used upon the system, it is impracticable to employ storage batteries, so that the generating equipment will thus be required to sustain at all times the entire demand. In the present city system a 150-ampere hour (one hour rating) storage battery is in use, which is kept floating on the line throughout the load fluctuations, to the relief of the gas engine equipment. In the new plant the gas engines must sustain both load and fluctuations without assistance. Each unit complete of the new equipment occupies a floor space of 20 x 17½ ft., allowing 4 to 5 foot passageways, which is equivalent to 3.65 sq. ft. per kw., or 1.9 square feet per h.p. capacity.

THE RIDLON TROLLEY CATCHER.

The Ridlon trolley catcher is presented to the trade as a strictly up-to-date design embodying numerous points of advantage.

It is positive in its working, having a permanent stop on the reel and in the case, with an action so devised as to prevent the partial locking of the reel. When used on single truck cars where there is considerable oscillating motion it will not catch and pull the wheel from the wire.

When the wheel does leave the wire the mechanism catches quickly and has the advantage of having an action devised to retard the unlocking should the pole rebound.

Owing to the simplicity of the catcher, the liability of parts working loose is reduced to a minimum. The reel spring is housed inside the case thereby protecting it against the entrance of rain water, which would cause the spring to rust and consequently shorten its life.

RIDLON TROLLEY CATCHER

The construction of the case is such as to allow ample room for the trolley rope so that with the pole down, the reel will take up the slack. The lower part of the case has a large opening, so access can be had to the reel without removing it from the case and the rope may be unwound without taking the catcher apart. This also provides a drip so that in wet, sleety or freezing weather the reel cannot become blocked.

These catchers are manufactured in the company's own factory, and it can guarantee superior workmanship and the best of material. A sample catcher sent on 30 days' approval.

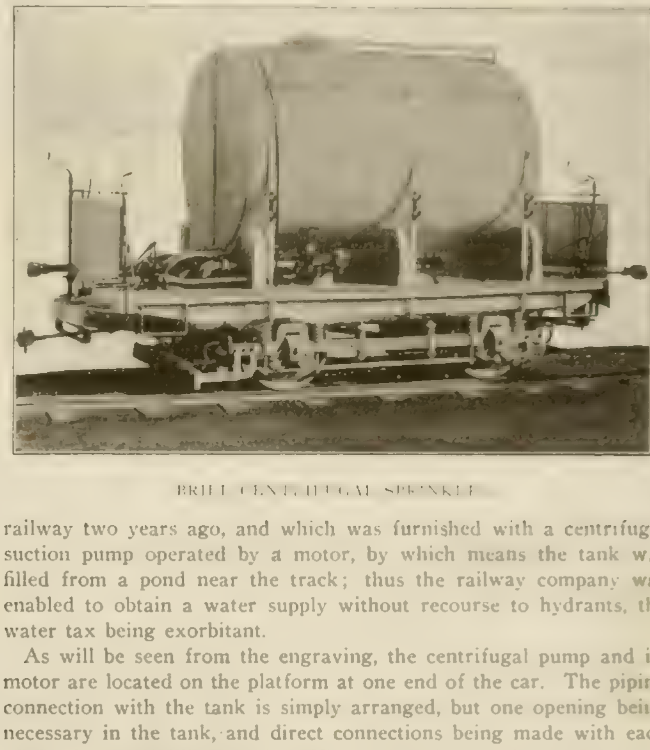
E. W. BLISS CO.

An elaborate display of gears and pinions is made by the E. W. Bliss Co., Brooklyn, N. Y., at space 23, section K. The latest designed gears manufactured by this company are built on heavy substantial proportions to meet the demands of heavy street and interurban service. The solid gear is given prominence by the company and are made from the best quality steel casting and cut mechanically correct. The company has a full line of split as well as solid gears. The company is displaying both machine cut and hammered pinions, and advises that it has in stock at its Brooklyn plant a large assortment of each of the standard types of gears and pinions for immediate delivery. The representatives of the company at the convention are B. W. Stone, J. Matthews and Charles E. Porter.

THE NEW CENTRIFUGAL SPRINKLING CAR.

One of the novel features of the [illegible] of the J. G. Brill Co. is a new type of street sprinkler known as the Brill centrifugal sprinkling car. The Brill company claims that in the centrifugal sprinkler, recently invented and patented, an apparatus is provided which has no drawbacks, which is highly efficient and [illegible] in every particular. For more than a year [illegible] experiments have been conducted to demonstrate the practicability of its operation under all conditions, and the builder is so well satisfied of its success, that it is now building a number, although the season is nearly at an end. The car shown in the engraving was delivered to the Lehigh Valley Traction Co. a few weeks ago, and the [illegible] its counterpart.

In late years the centrifugal pump has been found adaptable to a large number of purposes and the force of which it is capable is well known in connection with fire engines. Its use for expelling water from a sprinkling car was suggested to the builder by a gravity sprinkler, which the company designed and built for a New Jersey



BRILL CENTRIFUGAL SPRINKLER

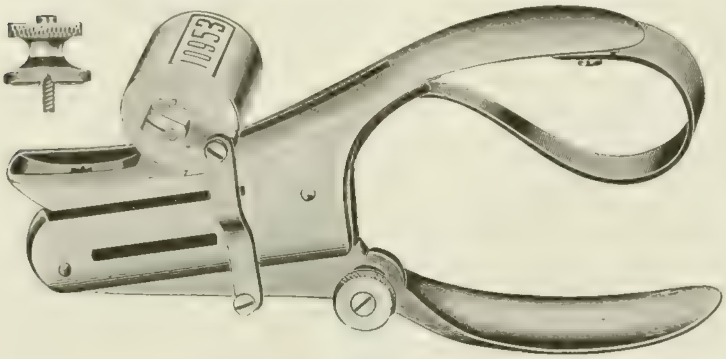
railway two years ago, and which was furnished with a centrifugal suction pump operated by a motor, by which means the tank was filled from a pond near the track; thus the railway company was enabled to obtain a water supply without recourse to hydrants, the water tax being exorbitant.

As will be seen from the engraving, the centrifugal pump and its motor are located on the platform at one end of the car. The piping connection with the tank is simply arranged, but one opening being necessary in the tank, and direct connections being made with each of the four sprinkling heads. The motor rheostat is a neatly contrived arrangement placed against the dasher. The pump may be used for filling the tank as well as expelling the water, and a connection for this purpose is arranged directly underneath the pump. Water may be easily lifted vertically 20 ft. and may be drawn from quite a distance, so that if there is a lake or stream anywhere along the lines, it is a simple matter to run a hose or lay a main from the track to the water and connect with a short hose to the pump; or the tank may be filled in the usual way by an inlet valve at the side of the piping or through the manhole.

The sprinkling heads have much to do with the success of this sprinkler. They are of the patented type of the builder and have been adopted after the most thorough tests of their all-round efficiency. The head is vertically slotted for half its circumference and has a cylindrical chamber with a corresponding slot. The cylinder is moved forward and back, and revolved, by a handle on the platform. The amount and the range of water is always under control and in a moment the water may be cut down to the thinnest film or may be made to cover any distance from a point inside the track to 50 ft. away. Therefore, for use on city streets where vehicles must be avoided and where the width of the street varies, the water can be directed accurately and started or cut off instantly. Gate valves are provided, although not absolutely necessary, for the sprinkling heads completely cut off the water, but they are an added convenience. An automatic by-pass valve prevents back pressure on the motor at such a time when all four sprinkling heads might be suddenly closed.

WOODMAN'S CONSECUTIVE REGISTERING TICKET PUNCH.

The R. Woodman Manufacturing & Supply Co., 63 Oliver St., Boston, Mass., is manufacturing and distributing Woodman's consecutive registering ticket punch, which is shown in the accompanying engraving. The design of this simple and ingenious device is neat and attractive, the action is positive, while its durability and ease of manipulation recommend it where a perfect register is required. It is equipped with a simple locking device attached to the handle, which locks the the punch when not in use and prevents



WOODMAN'S CONSECUTIVE REGISTERING TICKET PUNCH

the punch and register from working, which, of course, is essential to an accurate record of tickets or fares punched. The lock is operated by giving a half-turn to the reciprocating cam attached to the handle of the punch, while another half-turn will release the handle of the punch and give both the punch and register perfect freedom of manipulation. The register has a capacity for registering from 1 to 10,000 and any design of die can be made for the punch. The company also manufactures punches of every description and size to order.

NEW MEMBERS A. R. M. & E. A.

The following is a list of members of the American Railway Mechanical and Electrical Association, who have joined since the convention opened:

F. M. Brinckerhoff, engineer Hudson Companies, New York City.

F. W. Darlington, consulting engineer, Philadelphia, Pa.

R. L. Lindsay, general manager, Durham Traction Co., Durham, N. C.

A. D. McWhorton, master mechanic Memphis Street Ry., Memphis, Tenn.

F. D. Connelly, master mechanic, Conestoga Traction Co., Lancaster, Pa.

J. H. Hanna, assistant engineer, Capitol Traction Co., Washington, D. C.

J. M. Larned, engineer maintenance of way, Pittsburg Railways Co., Pittsburg, Pa.

C. O. Mailloux, electrical engineer, New York & Port Chester R. R., New York City.

Fred R. Newman, master mechanic, York Street Railway Co., York, Pa.

Terrence Scullin, master mechanic, Cleveland Electric Railway Co., Cleveland, O.

W. S. Patterson, master mechanic, Utah Light & Railway Co., Salt Lake City.

R. B. Stearns, superintendent Northwestern Elevated R. R., Chicago.

George B. Taylor, assistant engineer of way, Philadelphia Rapid Transit Co.

Edward Taylor, engineer of equipment, Brooklyn Rapid Transit Co., Brooklyn, N. Y.

Paul Winsor, chief engineer motive power and rolling stock, Boston Elevated Ry., Boston.

Frank D. Masterson is on hand to exploit the merits of the electrical specialties of the Chase-Shawmut Co., which company he is representing.

BUDA FOUNDRY & MANUFACTURING CO.

The exhibit of the Buda Foundry & Manufacturing Co., Chicago, includes the following products of the company: Paulus track drills, Buda track drills, switch stands, car replacers, jacks, track signs, switch clips, rods, rail braces and switch fixtures Also a complete line of Rich drill chucks and spindles, designed to be used in connection with the Paulus drill. The booth is located in space 4, section E, and the company is represented by Robert Spencer, W. H. Bloss and E. S. Nethercutt.

GENERAL ELECTRIC RAILWAY EQUIPMENT.

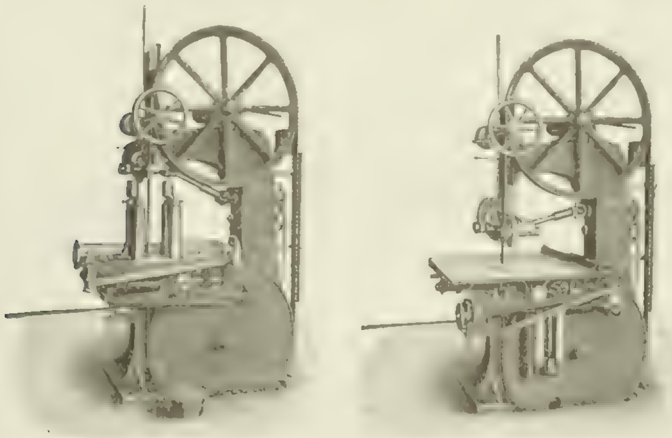
The General Electric Co. exhibits a complete equipment of the latest design of its Type-M Sprague-General Electric multiple-unit train control system. This shows a compactly arranged grouping of the various parts underneath the car, and is similar to the equipment furnished the Boston Elevated Ry. and as adapted for rapid transit systems in Paris, London, New York, Boston, Philadelphia. Chicago and San Francisco. The recent sales show a great variety of types and sizes of railway motors furnished by the General Electric Co. to many electric railways. The latest 40-h. p. railway motor, known as the GE-80, is already well known.

The Crane Co., Chicago, has recently issued advance circulars No. 6 CLJ, describing No. 181 E "Cranelap" extra heavy flanged pipe joints with swivel flanges, suitable for working pressures up to 250 lbs. These joints are also furnished with flanges made from cast iron, ferrosteel, malleable iron, cast steel or weldless steel. No. 295 E "Craneweld" flanged pipe joints with wrought steel flanges welded on, suitable for working pressure up to 250 lb., are described and illustrated in advance circular No. 9 CWJ.

If you want some pointers on "anti-straddling" switches with self-locking tongues as manufactured by the New York Switch & Crossing Co., Hoboken, N. Y., just talk to Arthur W. Pratt, who used to be with the Public Service Corporation, but is now selling switches.

NO. 146 BAND RIP AND RESAW.

The combination of a band rip saw and a band resaw will be recognized by experienced operators as most desirable and very convenient, having all the advantages of two machines and yet occupying the floor space of one. While the combination is new the mechanism for both operations embodies the features that have been so successful in single tools. In the machine of this type manufactured by the J. A. Fay & Egan Co., Cincinnati, the upper wheel is free from vibration, and saws of varying lengths may be used. The upper wheel is fitted with the company's patent knife edge straining device, always giving an even tension to the blade, thus prolonging its life. The lower wheel is solid (or webbed), lessening vibration, circulation of dust, and preventing any over-running. The wheels are 42 in. in diameter and carry a 3-in. blade. The table is 35 x 42 in., and is mounted on a rocker bearing, permitting it to be angled 15 degrees for bevel sawing, and is made in two parts. The front part carrying the resaw rolls is instantly reversible, and the lower side when reversed forms a perfectly clear table for ripping. Friction rolls are mounted in the table to facilitate the feed.



J. A. FAY & EGAN CO., NO. 146 BAND RIP AND RESAW

The resawing rolls are 3 in. in diameter, are arranged to self center, or by moving the lever pin one set of rolls can be made rigid to saw from one side of the board. Boards up to 18 in. wide may be resawed and the rolls open to saw to the center of 8 in. The feed rolls for ripping are carried on an adjustable dovetail slide fitted onto the upper bearing arm. The feed rolls are 8 in. in diameter and the distance between the feed-in and the feed-out roll is short, to permit feeding short stock. The machine can be almost instantly changed from a rip saw to a resaw, or vice versa. The fence is a new eccentric locking type and can be moved back to permit sawing up to 24 in. wide. The saw guides are of the latest type and are placed close to the cut of the saw. The feed of the machine is regulated by variable speed frictions operated by a lever convenient to the operator. For resawing the feed may be varied from 10 to 50 ft. per minute, and for ripping from 30 to 140 ft. per minute. A brake mechanism is furnished making it possible to stop the machine instantly.

MANNING, MAXWELL & MOORE, INC.

Manning, Maxwell & Moore, Inc., 85 Liberty St., New York City, is represented at the convention by Mr. Guy B. Gosman. The company controls the products of the Ashcroft Manufacturing Co., the Consolidated Safety Valve Co., the Hayden & Derby Manufacturing Co., and the Hancock Inspirator Co., all of which are shown at its exhibit at space 21, section I. Thomas G. Keogh and George E. Randle, manager of the Philadelphia office, are also in attendance.

The Frank S. DeRonde Co. has its exhibit at space 17, section C, and includes therein samples of Ruberoid roofing, P. & B. insulation, compound, tape, SPC armature varnish, cold water paint and Scarbolate, a new car cleaning compound. The company is represented by J. G. Satterthwait, C. G. Dickinson and J. P. Davison, who is looking after the interests of Sacarbolate.

STREET RAILWAY REVIEW

Vol. XV | OCTOBER 15, 1905 | No. 10

The Utah Light & Railway Co.

Being a History and Description of the Uniting of Several Generating Stations by One Transmission Network.

BY O. A. HONNOLD, ELECTRICAL ENGINEER

The present extensive lighting, power and railway system of the Utah Light & Railway Co. comprises several individual plants, a consolidation of the several companies having been completed Jan. 1, 1904. The object of this article is to describe the engineering and operating features of this system, particularly since it is one of the very few in the United States having so many power stations working in parallel and supplying current for all kinds of service.

The Salt Lake & Ogden Gas & Electric Light Co. was the original company, and operated steam generating stations in Ogden and Salt Lake City, also the gas manufacturing plants at these two cities.

The Citizens Electric Light Co. had a steam-driven, monocyclic 2,300-volt station in competition with the old Salt Lake & Ogden Gas & Electric Light Co.

During the summer of 1896 the Cottonwood power plant was started in Cottonwood Canyon, 16 miles southeast of Salt Lake. This plant has a capacity of about 2,000 h. p., driven by water with a 360-ft. head and generating 3-phase current raised to 10,000 volts pressure. This was stepped down at Salt Lake City to supply the 1,000-volt lighting circuits of the old Salt Lake & Ogden Gas & Electric Light Co's. system. There were two other substations one at Murray eight miles south of Salt Lake City and one about four miles southeast of Salt Lake City. These were to supply smelters, brick mills, etc. Two 150-kw. synchronous motors were installed in the old steam station in Salt Lake City, driving on to the main line shaft which had previously been driven by two large Buckeye engines. At the same time a 2,000-volt circuit was started in the city. It was intended to gradually cut over all the lighting circuits to this voltage; the synchronous motors driven by the water power would relieve the steam of that much load in driving the old alternators, arc machines, Edison machines, etc., which were belted off the line shaft. When the service from the water power was interrupted these motors were driven as generators to keep up the supply for the 2,000-volt load until they could be synchronized with the current from the water power plant again. It was then considered a very serious matter to synchronize these machines, but for several years synchronous motors of this size have been thrown in and brought into step as easily as a five-h. p. motor is started.

CENTRAL STATION—UTAH LIGHT & RAILWAY CO.

In 1896, the Utah Power Co. was organized, primarily to furnish power for the Salt Lake City Railroad Co's. system. The station of this company takes water from the tail race at Big Cottonwood power house through a flume about two miles long, thence the water is carried down through a steel pipe to the power house, giving a head of 460 ft. This plant consists of 2-phase Westinghouse machinery of 2,000-h. p. capacity feeding a transmission line 14 miles

long at a pressure of 16,000 volts, 3-phase, the Scott connection being used both for the step-up and step-down transformers. The railway service was supplied with current from 60-cycle, 2-phase 450-kw. rotary converters. These converters were among the first to be put into service and much pioneer work was done to make them work properly without "pumping." More will be said regarding the handling of these converters. As a competitor of the other company the Utah Power Co. obtained franchises to furnish lighting and power current in Salt Lake City.

In 1897 the 5,000-h. p. station of the Pioneer Electric Power Co., in Ogden Canyon, 37 miles north of Salt Lake City, was completed and started. This company obtained a 10-year contract for street lighting and thus gained an entrance to the city. It was also intended to contract for power with the Salt Lake & Ogden Gas & Electric Light Co., both in Salt Lake City and Ogden. Engineering features required the parelleling of the Pioneer Co's. system with the old Cottonwood Co's. system through the medium of the Salt Lake & Ogden Co's. plant. This made for the engineers a very difficult problem of properly measuring the power received from the individual companies.

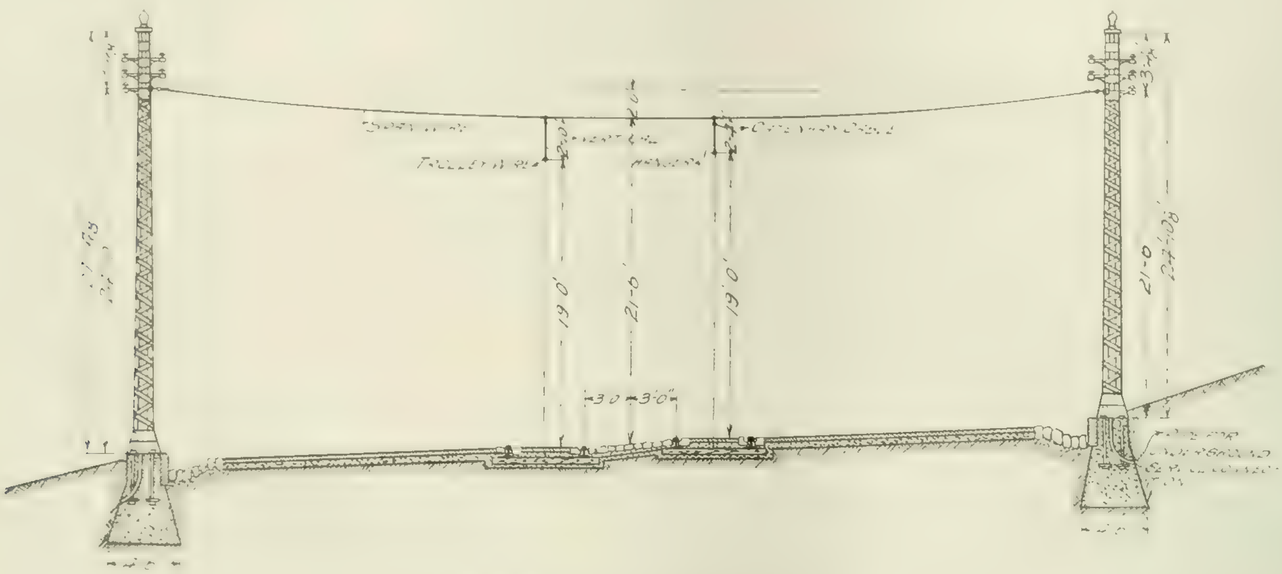
Consolidation of these three companies seemed the easiest solution. This was brought about, all including the Citizens Electric Light Co., being combined under the name of the Union Light & Power Co. It is believed that many times in other places the engineering requirements have been the predominating arguments for the consolidation of interests and particularly so in later years when high voltagee has been brought into use for serving large districts with current both for lighting and railway use. The voltage of the Cottonwood system being 10,000, and that of the Pioneer 16,000, these two plants were paralleled through the 2,000-volt distribution circuit at Salt Lake City. The old 1,000-volt circuits were all gradually cut over to 2,000 volts. The old alternators were all sold to various small companies throughout the surrounding country and many of them are to-day giving good service.

One very interesting feature is the method of supplying current to the commercial district. When current from the water power plants was first brought to the city, the commercial district was covered by a 4-wire solid network secondary of 115-200 volts. Transformers were placed from time to time in the most suitable locations as the load continued to grow. Today this load has grown to be a very heavy one, and the network is still maintained and never yet have there been any interruptions due to transformers burning out and thus causing trouble from the fact that all are tied in solid on the secondary side. Cutouts are used on primary side.

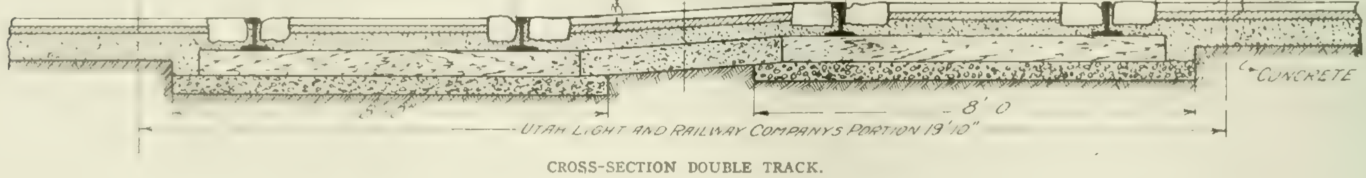
Water conditions, due to the dry autumn seasons and to freeze-ups in the winter, soon seriously required that the engineers connect all available power from the three water-power stations and the steam plants of the Salt Lake & Ogden and Citizens companies. The plant of the Utah Power Co., which was still outside the consolidation, received its share of troubles. It was tried in various ways to parallel with the other system this 2-phase-3-phase Westinghouse plant, which fed its transmission line at a pressure of 14,000 volts. One night about 11 o'clock an emergency call came to the engineer, requiring the paralleling of the system of the Utah Power Co. and the Union Light & Power Co., or else stopping the cars and leaving many customers without lighting service.

Two potential transformers and pilot lamps were thrown into a buggy and a drive of 14 miles made to the power house. In about 15 minutes after arriving a 2-phase-3-phase system was successfully paralleled with the 3-phase of the main system and has been so running since. It is believed this was the first time such connections were made and these brought about a lease arrangement, this station was to be run for several years in parallel with all of the others and supply current for all the street railway service.

The next object was to tie the Cottonwood power station to the rest of the system, on the high tension side instead of through the 2,000-volt link in Salt Lake City. There happened to be on hand a bank of 16,000-volt to 2,300-volt transformers. These were connected in between the 16,000 and the 10,000-volt circuits, acting the same as ordinary boosters; that is, the 10,000-volt current was connected through the 2,300-volt secondary coils and the regular booster connection of potential wires made on the 16,000-volt side. This worked satisfactorily for a year, when one of the transformers was burned out by lightning. It is interesting to look back on all of these experiences, making the various types of machines, 2-phase and 3-phase, all at various voltages, work with each other. It was



STANDARD TROLLEY SPAN CONSTRUCTION.



CROSS-SECTION DOUBLE TRACK.

noticed when the first two stations were put together that there was a very great advantage gained in regulation; that is, more machines gave more momentum to the system. Some break down of a flume, steam plant or a snow-slide or other cause of shortage of water simply made the other stations pick up the load automatically and the lighting or railway service were not inconvenienced by the trouble. Frequently a quick call would be made on the engineer, "What can we do to keep things going." Away out west here, we could not wait to wire and ask the factory if the 2-phase and 3-phase systems would work together, or if the high voltage boosters would do the business without breaking down. It was necessary to connect them up in a hurry and try them. They operated successfully for some time and in the meantime most of the old Cottonwood step-up transformers had been furnished with new coils having 16,000-volt taps. A direct paralleling of all stations at 16,000 volts pressure could then be made.

The next move was the consolidation of the Salt Lake City Railway Co. with the Rapid Transit Co., making one system of street railways in Salt Lake City, and as the system grew rapidly the question of power became an important one. This company's water power plant being already practically operated with the other company's system an arrangement was made for the Light & Power Co. to supply the entire street railway system with power, operating its old steam station as well. This arrangement began in March, 1902, and at the time much steam-driven machinery was still being run with only one rotary converter supplying power.

Before this there always had been some difficulty in making the two converters run in parallel. The principal reason for this trouble was because it had been tried to run both converters from the same bank of step-down transformers. Another trouble was that the step-up and step-down ratio between the power house and rotary station was such that the generators were not allowed to come up to full excitation. The ratio was corrected by connecting in multiple two of the four secondary coils in the step-down transformer instead of all four being in series. This also relieved the tendency to "pump" which had been causing trouble, due to the same cause, when running the Utah power house and the rotary in parallel with the rest of the system. A second bank of transformers was installed and the second rotary started. As the rotaries were both heavily overloaded some choke coils were wound on old transformer cores. These were used to equalize over excitation due to the series com-

SWITCHING ROOM, MAIN RECEIVING STATION.

pounding. It was then possible to work the rotaries in parallel both on the alternating current and direct current sides. Today these machines run satisfactorily and with as little trouble as a 25-cycle rotary.

The street railway power and lighting loads in the valley increased, requiring much additional power. A 1,500-h. p. reserve steam plant was put in at Salt Lake City. As the Telluride Power Co. had completed its transmission lines from Logan to Provo, arrangements were made to [illegible] 40,000 volts pressure. The paralleling of this system with the already large system of the Light & Power [illegible] side. This gave a system with five water power stations and three steam stations, all running in parallel.

A [illegible] water power [illegible]

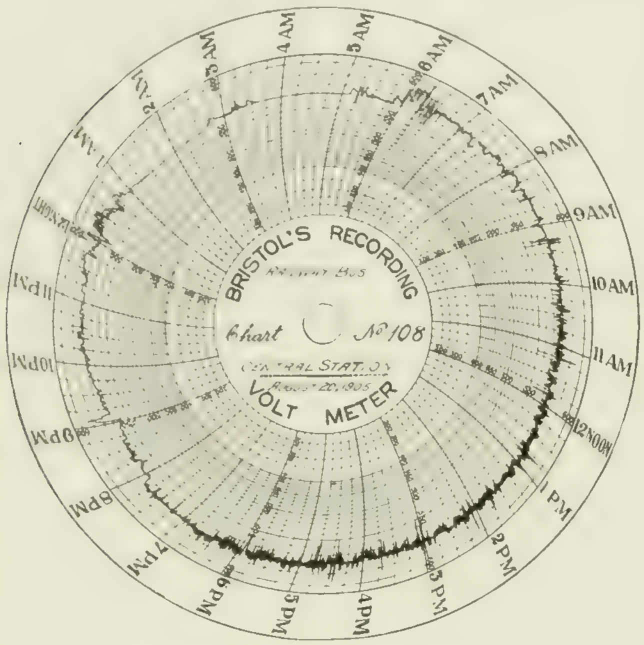
TRANSMISSION LINE ENTERING OGDEN [illegible]

tem in December, 1903. This plant with 3,000 h. p. Westinghouse machinery was installed by the Utah Sugar Co. to operate in connection with its large irrigation system for Bear River Valley. The power house is located 85 miles north of Salt Lake City, or 45 miles north of Ogden, and the transmission line ties in with the main Ogden-Salt Lake lines at the power house in Ogden Canyon. The transmission pressure at present is 28,000 volts, but it is intended later to run at 40,000 volts. The power house is located two miles below the dam in Bear River Canyon, and gets its supply of water through a large "U" shaped pipe nine feet wide connecting at each end with the two large irrigating canals, one on either side of the river. These two canals, during the irrigation season, carry water for irrigating 36,000 acres of land. They are on the same level, and the construction of the bridge and pipe line across the river for power purposes has proven very valuable in allowing the upper end of either canal to be shut down for repairs and yet keep the service continuous in the two irrigation systems below. One of the illustrations shows this unique scheme for obtaining power as a by-product of the hydraulic plant put in primarily for irrigation purposes. The head is 125 ft. and the pipe is designed for about 4,000 h. p. The operation of this station with its 85 miles of transmission line has been a success from the start.

A great deal of difficulty was had in cases of trouble because of the very scattered condition of stations, the load in Salt Lake City alone being supplied from four separate steam stations and four step-down transformer and high tension switching stations; there were also various sub-stations located in different parts of the valley for smelters, brick works, cement works, etc. This again was a big problem for the engineer to solve, and again it was apparent that the engineering requirements meant a further consolidation, and on Jan. 1, 1904 the railway companies' interests were all combined with those of the Utah Light & Power Co., under the name of the "Utah Light & Railway Co." This at once allowed for the completion of plans for the consolidation of the various stations and sub-stations in the city; the work was carried forward rapidly. A large tract of ground was purchased on the Jordan River in the western part of the city. Here plenty of room was to be had for

the high tension lines and the steam generating station, together with plenty of condensing water. The old central station in the center of the city was re-designed to contain all the railway and direct current Edison 3-wire system machinery as well as distribution panels, induction regulators, etc. for the handling of the commercial district lighting and power circuits.

This central station is now being fed by large bus circuits from the main distribution and steam stations at Jordan. The transmission pressure is 4,000 volts, everything being designed for changing



RAILWAY VOLTAGE, STATION BUS BAR.

to 12,000 volts when the commercial district lighting and power distribution cables are placed under ground. The rotary converter transformers are supplied at 4,000 volts pressure, the sychronizing being done at the 4,000 volt switch. Two 1,200-h. p. motor-generators have been installed, making the total capacity at the present time about 3,000 h. p. for the railway service. Besides this there is a 900-h. p. steam reserve, generating direct at 550 volts for railway use.

The new Jordan station now being completed will contain the most modern high tension apparatus that can be purchased, each circuit entering through high tension oil switches. The design is such that it will be possible to parallel all circuits either on the primary or secondary sides of the step-down transformers.

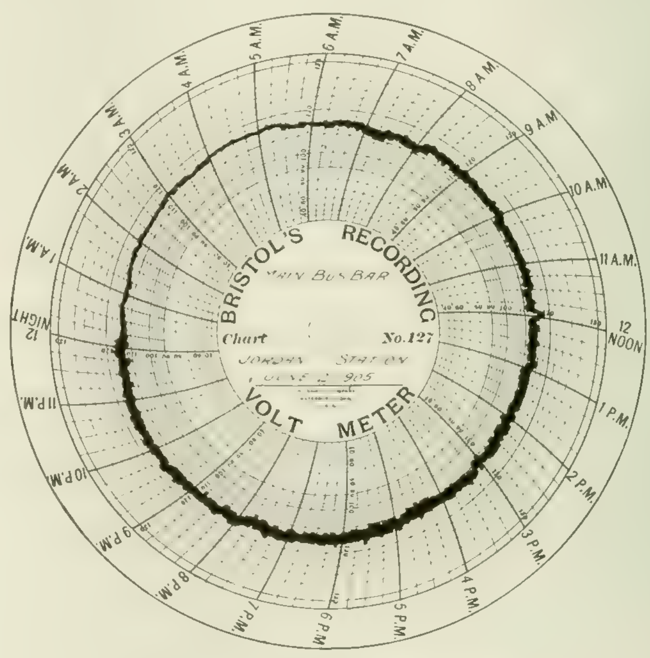
The new Jordan station is built of concrete and brick and is thoroughly fireproof. The transformer banks, lightning arresters and similar apparatus are all contained in separate vaults. The station is so constructed that there are four main divisions; that is, the transformer vaults can only be entered from the outside, the lightning arresters and choke coils on the second floor are separated from the rest of the building by fireproof walls, the low tension oil switches in brick vaults with their wiring located in the basement, and the low tension panels are located on the main floor at one end of the building, with nothing but 100-volt wiring coming through the floor to the instruments. The high tension switches are in brick vaults opposite the high tension entrances with the transformers just outside in other vaults. The arrangement of the apparatus is shown in the acompanying illustrations.

In designing this new step-down and distributing station it has been a desired object to have the whole system sectionalized; that is, any generating station, with its transmission line and step-down transformers, will have connected to it a portion of the whole load proportional to the capacity of that station. In the development of the parallel running of the several systems this has been found to be of great advantage in case of short circuit or other trouble on a transmission line. With so many stations running in parallel in case of accident it is difficult at first to know which section of the system has the trouble. With the new switching arrangement at Salt Lake City, if the sections become separated, each power station without waiting for any orders over the telephone, will maintain its own portion of the load, holding speed and voltage normal; the operator at the main station then synchronizes all together again on the low tension side, afterwards throwing in the high tension paralleling switches. If a section of transmission line has trouble that cannot be cleared or burned off, it is left out and this load transferred to the other stations. There have been cases of severe storms when all of the telephone and telegraph lines have been down, leaving no means of communication whatever with power stations, but with the arrangement as outlined it is not necessary to use the telephone to establish service again if the transmission lines are in operating condition. It is very seldom that any kind of a storm will disable the copper circuits of the transmission line. Pilot lamps and frequency indicators, also load measuring meters on the main paralleling panels at the Salt Lake station indicate to the chief operator when each station is in service again so he can parallel them. This paralleling will be done through very large capacity oil circuit breakers.

Long transmission line operation can be made a success as has been exemplified during the last few years that the several plants have been combined together. The transmission lines must be constructed mechanically strong, good insulators being the most important detail, with the best of men regularly and thoroughly inspecting the line. The various station operators of these lines are kept posted on the operation of the whole system and are given the opportunity to operate in all stations, thus acquainting themselves with the various local conditions and keeping in touch with the operating details of the whole system.

Generating System.

As stated, six different water power plants are supplying power through 450 miles of transmission lines and all working together in parallel with the steam generating plant in Salt Lake City. The most distant stations are 120 miles apart. The stations are never run separately. Depending upon the season of the year with the consequent water conditions, some are run with steady load; that is, they utilize the total flow of the stream, while others have their govern-



BUS VOLTAGE, MAIN STEP DOWN STATION.

ors cut in to do the regulating. During the three months of the irrigating season, practically all the water available in the various streams is utilized for generating power. The steam stations take much of the load fluctuation, and to carry over the peak load in the evening the big power house at Ogden is used. Nearly all the flow of the Ogden River is conserved in the upper reservoir through the 18 hours of lighter load, then utilized to run the station at full load during the peak. The irrigating canals below must have a steady supply during the 24 hours; to allow of this being done a

reservoir below the power house is used for storing the tail race water and thus equalizing the flow.

The steam generating station consists of a 1,200 h. p. Hamilton corliss engine, belted direct to a General Electric 2,300-volt generator. The boiler equipment consists of 1,500 h. p. capacity of Heine boilers equipped with Roney automatic stokers. This steam plant was erected for use as a reserve station, but as the load has grown so fast it will this year be called upon to run quite steadily for perhaps half of the time. During the year 1904 the total steam generation amounted to but three per cent of the total output of all stations.

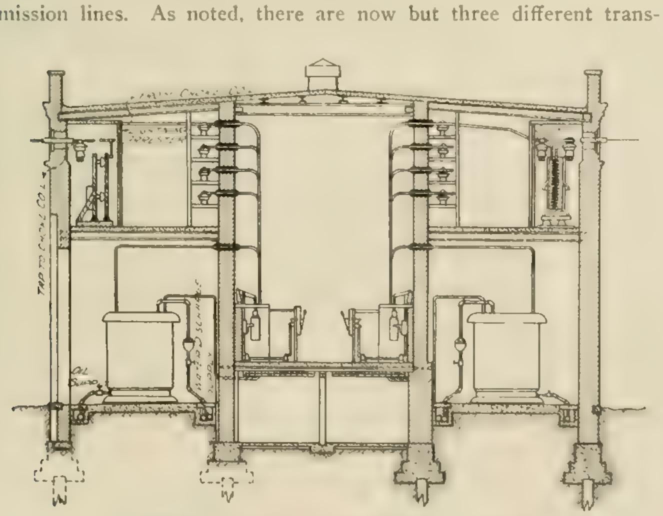
All stations are equipped with the "two meter method" of integrating wattmeters, and daily reports are sent to the general office of the power generated, etc. Meters thus connected also give a continuous check on the power factor; standard indicating power factor meters are also installed, as it is necessary to give special attention to this important point in the regulation to prevent any flow of wattless current between stations.

Good speed regulation is very essential to the successful operation of all of the plants in parallel, and especially so since all classes of load are connected. "Replogle" and "Lombard" governors are used in the water power stations and the steam generating plant is a splendid regulating medium since it is connected so close to the main load in Salt Lake City. From the standpoint of practice and the special requirements of the various classes of load connected up it is necessary to maintain a speed regulation better than two per cent. Voltage charts taken from the main railway bus and the Edison 250-volt bus in Salt Lake City are shown. Since the direct current voltage is a good indication of the speed variation it is believed that it would be difficult to find better regulation supplied from water power stations handling a mixed lighting, railway and power load such as is found in this valley. The 250-volt system supplies service direct to the telegraph and telephone companies for the operation of their systems in this locality. The operation of the telegraph system requires an especially steady regulation.

There has been some serious difficulty in trying to govern water wheels under a high head. As for instance at the Ogden power house with a 450-foot head supplied through a six-foot pipe line six miles in length, it is not safe, nor is it proper to try to stop or start suddenly such a body of water. For this reason arrangements are being made to connect a governor and water tank load so that the generators may always be loaded and the artificial load simply thrown on or off to hold the speed of the system steady.

Transmission Lines.

Some reference already has been made to the handling of transmission lines. As noted, there are now but three different trans-



VERTICAL SECTION, MAIN RECEIVING STATION.

misison voltages; 16,000, 28,000 and 40,000. The 16,000-volt step-up and step-down system is all connected "delta." The 28,000-volt system has both "star" and "delta" connections, with neutrals grounded. Much has been learned in the way of developing proper switching arrangements, lightning arresters, etc., to take care of lightning and other disturbances. Very little damage is done by lightning discharges; only this summer has been tried with remarkable results the scheme of grounding through a lightning storm one of two circuits on the same pole line. Where lightning formerly shut down the system for a short time, this summer several heavy storms have passed over the lines so grounded without doing any damage or causing any interruption of service.

One very important part of the transmission system is a proper installation of telephones and circuits. The power houses on this system have one and [illegible]

MAIN RECEIVING STATION, SALT LAKE CITY.

with the main Salt Lake City distributing station, also with the chief operating engineer's office. Telephone instruments are never left connected on the lines, only an extension bell, which is connected to one side of a double throw switch. When a ring is received or given the switch is thrown over to the other side to connect the telephone with the line. The lines are thoroughly equipped with a type of lightning arrester consisting of metal cylinders set very close together. These arresters are but a modification of a unit of the regular high tension lightning arrester. When a high tension wire breaks and falls across the telephone, this arrester will care for the high tension current in a safe manner. It is also possible to keep up a conversation through a lightning storm, the arrester taking care of the discharges which may occur over the telephone lines. As careful attention is paid to the insulation of the telephone circuits as to the transmission circuits. The two wires are kept insulated from each other and from ground, where they enter a building and up to the instruments with a consideration as if they were for a 2,000 volt circuit. These telephone lines working under transmission circuits are almost as clear and free from noise as a city telephone circuit.

Distributing System and Load.

The distribution generally is done by carrying 3-phase primaries on every street. It is intended to have a separate panel and main feeder for each 1,000-kw. capacity. Each feeder panel has a main oil circuit-breaker, ammeters, two integrating wattmeters, power factor meter, etc. Each feeder is also equipped with an induction regulator, having an automatic compensating device for operating the motor control. With this device it is possible to give a perfect voltage regulation for all lighting. As mentioned before, the commercial district is supplied by a 3-phase, 4-wire secondary network with 3-wire, 3-phase primary. Off this network are fed the incandescent and arc lighting circuits and induction motors driving printing presses and various other classes of machinery. From the same primaries are fed synchronous and induction motors, two synchronous motors being of 150-kw. capacity. These drive arc lighting and other machinery at the central station. Voltmeters recording the regulation on the main bus and on the lighting circuits are used. These several circuits are supplied off the general bus at the main step-down station from off which are also fed the railway and Edison service through the synchronous motor-generators and rotary converters. The scattered load outside of Salt Lake City and in the mining districts consists of cement works, brick yards, mine hoists, air compressors, smelters, etc. One smelter in the valley taking about 800 h. p. depends on the power company for its entire supply. This latter plant has been kept going without serious interruption for four years, which speaks well for the possibility of getting reliable service from water power stations and long distance transmission systems.

The direct-current motor-generators and rotaries in the central station up town are all so connected that the compound field wind-

ing is on the negative side thus allowing very simple switch-board connections. Only the positive lead is carried to the main switch and circuit-breaker on the direct current panel the equalizer connections, negative lead, equalizer switches and pedestals being mounted close to the machines. There is no ground connection on the main switchboard or feeder panels excepting a potential wire for the voltmeter and lighting circuits. Both the rotary converters and motor-generators are started on the direct current end as shunt motors, being synchronized on the alternating current side. If the station is completely shut down the rotaries can be started first by means of the small induction motors on the ends of the main shafts or else both types of machines can be started as shunt motors from the steam reserve.

In designing and erecting the machinery in the station the main object was to have simplicity, particularly in the wiring and connections back of the switchboard. All oil switches, potential and current transformers, primary cut-outs and like apparatus are placed in fireproof vaults built of brick or concrete. All the rheostats are set on pedestals in the basement directly under their own panels.

The synchronous motor generators and the rotaries are run with special attention being given to the power factor and the regulation of voltage on the whole system. In case of momentary short circuit the rotaries and motor generators are seldom thrown out of step. The motor generators particularly will stand all kinds of severe handling on the alternating current side, and if the voltage on the supply feeders drops to zero and remains there for some little time the machines will come into step again as the power plants come up to normal.

The street lighting consists of both direct and alternating current series lamps and circuits. About one-third of the total street lighting is now being done by the "tub" system. Much of the street lighting in the commercial district is done by means of multiple alternating current lamps connected to the secondary net-work. These are thrown on and off in groups by means of special auxiliary switches and circuits.

The Edison 3-wire system furnishes service for fans, elevators, printing-press motors, dental motors, telegraph instruments, etc.

Railway Department.

The total trackage in the city and suburbs is about 90 miles. From 60 to 100 cars are operated, depending upon the season. Since the consolidation of the two companies and the combination of the whole railway system with the lighting and power system, it has been endeavored to standardize the rolling stock and tracks. Previously there were many different sizes and types of open and closed cars, trucks and motor equipments, and the tracks were constructed of almost every kind of rail sections from 30 to 70 lb. During the last two years the city has done a large amount of street paving which has necessitated much track reconstruction. Eighty-pound standard section "T" rails are now being put in when such reconstruction work is done. Most of the new track laid this year has been put down with the "Thermit" welded rail joint. Steel lattice poles are used and are set along the sides of the street. This is a very decided improvement in Salt Lake City over the older type of construction which consisted of a line of poles, for all kinds of service, down the middle of the streets between the tracks. The drawings show the standard construction that is now being used in the newly paved district. Much new work is also being done outside the paved districts and 70-lb. standard section steel is being laid with heavy ballast. The heavy and continuous grades in Salt Lake City require four-motor equipments, and many of the double-truck cars are now thus equipped. The standard cars will be convertible for summer and winter use, with middle aisle and cross seats excepting near the door where short lengthwise seats will be placed, allowing more room for passengers entering and leaving the car. The cars are being equipped with the National Electric Co's. air brakes. It is required that fenders be used and cars are so equipped.

Several interurban systems have been projected and next year will probably see the first in the valley put into operation. This is projected to run from Salt Lake City to Ogden and into Ogden Canyon; about 22 miles of existing single track steam road will be changed to double track, electrically equipped, and this extended on into Ogden.

Sixteen miles north of Salt Lake City, and located near the base of the Wasatch Range is a beautiful summer resort and park with quite a large lake. This is making summer traffic to that point very large. The change to a modern up-to-date interurban system with cars running up through the main streets of the city should build up a splendid traffic. Added to this the valley through which this line extends is rich and is thickly populated. Freight and express traffic, the handling of milk, fruit, vegetables, groceries and various products should develop into a paying business. Plans are being discussed for equipping electrically the Salt Air Beach Line, 16 miles long, and extending it to the location of the new $2,000,000 copper smelter just being built at a point about four miles beyond Salt Air Beach, and where a town of probably 10,000 population will be built up within the next three years.

Nine years ago the first water-power plant was started, and for two or three years it was very difficult to convert anyone to the use of electric power. A few days ago at a conference of engineers of the companies here it was asked: "How much power will this district probably require within the next five years?" The estimate was placed at 50,000 h. p. Basing the estimate on the developments of the past few years this is probably a very close estimate, considering that in the last five years four new smelters have been constructed in the valley and all are crowded to their extreme capacity today. One new railroad has just been completed from Salt Lake City to Los Angeles, construction work on a second one to run from Salt Lake City to San Francisco has begun, and a third is headed this way from Denver. There is much undeveloped water-power within a radius of 200 miles, and it is probable that within the next two years one or two more large transmission plants will be tied in with those now existing. It is proposed to erect in Salt Lake City additional steam generating capacity, equipped with the latest type of steam turbine and boiler installations. This will consist at first of two units of 2,000 or 3,000 kw. capacity each. Much hydraulic development must be done in the state for irrigation purposes and a great advantage will be gained by combining capital and incentive in the construction of power plants in connection with such irrigation works.

Annual Report Brooklyn Rapid Transit Co.

The annual report of the Brooklyn Rapid Transit Co. for the year ending June 30th, 1905, has just been issued, and the results of the operation of this system for the fiscal year are as follows:

Gross earnings from operation	$16,333,444
Operating expenses	9,803,870
Net earnings from operation	6,529,574
Income from other sources	252,135
Total income	6,781,709
Less taxes and fixed charges	5,178,491
Net income	1,603,218

Out of this was taken for betterments and additions to property, $453,284, leaving a surplus for the year's operation of $1,149,934. This, in addition to the surplus of the previous year, made the surplus June 30th, 1905, $2,744,123. Of this amount there has been appropriated in adjustment of supply accounts, and for discount on bonds sold $1,759,400, leaving a balance of $984,723. The percentage of passenger traffic of 1905 over that of 1904 was, for the surface lines, 6.02 per cent, and for the bridge and elevated lines 13.53 per cent. The increase in freight, mail and express amounted to 190.49 per cent of that of the previous year.

The new Williamsburg power station is approaching completion. One 7,500-kw. turbo unit, and one 5,500-kw. unit will be installed before the end of the year, and a third unit of 7,500 kw. capacity will be installed next summer. The station is designed for an ultimate capacity of 130,000 h. p. A new sub-station has also been erected on Myrtle Ave., and is almost ready for use. This station will be equipped with four 1,000-kw. rotaries, and the necessary transformers and switchboards. There have been constructed during the year 87,000 lineal feet of subway conduits ranging from six to 24 ducts, 143,000 feet of high tension, and 85,000 feet of low tension cables have been installed. A new elevated yard with capacity for 327 cars is nearing completion, together with an elevated car repair shop at East New York. The physical condition of the property has been generally improved.

The first trip over the line of the Louisville & Southern Indiana Traction Co. was made September 12th.

Modern Boiler House Equipment.

Being a Comparative Review of Modern European and American Practice.

BY FRANZ KOESTER.

In recent years marked progress has been made in the design of power and lighting plants, principally in the engine and generator rooms. While the engine has found a worthy rival in the steam turbine, the boiler, here as well as in Europe, is still without a competitor, thus confining boiler house progress to improvements in the boiler itself and the adoption and development of modern accessories, such as coal and ash handling apparatus, economizers or feed water heaters, smoke preventors, and most important of all, the superheaters.

In America, particularly in the large cities where land is expensive, it is not unusual to install the boilers in two or sometimes even three tiers. In Europe, where land is comparatively much cheaper, the practice is to build only one floor of boilers, covering the boiler house with a glass monitor roof, thus insuring ample natural light and ventilation. These provisions are both very desirable and in this country are often given too little consideration in boiler house design. This glass roof construction is clearly shown in the accompanying illustrations, Fig. 1 and 2. Fig. 1 shows a boiler plant in Hamburg, Germany, where there are several of this same type, and Fig. 2 one of the twin municipal plants in Vienna. These plants were designed by the Schuckert company.

In the design and installation of a boiler plant care should be taken to plan the arrangement of all valves, cocks, gages, etc., so as to make access to them as convenient as possible. In the [illegible] of Europe it is common practice to erect a gallery in front of the boilers, over the fire doors, which materially assists the operator. In the boiler plant of the Berlin Underground & Elevated R. R. the valves, both for the steam and for the boiler feed water are operated from the main floor by means of chains and extension rods. In plants where overfeed stokers, such as the Roney, are used, a gallery may be installed with advantage. Both the Boston Elevated and the New York Subway boiler plants are equipped in this manner. In addition to the other advantages mentioned this enables the operator to watch the feeding of coal.

FIG. 1. INTERIOR OF BOILER PLANT AT HAMBURG, GERMANY

Modern practice is towards the adoption of electricity as the motive power for coal and ash handling apparatus, coal being taken from the cars or boats either by means of clam shell buckets or through hoppers to a belt or bucket conveyor and thence to the bunkers above the boilers. Quite different from this is the coal handling in the plant in Vienna, already mentioned, where the coal storage house extends along the entire side of the boiler room. Cars containing from 15 to 20 tons of coal are hoisted by means of 35-h. p. electric motors to a level 25 ft. above the floor, when they are run on tracks over the bins, 10 in number, and dumped according to the grade of coal. The storage capacity of these bins, which is 3,000 tons, is sufficient with the coal consumption that has been

realized at this plant, namely 1.3 lb. per i. h. p. h., to last about six weeks with the plant operating 24 hours daily. This large storage capacity, which is also found in other continental plants, is necessay on account of the frequency of strikes, which while more common than in this country, do not last for so long a period, a few weeks being about the maximum duration. It may be of interest to note here that at the "Moabit" power plant in Berlin, located directly on the River Spree, it was found necessary to deflect the river in order to obtain space for a sufficient coal storage capacity.

Fig. 3 shows the coal handling apparatus of a recently installed coal storage field for the New York Edison power plants. The field itself lies at Shadyside, opposite 110th St., on the East River, on account of the lack of space on Manhattan Island, and has a capacity of 100,000 tons of anthracite and 50,000 tons of bituminous coal. The Dodge Coal Storage Co., of Philadelphia, was the designer and builder of this plant.

As will be seen in the illustration of the Hamburg plant, the coal is conveyed to the front of the boilers in small cars of one-half ton capacity mounted on three wheels and fired directly from these cars by hand, and this same system is employed at the Vienna plant. These cars are both filled and propelled by hand, a method which while not the most up to date is the cleanest, and while the cost of labor is considerably increased the net result is economical, as a careful record of results for each ton of coal is kept and thus the work of the individual stokers closely supervised and the plant operated most efficiently. In Europe the preference is for hand stoking, which is considered often more economical than automatic stoking; this may be due to the fact that while in America it is possible for almost any man to secure a position as stoker, on the continent of Europe an apprenticeship of several years is required, one year of which is frequently spent in a special training school. Although there are many different types of automatic stokers in use in Europe, they are not generally favorably considered by the continental on account of the comparatively large percentage of coal which falls through the grates, and also because the grades of coal are limited.

Fig. 4 shows a boiler unit of the new power house for the Interborough Rapid Transit Co., New York City. It was first proposed to install hand-fired grates only, but finally decided to equip 30 of the 60 Babcock & Wilcox boilers, 600 h. p. each, with Roney stokers Some fine particles of the coal fall through these grates, and the writer had to provide a method for conveying this coal back to the bunkers and re-stoking it. This is accomplished in the following manner: Along the entire length of the front of the stoker are installed four conical receivers placed side by side and connected to pipes leading through the floor to cars running on tracks under the ash hoppers. It is impossible to prevent some incandescent coal entering these receivers, which if carried over the belt conveyor to the bunkers might start a fire; danger from fire is also incurred if wet coal is stored in bunkers on account of spontaneous ignition.

During a recent western trip, Mr. A. L. Haydin, chief engineer of the power house of the South Side Elevated R. R., in Chicago, showed the writer a similar system here adopted for chain stokers

In the New York Manhattan power house, where these receivers are not installed, one man is required for every six boilers to shovel the coal which falls through, back into the stoker hoppers, and it will be seen that as long as such provision is necessary there remains room for improvement in mechanical stokers. This is the principal disadavange of the automatic overfeed stokers. They have many good features; one in particular is the ensuring of a uniform temperature throughout the furnace chamber, which is of especial benefit where superheaters are installed in the boiler flue, as the superheater may be easily affected by the frequent opening of the door necessary with hand firing. This, however, depends largely on the superheater itself, as will be described later. Better combustion may also be secured with mechanical stokers with less skillful attendance than required for hand stoking.

FIG. 2 BOILER ROOM VIENNA MUNICIPAL PLANT.

It may be of interest to state here that the new St. Ouen power house in Paris, now in the course of design, will be equipped with 20 Babcock & Wilcox marine-type boilers of 4,300 sq. ft. heating surface each, provided with chain stokers, the same as installed in the new Chelsea power house in London. They are also provided with superheaters with 640 sq. ft. of heating surface. Marine-type engines are often seen in power houses, but very seldom marine-type boilers. This choice was due to the fact that the adoption of the 5,000-kw. Brown-Boveri-Parsons turbine, which requires a small floor space, would make the stationary type boiler seem comparatively large. Although the French engineer was desirous of economizing floor space the boilers were placed in four rows with wide aisles, as the French law prohibits two-story boiler houses. This design resulted in only 4 sq. ft. of heating surface per sq. ft. floor space, while the Chelsea plant has 4.3 sq. ft. per sq. ft. of floor space for each of the two floors, and New York Subway power plant has 7.5 sq. ft. per sq. ft. of floor space and has only one floor,

the latter two using stationary boilers and London plant having the economizers on the same floor.

The noticeable features of these boilers with which the Carville plant in New Castle, Eng., is equipped, are the cross drum in the front and the generally compact appearance.

Mechanical draft, forced or induced, or a combination, is much more used in this country than in Europe, where it is looked upon unfavorably by the engineers on account of the cold air usually introduced. The advantages of the mechanical draft are that it is easily possible to force a boiler, that the height of the chimney may be reduced to a minimum and that the heat required in the escaping gases with a natural draft may be extracted to advantage in connection with economizers and superheaters. Many European plants are equipped with smoke consumers, a device seldom used in this country. The main requisite of a good smoke consumer is that it shall burn all the small particles of coal carried over by the draft, thus increasing the calorific efficiency, and making it possible to burn the poorest grade of coal [illegible] deposit to a minimum. It is [illegible] material before it comes into contact with the tubes, either by introducing heated air at the point where the smoke is formed or at the fire bridge. The higher the temperature of the air supply the better.

In good practice [illegible] the boiler setting around the fire chamber and then above the grates. Another system used successfully has steam jets introduced through the boiler setting above the fire doors. By installing a coking arch similar to that in mechanical stokers and then narrowing the passage for the gases, the combusitnon of the smoke is made more complete. The narrower this passage the more complete is the mixture of air and smoke and hence the better the combustion. This must not, however, be carried to too great an extreme. Experiments which the writer has observed show that when this passage is made very narrow the heat developed is so enormous that the fine particles of ash, usually carried over the fire bridge, may be fused into a very hard glazed scale deposited on the fire bridge and the arch above, which if carried on long enough will entirely close the passage.

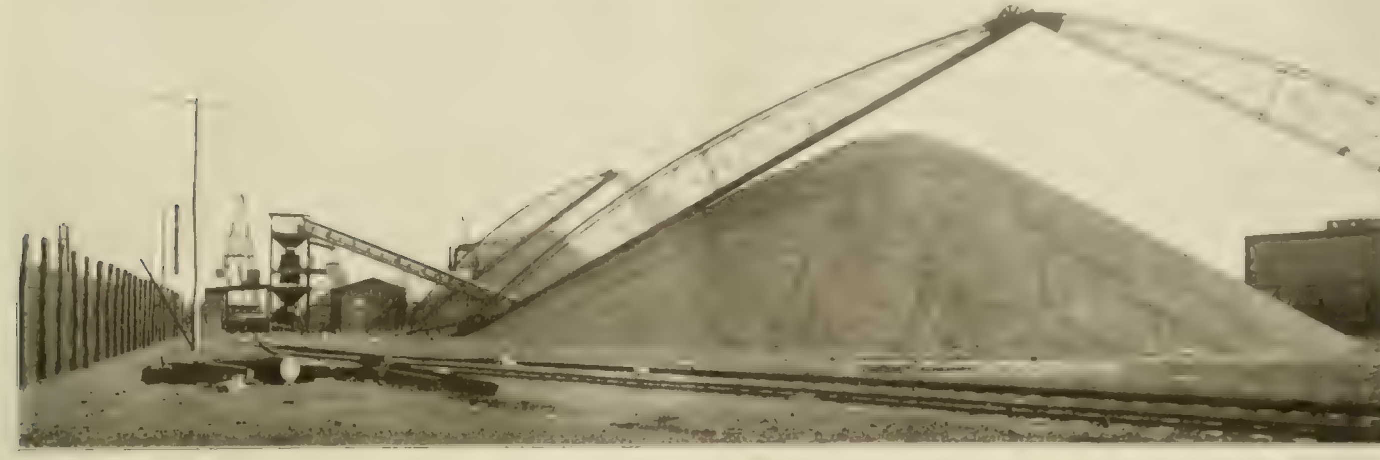


FIG. 3. COAL HANDLING APPARATUS, SHADYSIDE, N. Y.

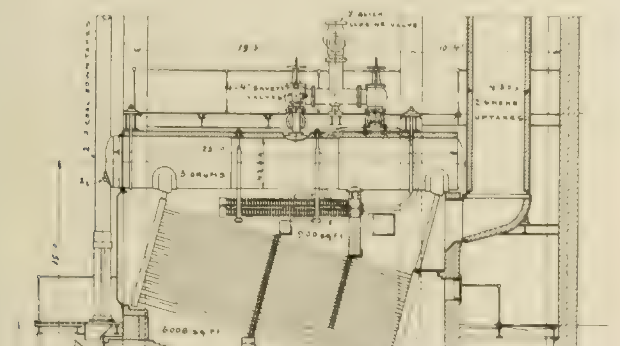


FIG. 4. BOILER UNIT, NEW YORK SUBWAY.

In order to derive the most benefit from the heat in the gases it is necessary to construct a very compact boiler, placing the superheater and economizer as close to the combustion chamber as possible. An example of good European practice is shown in Fig. 5. The boiler itself is built on the lines of the Babcock & Wilcox system with 3,250 sq. ft. heating surface and 87.5 sq. ft. grate surface, designed for a working pressure of 215 lb. A superheater with 360 sq. ft. of heating surface capable of furnishing a superheat up to 570° F. is installed between the tubes and the drum. As will be seen from the illustration, the economizer is placed directly behind the boiler, thus avoiding long runs.

FIG. 5. EUROPEAN [illegible]

Each boiler contained 14 headers of eight 4-in. tubes, and as each header was connected to the drum by one 4-in. tube, the circulating water from the eight tubes would have to pass through this one narrow passage, the Schukert company decided to add a horizontal header with 22 tubes connected directly with the drum by means of eight 4½-in. tubes, the idea being to improve the circulation in the lower tubes and decrease the liability of burning them. In addition

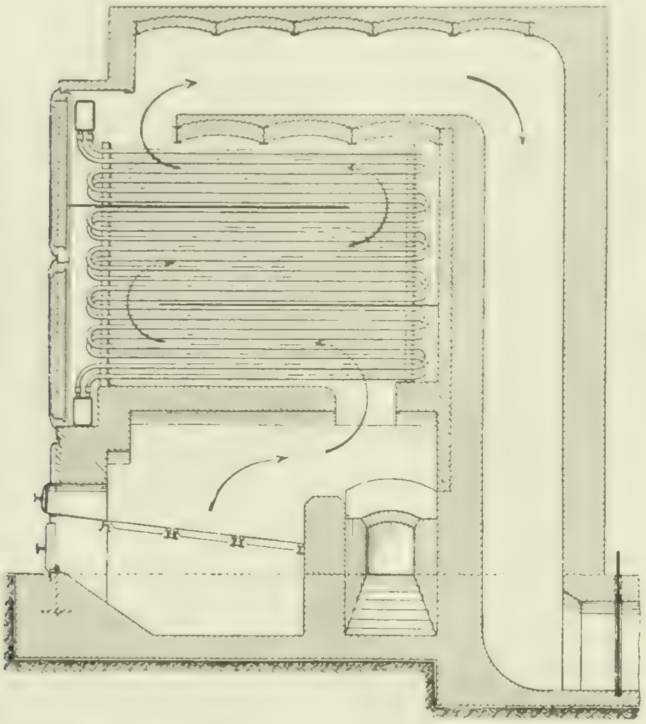


FIG. 6. INDEPENDENTLY FIRED SUPERHEATER OF THE BUETTNER CO SYSTEM.

to this, in the boiler drum is installed a Dubian artificial water circulating apparatus by which the generation of steam is increased, it is claimed, from normal 3 lb. per sq. ft. of heating surface to 4 lb. and higher. Steam and water passing up through the header with great force, pass through the vertical tubes of this system, which project above the high water level in the drum, thus greatly accelerating the circulation and evaporation.

The ash hopper through which the soot passes to a common conveyor, is built in with the boiler setting entirely of brick, thus eliminating the objectionable features of the iron hoppers common in this country. Where wrought iron hoppers are used it frequently happens that hot ashes are dumped into them from the grates, raising the hoppers to a red heat, and then by the application of water they are suddenly and unevenly cooled and warped out of shape, and in eight or ten years are often rusted or burned through and discarded. By lining these iron hoppers with fire brick their life is materially increased.

The installation of a reliable system of feed water purification is considered of great importance in good power plant engineering practice. The amount of labor and trouble necessary for cleaning scale from the boiler tubes is well known. The two Vienna plants mentioned are equipped with apparatus to give the feed water the required chemical treatment and filtration before it enters the boilers. In this plant no mud drums are provided, 2-in. drain pipes leading from the lowest point to the headers of the boilers.

The advantages of heating the water before supplying it to the boilers are well known and are to be secured by utilizing the excess heat in the escaping boiler flue gases, the exhaust from pumps and auxiliary engines, or by live steam heating. Under ordinary circumstances it is not necessary to discharge the escaping gases at a temperature greater than 500° F. in order to obtain a good draft; a large amount of heat may therefore be extracted from the boiler flue gases for feed water heating by installing an economizer. This generally consists of a large number of tubes, thus providing a large volume of water at a high temperature, this not only being a great convenience, but also prolonging the life of the boiler and making possible a more rapid evaporation. In using the condensed steam of the engine it is necessary to first pass it through an oil separator, which is not required when using steam turbines. By utilizing the heat of the exhaust steam of engines or pumps by means of heaters the temperature of the feed may be raised to about 200° F. Quite frequently on the continent of Europe are found large storage tanks in which the feed water is heated by live steam passed through coils. With the latter system it must be borne in mind that whatever heat is used in raising the temperature of the feed water either by live or exhaust steam is returned to the boiler and hence does not decrease the efficiency of the plant.

One of the most important of the improvements in modern American boiler plants is the adoption of the superheater, the efficiency of which has long been recognized in Europe. Although efforts were made to introduce superheaters in America, many difficulties were encountered, which while usually assigned to the superheater may as well be due to imperfections in the design of the engines, and even more to ignorance on the part of the operators. The writer has inspected plants where superheaters have been discarded on account of trouble encountered in the operation of the engines, and unjustly blamed on the superheaters. And even at the present time, the advantages of the superheater are not thoroughly understood in this country. It must here be stated and be borne in mind that for each 9° F. increase in the temperature of the steam a decrease of 1 per cent in the steam consumption is often effected, a fact which has been proved by many experiments on the continent of Europe, a superheat at the boiler of 300° F. and higher being frequently attained. There are many different types of superheaters, most of which are constructed of seamless drawn wrought iron or steel tubes; a few are of cast iron. In Germany, where superheaters originated, there were several cast iron types. The "Schwoerer" was the most successful and is today the only one in use, due to the special grade of cast iron, which is manufactured under a secret process. Mr. Berner reports in the "Zeitschrift des Vereines Deutscher Ingenieure" that in the districts of mine boiler inspection societies in Prussia only one cast iron superheater was in use. The great difficulty encountered in the use of cast iron superheaters is due to the enormous difference in temperature between the inside and outside of the tubes. Mr. Rippes,

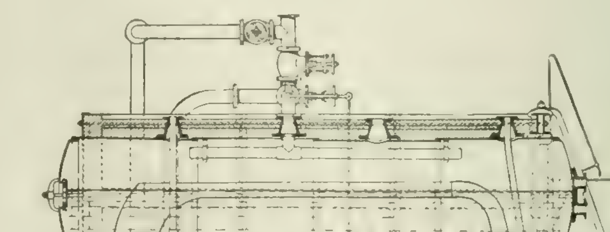


FIG. 7. BUETTNER SUPERHEATER IN WATER-TUBE BOILER.

in a report on a test before the Institution of Civil Engineers, states that in one case the inside temperature of a wrought iron superheater was 340° F., while the outside was 610° F., a difference of 270° F. The life of a cast iron superheater depends also much upon the particular form of the tubes. New types of superheaters recently introduced on the continent of Europe are the Heizmann and the Pregardien, both of which rest on the early superheater principle of passing the flue gases through tubes placed in a cylindrical receiver through which the steam passes. The Heizmann heater

is a flat box formed chamber, the two sides of which are connected by rows of short staggered tubes expanded in the plates. The staggered position of the tubes, through which the hot gases pass, deflects the steam, causing a better contact with them. The Pregardien heater consists of a similar chamber with all parts welded together by a patent process, making the equivalent of a single piece without milling or tool work except at the inlet and outlet flanges. Excellent results are reported to have been obtained with both of these superheaters. As has already been stated, the greater number of superheaters consist of a series of narrow tubes or return bends, through which the steam is passed at a high velocity to insure all parts coming into close contact with the inner surface in order to absorb a maximum amount of heat from the surrounding flue gases. It will be seen that under these conditions a wrought iron or steel tube transmits the heat much more readily than the thick shell of cast iron, although it must be borne in mind that with the former the introduction of cold air through the fire door with hand stoking or by forced draft may do more harm than with the latter. From the foregoing it would appear that a cast iron superheater may be more advantageous where hand firing and cold forced draft are employed and al[illegible] change in temperature and is not so liable to burn out, it may be favorably considered for independently fired apparatus. Most wrought iron or steel superheaters are flooded before the first generation of steam in order to prevent burning out; there are, however, types successfully used which are of such heavy construction that this precaution is unnec[illegible] for example [illegible] fired superheater of the Buettner Co.'s system. This type of superheater installed in a water tube boiler is also illustrated in Fig. 7, where the heat supply in regulated by dampers.

The heating surface of a superheater depends upon the final temperature required, the special type and its location in the boiler, etc. The relative advantages of a direct or indirect fired superheater depend entirely upon the design of the power plant itself. Tests on engine plants have been made by Professor Schroeter, showing a reduction in water consumption of 20 per cent by using superheated steam at 175-lb. pressure and 662° F. Another report, also in Zeitscrift des Vereines Deutscher Ingenieure, by Professor Gutermuth, gives 21 per cent in a similar case. Similar and even better figures have been obtained.

The Policy of More Liberal Instruction for Motormen.

BY EDWARD TAYLOR.

The title of this article may appeal to the reader with a sense of familiarity, as of an old acquaintance. But, although this subject has already been discussed to such an extent that it may seem worn threadbare, the writer ventures to hope that its familiarity has not bred contempt for a question of so lively an importance both from a standpoint of business, and from that of the moral considerations involved. And he believes that the experience gained from personal contact, for a number of years, with the rank and file of workers on several different roads, where varying methods were in use, will make it possible for him to view the situation, and to sum up the arguments for both sides with a minimum of prejudice.

First of all, if we seek to reform a certain existing condition, it is well to know what that condition is, and to what an extent it is desirable and practicable to alter it. For this purpose let us look in, briefly, on Mr. Motorman and see what he does, how he does it, and whether he could do it better.

The position of motorman on an elevated or surface road is not a sinecure, for the incumbent is brought each day to face a twofold responsibility,—first for the safety and comfort of all persons who are on his car (not to speak of those who may cross his track ahead of him). Nor is this a responsibility which his employers or the public itself are willing to take lightly, even were the motorman himself to do so. In case of an accident to passenger or pedestrian, the first impulse of an angry crowd is generally to take vengeance on the culprit nearest at hand—in most cases the man at the lever, who is often least to blame—but who can generally rate himself as lucky if he gets to jail without being hurt. And all this is only one fold of the responsibility, the other follows.

The company has intrusted to the immediate care of this man a piece of apparatus whose money value far exceeds the product of many years of his labor—a car equipped with delicate and powerful mechanical appliances, whose safety and continued usefulness depend, for the time, almost wholly upon his skill and foresight.

The conditions under which the motorman's work must be done are varied and often unpleasant. He must meet all sorts of weather, and all degrees of temperature—whether frozen or broiled, his work is there to be done—his hours of labor are never short, and his lunch-hour may in many cases be just as far away from him, at noon, as it was when his run started. In short, he is required to do a very full day's work every day, Sundays and holidays included, in the face of heat, cold, hunger and weariness, and to be at all times watchful, alert, resourceful, and steady of nerve. His salary for all this will not tempt him to make large investments in bonds.

When we come to study these heavy responsibilities which motormen, as a class, must assume, and to observe the various trials, discomforts and dangers to be met with in the pursuit of such a calling, and then look into the methods at present in use by our large city railways in selecting and training the men who handle the controller, the contrast would be ludicrous, were not the situation of so serious a nature. "Motormen Made While You Wait" seems an appropriate motto for the case. The fact is that apparent good general health and the ability to understand signals are sufficient qualifications for the job, on nearly all lines, and that an apprenticeship of from three to nine days is generally thought to be time enough for instruction in all the duties of the motorman.

At the close of this probationary period, the "green hand" is supposed to be able to run his car in a safe and efficient manner, and it is assumed that he will rise to the occasion whenever the emergency turns up. The chances are that he knows how to start, stop or reverse, under favorable circumstances. He will also know a little about the various signals, with the same qualification. But just how many of these things he will remember, in case of a sudden emergency, or just how much of a mess he will make when any little thing goes wrong, can only be guessed at. His blunders go into the repair or claim department, and come out as "necessary expenditures."

Inexperienced and inefficient service of this kind is of advantage to the company in no respect—neither as regards the moral effect of the matter—the safety and ease of its patrons—nor as it has to do with the important financial end thereof. The number of lawsuits annually brought against city railways for damage to person or property, resulting from the stupidity or ignorance of employes, is so appallingly great as to make it necessary for each organization to have always in its employ a number of lawyers whose sole duty it is to fight or settle such litigation. It is a well-known fact that the American jury is seldom fair to the railroad, when the case is one of injury to passenger or employe, and that it is only necessary for the injured one to present his case in a sufficiently pitiable manner to get a substantial verdict, and the consequence is that the claim department often presents a very large budget, at the year's end.

The equipment of a modern electric railway is by no means a matter of small expense, especially with materials at their present high prices. That this equipment should need renewal, from time to time, is only to be expected (as all machinery is subjected to constant deterioration), but where delicate and highly sensitive machinery falls into the hands of unskilled and ignorant men, it always follows that the deterioration is more rapid than it should be—and such is the result in the present case. It takes the bungler a very short time to ruin an amount of equipment worth much more to his

employers than his services in perpetuity would be. The result is shown in the present tendency of all street railway companies toward the adoption of new machinery and appliances. Large sums of money are spent every year in making machinery, which is fit to be handled by men of the lowest grade of intelligence. "fool-proof" machinery, as it is justly called. Equipment of this kind is enormously expensive, and, while simpler in its handling from the outside, is necessarily of a very highly complex nature in its inward workings, so that in case of some internal disorder it is a great deal harder to repair than the simpler and less automatic variety. Anyway, leaving out the expense of matter it is obviously a case of going the wrong way about to get at the desired result. The present machinery is simple enough for a man of any intelligence to handle. And again, no matter how far you reduce the human element in the running of cars, in the end it is always necessary to have some kind of a man there, some human intelligence, if only to press a button. And the bungler will often press the wrong button in case of emergency. So that no matter how far the human element is reduced in a matter of this kind, it always remains the most important in the end.

We have an example of this in modern warfare, where science has reduced the human element to its very lowest terms, by the introduction of submarines, long-range guns, and all the murderous automata which take the place of the good old hand to hand struggle which decided the outcome in ancient times. But in spite of all these death-dealing machines, and contrivances, Victory still perches oftenest upon the banners of that side whose rank and file are composed of the strongest and best trained soldiers, and upon the personnel of the ranks, as of old, depends and will ever depend the outcome of the battle. Just so in the similar case of the man who holds the controller—it has been conclusively shown that an efficient man can do the work better, more cheaply and with a greater degree of safety than his less intelligent brother—regardless of the simplicity or complexity of the machinery to be dealt with.

In view of these facts, would it not be a measure of true economy, as well as of moral excellence, to substitute for attempts to make machinery "fool-proof," the more logical endeavor to make the fool wiser and better and better able to handle any machinery, and to transfer the uninstructable fool to some vocation where he is in a position to do less harm? The two items, first for maintenance of equipment, and second for damage claims, taken together form a very large percentage of the annual expenditure of operating companies. Would not the very notable decrease in the size of both items which would surely result from increased efficiency of service be a very good and sufficient reason for the adoption of any measures which would give more efficient service at small expense? The writer has tried to show that the application of fool-proof machinery would not lead to the desired result, but that an increase in the skill and intelligence of the motormen would most surely accomplish the purpose. The question now is, How are we going to effect this growth of intelligence?

The means are very simple. No university course is needed for the making of a good motorman. All that is required of him is that he know perfectly his signals, realize to some extent the importance of the double responsibility he carries, and have some clear idea of the inner workings of the machinery he handles.

At this point, we often hear the voices raised in protest, and view the hands uplifted in furious horror of those who believe that it is better to know nothing than to know a little about a subject. "Teach the motorman about electrical machinery? Preposterous! Would you then have every wielder of the lever ready on the instant of breakdown to make matters a thousand times worse by his unskilled attempts to tinker up machinery about which he knows practically nothing?"

Nothing of the kind is meant—only this—that it is surely the case that a man who knows a little about electricity will have the more respect for it, from that knowledge, and that he will certainly be able to keep his equipment in better repair with that knowledge than without it. It is rarely, if ever, necessary for the motorman to repair his own engines, and it would be the height of folly to mentally equip each candidate for a position as a walking repair-shop. Our position on the question is that every little a man knows about the machinery he handles should help him to handle that machinery in a more efficient and economical manner—time-worn adages of "a little learning" to the contrary notwithstanding. The length of a course which would accomplish the desired end without being so long as to be too expensive, is a matter on which there is much room for discussion. A period of not less than thirty days would seem to be about the right length of time to spend in preparation. If more time could be spared, so much the better—but there are few roads which would be willing to sacrifice a longer period. During these thirty days or more, it would be quite possible by means of competent instruction and a well-planned distribution of time, to fit the candidate in most if not all respects, for his position, and also to give him a quite thorough knowledge of his run. It will be argued against so long a time of probation that a man in the position of the average applicant for a job of this kind cannot afford to work for thirty days without pay, and that if the company should pay him, he would be very likely to take French leave, as soon as he had "made a stake." Unfortunately a large percentage of the men who seek this kind of employment show a most unpleasant tendency to do that very thing, but a system of paying a part, and holding the rest for a certain time would overcome this difficulty. Another argument is that as soon as you succeed in getting your man thoroughly instructed he will quit and go on some other road. A prevalence of this symptom would make it appear that you are not paying large enough wages, or that your system, and its general surroundings with which he comes in daily contact, are less attractive than elsewhere. Objectionable features of this kind in a road often lie very near the surface and can be easily changed. But whether easy or difficult to alter, something must be effected in that line, if good service is considered desirable.

We may now consider the applicant for a position as having passed through all the preliminary stages and as emerging upon the road as a full-fledged motorman. The company will be justified in expecting from him far more efficient and intelligent service than from his untaught brother—but any company in search of the best possible service will not be justified in letting its watchfulness end here. Eternal vigilance is the price of safety, in this as in other cases. The employe must not only be taught what manner of service will most benefit his employers, but also that any deviation from the rules laid down for him by those in authority will be noted to his discredit, and that continued carelessness or lack of skill in handling equipment will meet with prompt and suitable punishment. At the same time it should be forcibly brought to his attention that there is a certainty of advance and reward for satisfactory service. In short the fact should be brought home to every motorman that his actions are at all times subject to scutiny, and that it will pay him to do his work well.

To this end, whenever a car is taken out, it should be examined by the motorman who is to run it, and, if in good order, should receive his O. K. at the beginning of the run. At the end of the trip, the same car should be re-inspected by the shop inspector, and if then found to be out of order, a report to that effect should at once be turned in, stating the location and extent of damage done, together with the name of the motorman in charge. In this way, it will soon be found that trouble most often occurs to a certain number of men, and that each of these men has his special failing. The reports will enable the management to discover where the weakness of each man lies, and to caution him, in a specific manner, upon the very point where he fails. It stands to reason that such a warning, directed against the spot where weakness is most evident will have a far greater corrective efficiency than any general set of regulations which deal with many varieties of faults applying to the mass, but not to the individual. A higher average grade of service will, again, be insured when those in authority are able to single out for dismissal the individuals whose mistakes are persistently causing useless expenses from the deterioration of equipment in their hands.

We have purposely left the question of the selection of applicants to the last. At present the idea entertained on this point seems to be that "we are lucky to get any kind of men to do the work," and as matters now stand this is very true. But, with a system of instruction as has been indicated, coupled with the prospect of advancement held out to able men, under a wise method of supervision, it stands to reason that men of a higher grade of intelligence will seek the situations thus offered, and that the companies will be in a position to make more satisfactory selections from among them than would be possible, at the present time. These men, again, possessing a higher grade of intelligence will be

less likely to desert make their take and get away than the former applicants, and so will be the cause of less trouble to all parties concerned.

In the foregoing, the writer has tried to show that any city railway could provide for itself a more efficient service, by means of a proper system of instructing and watching its motormen—and that the cost of such a system of instruction and supervision would be small indeed, in comparison with the saving effected, in claims and repairs. There are several other reasons why a change in this line is desirable.

City railways would do well to take into serious consideration the fact of the ever-widening scope of electric transportation. It will not be many years before a large number of the more progressive steam railways of this country will adopt electricity as a motive power on all their lines. Even now, electric engines of great speed and power are being tested by the leading companies. The general equipment of steam railways for operation by electricity will bring into the market a large and rapidly increasing demand for the best class of skilled motormen, thus notably decreasing the visible supply of good men for the city railways, because of the greater inducement as to salary which they will hold out. It is quite probable that, for a time at least, such a demand would create a veritable famine of good men willing to take jobs on city lines. Under the present system, such an exodus would seriously hamper the running of street and especially of elevated railways, causing not only increased inconvenience to passengers, but also making great inroads upon the coffers of those railways for the renewal of machinery damaged by misuse at the hands of a large number of green recruits. A great deal of this trouble would be averted by a more advanced system of instruction, as has been recommended, and a large number of men would no doubt be held on city railways—by an improved system of supervision and the hope of promotion which would naturally attend it.

In the observations, up to this point, it has been taken for granted that operating companies, having the control of city railway franchises, transacting business with the public on a large scale are desirous of carrying on their transactions with the body of the people, in a manner that will be satisfactory to the public as well as financially profitable to the company itself. Looking at the case from the moral standpoint, it will be seen that such an attitude is the only proper one for the company to assume. But, very often it appears to the public that this very moral standpoint is likely to fall into considerable degree of dimness and neglect, when it happens to interfere in any way, be it never so small, with the annual profits. That the people have a right to be well served is without question true, but may sometimes be put away on the shelf, with various other truths—notwithstanding the heated protests of certain member of the body public who sign themselves "Citizen," "Americans," "Vox Populi," etc., when they write to the daily papers. Now "Citizen" and his superheated brethren often make themselves appear very ridiculous in cold print, but the fact remains that, just now, protests of that description, however banal, are not to be passed by on the other side.

. There is a growing sentiment that public franchises should be, and could better be handled by the public itself. It was only very recently that the second greatest city of the United States decided a municipal election on this point—and turned it very visibly in favor of public ownership of city railways. The note of warning may seem faint and far off—and the measures recommended by Chicago may or may not succeed, at once—but there is little doubt that, at some time in the near or far future, something will be most decidedly done in that direction in certain other large cities in the United States. The moral features of this problem are far too intricate to be handled here, and the great American public is far from giving them first place in its consideration. The public (to its shame be it recorded) seldom gives a very deep or exhaustive consideration to the moral side of questions such as this. It is only when something happens to interfere with its convenience, safety or comfort that the hitherto unappreciated right-and-wrong of the matter begins to strike to the hearts of an easy-living, homeward-faring people. Only then is the time ripe for the voice of the demagogue to be heard in the land proclaiming with due loudness those new, and startling truths, whose most startling feature is that everybody at once confesses to their complete verity. So little things, like tie-ups on surface lines, or blocks on elevated roads, caused for the most part by the [illegible] of some novice ignorant of the machinery he controls, may hasten the time when a majority of [illegible] up the proposition [illegible] down to the [illegible] men make for good service, good service tends to satisfy the public, and public satisfaction prolongs private privileges. Of course, if the profits from street railway [illegible] in the mind of those holding [illegible] longer, this argument falls very flat—but we are led to believe that most street railway companies make, at the least, a fair profit.

At this point, the reader may inquire, somewhat after the following fashion—"All this that you say may be very well, indeed, but if these things are true, why has not [illegible] tried out, years ago? The directors of enterprises as large as those with which we are dealing are generally pretty wise men. Why have not they seen this, and already taken it up, if as you say it is all to their own profit?"

It is truly to the outsider an astonishing feature of this question that while the highest and most progressive men directly concerned with the inner working of concerns of this kind are agreed that a raising of the standard of intelligence among the motormen would be a measure of true economy, and that a more watchful supervision of those actually in service would likewise tend to lessen the difficulties of operation, such a system has not as yet, even come up for a fair trial. This may be because those in a position to act definitely on the matter have not yet been brought to a realizing sense of the advisability of more advanced educative measures. Perhaps this is the result of misinformation—perhaps of a natural neglect to go deeply enough into the matter, with so many other affairs at hand, which seem to be of more pressing importance. The personnel of the staff of all operating companies will be found to contain many broad-minded, liberal men. Indeed, liberality of view and breadth of mind are almost requisite to the attainment and holding of such responsible positions. The lamentable fact is that these officials who come in direct contact with the men and their problems have not succeeded, thus far, in putting their side of the case before these persons in authority, in a manner sufficiently convincing to bring about the desired alterations.

It would perhaps be possible to have this done, if the different departments of the road were to get more thoroughly together, and act in complete harmony, as a whole. At present, the Mechanical and the Claim Departments being those which have to do with damage done to the persons and property of passengers, as well as to the machinery and equipment belonging to the railway are more in a position to appreciate the advisability of a change, while the Transportation Department is often unwilling to recommend any plan which is calculated to add a considerable amount to its expense roll. That this very eagerness to cut down expenses, though largely profitable to the company in general, should, in this particular case be very much on the other side, does not occur to these zealous economists.

The arguments which they bring to bear on the question are supported and seconded by a certain element which is to be found in every large organization—that element, namely, which does not believe in change, or think that any change is good, until long after it is accomplished—the element which is pleased to call itself solid and conservative, not realizing that solidity and conservatism, while very good and very necessary qualities, are much worse than useless, where driven to an extreme.

We have already noticed one or two of the reasons given by these people, why this particular alteration is not for the best, and have tried to show how these reasons are inadequate. But it is far from unlikely that, added to these, two further assertions will be made—one, that the plan has been tried before, and found wanting, and the second, that the motormen would not approve of the new system, or appreciate its advantages.

The first is a mistaken idea, to say the least. No real live plan of this kind has ever been given a fair chance on any street railway in this country. There have, indeed, been several abortive attempts in a general direction toward educational ends, seemingly conceived with a dim idea that such a thing would be an advantage, and worked out in a vague, blundering fashion that stamped itself as a failure before it started, either because the men appointed to instruct were not competent, or because the time of instruction was too short, and the hours not wisely distributed. In none of these

attempts moreover, except in isolated cases was there any practical effort to follow up the incomplete course of study after the men had gone out on the road—or to devise a real and tangible system of rewards for good service and punishment for inefficient. All attempts of this kind furthermore have been needlessly hampered and held back by the persistent objection of the conservative element before mentioned, in its desire that things remain as they are. So that it cannot be truthfully said that a fair chance has yet been given for a proper system of instruction to work itself out. The tale would be very different, if it had.

The second argument is, as has been previously stated, that the men will not take kindly to being taught, will not, in short, appreciate any efforts for their mental advancement—(dark hints are even thrown out, that they might strenuously object). It is only necessary, in reply to any argument of this nature, to point out the fact that in other industries, where such opportunities were held forth, the employes concerned have almost invariably shown marked appreciation for any efforts in their behalf, and that the consideration that an employer has done a little something to improve the condition of his employes has often helped to turn the scale of opinion in his favor, in times of disagreement between Capital and Labor. The statement that any body of intelligent, hard-working men will resent any effort for their mental improvement verges somewhat on the ridiculous, and would not be worthy of mention, were it not so often heard. Perhaps the source of such a belief may lie in a certain rather hostile attitude of these laborers toward college men working among them—an attitude full of large surprises to the college men, who are generally at loss to locate its cause—possibly for the reason that the cause is made up of such a complicated mass of little things as to be rather difficult of unraveling. It has been more or less made clear, recently, in our metropolis, where a number of the more frolicsome students at one of our largest universities enjoyed a few days of refreshing sport on a certain city railway, when that railway was in a state of disagreement with its employes. The fact that a number of laborers were made to pay very heavily for the harmless prank of these semi-innocents has, of course, not greatly narrowed the breach between the college man and the laborer, nor enhanced the respect entertained by said laborer for the product of institutions of learning. But a natural distrust among working men for Mr. Butt-in and his family connection should not be interpreted to mean a disdainful attitude toward practical instruction in every day duties—and the average motorman will receive such instruction, not only with willingness, but even with gratitude.

It is beyond the province of this article to go very deeply into the subject of associations formed among the employes for mutual protection. Volumes could be written, and have been written on this matter alone, since organizations of this kind form perhaps the most lively problem to be faced by the employer today. One thing only, we will say on this point. The measures herein recommended, making for the heightening of intelligence among the men, for the encouragement of individual work, and for the holding out of suitable promotion for meritorious service, are measures which will have a marked tendency to ward off from the companies adopting them many of the serious difficulties which arise from the action of organized labor. The employe who knows that his work is noted and appreciated, and that continued good service on his part will surely meet with substantial reward is not likely to lend a willing ear to the seduction of the walking delegate. This fact alone should prove a very strong recommendation for a system such as has been outlined, considering the enormous expense which any difficulty with its employes is certain to bring upon an operating company.

In the previous handling of this subject, an attempt has been made to show that a more thorough system of instruction for motormen, followed up by improved methods of supervision would be of actual benefit in dollars and cents to any street railway company. On the moral side, but little has been said. The situation there is too plainly in favor of such measures to require lengthy discussion. It is every man's duty to make this world as much better, as he possibly can. The men who have it in their power to confer a lasting benefit upon a large number of their fellow mortals are those upon whom this duty should be very binding. The persons in charge of the organization and management of large street railway concerns are, for the most part, individuals of high standing and good repute in the communities in which they live. The ancient truism of the "soulless corporation" does not apply in the least to the individuality of the directors of this variety of corporation, whose activity in the interest of general philanthropy, outside of business lines, is both known and respected.

These men must surely realize what vast opportunities for bettering the condition of their fellow man are placed in their hands, and to what a marked extent the smallest action or want of action on their part will influence the lives, and destinies of a worthy and industrious class of men. The pleasure of doing good for its own sake is after all the very greatest in existence, and the abundant satisfaction to be gained from looking back on a life whose labors have been largely beneficial to mankind is a satisfaction for which the gainer is indeed to be envied. Let it be understood that this article does not presume to instruct men of long experience and recognized ability in their moral duties toward mankind in general. But in this particular case, where moral duty is so plain and clear, and the right path so easy to follow, it would seem that the most faltering footstep could not go astray.

May we not hope that in the near future, something will be done toward the improvement of a condition which so needs improvement—something that will redound to the credit of the organization and to the advancement, both mental and financial, of its employes, and will be recorded in the history of electrical achievement as a great step forward in the line of city railroading. The time is ripe for action. We await the man who will act.

Some European Notes on Tickets.

BY T. J. NICHOLL.

Tickets are generally used on all the lines of electric tramways, horse cars and omnibuses in Europe. In England and some few lines on the continent card tickets are used, being cancelled by a common punch, while usually on the continent the tickets are printed on exceedingly thin paper, so thin in fact, that the printing could not be erased without destroying the ticket. They are too thin to punch, and are cancelled with an indelible or colored pencil.

The tickets used on the Manchester Electric tramways and the Liverpool Corporation tramways are card tickets of rather light weight, $1\frac{1}{4} \times 2\frac{1}{2}$ in. in size, and show the destination, price and series number on the face, and on the reverse side advertisements are printed. Four types of tickets which are used on the continent, and are about the same size as those used in England, are those of the Marseilles tramways, Tramways de Nice from St. Roche to Monte Carlo, the Paris electric tramways and the Paris Underground R. R. The three former tickets are printed on thin paper and, as stated, are cancelled with pencil, while those on the underground system are printed on heavy paper and are cancelled with a punch. The information contained on these includes the destination, series, price and class. On the Marseilles tramways the price of the regular city ticket without transfer is 2 cents; with transfer, 3 cents. A second-class round-trip ticket from St. Roch to Monte Carlo, a distance of 12 miles, costs 17 cents, while a first class ticket on the Paris underground system from Tuilleries station to any point on the line is 5 cents, as against 3 cents for the second class passage. The tickets on the Paris underground are punched at the gate when the passenger enters the station and are also examined and punched on the car to prevent second class passengers riding in first class carriages, the ticket remaining in the possession of the passenger or thrown away. The tickets used on the Brussels tramways differ from those above described in that they are larger and contain considerable more data, being $1\frac{3}{4} \times 4\frac{1}{4}$ in. in size. The cars of this company are partitioned for first and second class passengers, the fare for the former being 20 centimes (4 cents) and for the latter 15 centimes (3 cents). Upon the payment of three cents more the passenger is entitled to a transfer. Besides the series number, destinations, class and price, there is stated on the face of these tickets in French and Flemish that "this ticket is personal and must be presented whenever required by an agent of the company." On the back it states in the same languages, the following:

"The pasenger must tell his destination when he asks for a transfer and pay for the same on the initial line. The transfers are personal and not transferable, are good only for one change of line, without paying again. First class transfers good for first class places, second class transfers good for second class places, unless the second class car is crowded and has no seats disengaged, in which event

second class passengers may be permitted to ride in first class [illegible]. The transfers are not valuable unless accompanied by ticket of initial line. The transfer and duration of trip is not guaranteed and it does not give the right to place unless there is one disengaged.

All of these tickets are subject to inspection by regular inspectors, who board the cars at various places and times and if the destination is wrongly marked or punched, or if the passenger has no ticket he is required to pay the fare or difference at once. If the conductor collects a fare and neglects to issue a ticket therefor and if detected he is either discharged or fined and perhaps placed under arrest if it can be proved against him. It is this kind of thing that makes the conductors honest and law abiding. In all my experience in England and on the continent I have seen but one case where a conductor failed to give a ticket for a fare; he was not detected as the inspector did not board the buss until after the passenger alighted. I feel quite certain that in Europe a far larger proportion of the fares are collected than in this country, with the spotter system. Men should be treated as men in order to make them honest, and if you do check them up let them know it, employing a superior class of inspectors for this service.

Tickets are sold by the conductors, who often carry as many as 18 or 20 kinds and colors for the two classes and several points of destination, the rate of fare being based on the distance. The tickets are generally arranged in a book made especially for the purpose and are arranged therein according either to value or locality. The book is simply a long piece of cardboard covered with leather and having flaps on each end and one side to cover the tickets when not in use, and in which the tickets are held by rubber bands. While these cases are not handsome they are very handy and serve their purpose admirably.

In connection with the subject of tickets, a description of a chair ticket issued by the city of Menton, France, should be of interest. This ticket is printed on very thin paper, 2⅛ x 2⅜ in., and sold for 2 cents, entitling the holder to a chair for the day in any of the parks of the city. The same kind of tickets are used in London, Brussels and other cities. The chairs are usually close to the band stand and enable one to comfortably listen to the music on an individual chair. The quantity of 2-cent fares thus collected pays for the maintenance of the chairs, music and programs, and often saves the necessity of the street railway company paying part or all of the band expense as an attraction. The people hear good music and certainly ought to be willing to pay 2 or 3 cents for this comfort, which is far better than sitting on the damp ground or a hard and crowded park bench. At some of the band concerts on the continent the programs are sold for 2 cents and are used the same as the chair tickets, except that the chair tickets are good for all day on any vacant chair in any of the parks in the city issuing, so that one may be able to hear one or several concerts for the same fee.

Verily, we have many things to learn in America. In England all electric tram cars or buses have but one class, while on the continent the cars or buses are either divided by partitions, have inside or outside fares or have separate cars for the two classes. In all cities companies are compelled to furnish seats for the passengers, except in the underground roads of London and Paris, particularly on the latter at rush hours, when you can scarcely ever secure a seat and the crush is simply terrific. You have to fight your way out and fight your way in, and if you happen to be an American or Englishman not understanding the French language, you are simply "in the soup." I suggested to the manager of the Paris road that he permit the people to enter by one door and pass out of the other; he said he had tried this rule and it could not be enforced so great is the crowd he has to handle at rush hours.

The Ottawa Electric Railway Co., Ottawa, Ont., has recently distributed $1,000 in bonuses to its employes. To men who received no demerit marks for a year a bonus of $10 was given and those who were charged with only five marks received a bonus of $5.

The Brooklyn Rapid Transit Employes' Benefit Association has recently organized a band of some 60 pieces, which made its first public appearance the latter part of September, at Luna Park. The services of Mr. W. S. Mygrant, band master of the 13th regiment, have been secured and the members of the band from every branch of the company's service are making great progress in perfecting the organization.

Gorleston-on-Sea Electric Tramways.

[illegible]

The one-time little east coast fishing village of Gorleston, England, has during the last few years been slowly and surely creeping into public [illegible] received a very widespread advertisement, its visitors having seen for themselves the successful growth of its sanitary policy, its decorative outlay, the quiet, comfort, and safety of the beach and bathing arrangements.

[illegible]

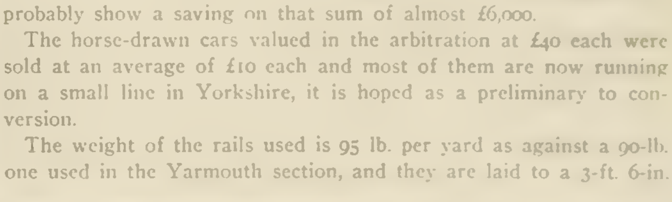
This summer Gorleston has added another attraction to its list and on June [illegible] parent borough of Gorleston) opened the electrically equipped line running from the Great Eastern Station (Southtown) at Yarmouth to the Beach, and also via the Lowestoft Road to Gorleston Bridge Station.

In 1902 Yarmouth electrically equipped its tramway service and the change from the old horse car service was so appreciated that Mr. J. W. Cockrill, the borough surveyor, was instructed to take an early opportunity of negotiating with the British Electric Traction Co., who were the lessees of the Gorleston lines on the other side of the River Yare, which lines were being operated with a horse car service. He was instructed to acquire them for the borough and to bring them up to the same electrical perfection as the Yarmouth system enjoyed. The result of the arrangements with the owners and the subsequent work of the winter of 1905 was the conversion of three and one-half miles of track and roadway from a dirty, rough road to a first-class condition of electric service.

The actual costs of the Gorleston Tramways are not made up yet, the original estimates were set at £56,000 but the final figures will probably show a saving on that sum of almost £6,000.

The horse-drawn cars valued in the arbitration at £40 each were sold at an average of £10 each and most of them are now running on a small line in Yorkshire, it is hoped as a preliminary to conversion.

The weight of the rails used is 95 lb. per yard as against a 90-lb. one used in the Yarmouth section, and they are laid to a 3-ft. 6-in. gage. They were supplied by a Belgian firm. It is presumed that the water carriage to the port of Yarmouth was a factor in this selection, but all the switches and crossings were the well known manganese-steel production of Askham Bros. & Wilson of Sheffield. The Dennis bonds which gave satisfaction in the earlier installation at Yarmouth were again used.



LAYING [illegible]

The twelve cars supplied by the Brush Co. are of its latest "top-seated" design; the bodies have mahogany main panels, canary

lower ones, ash pillars and underframes. The interiors are finished in oak with ash panelling with seats of oak slats. An improved type of ventilator is used. The cars measure 28 ft. over all with carrying capacity for 22 passengers inside and 32 on the roof. The arrangement of the spiral staircases gives free access to the passenger and affords a clear view of the road and plenty of room for the motorman.

The car is mounted on a truck of the Brush [illegible] type, the wheels having wrought iron centers and steel tires. Two Brush 1002 B motors of 32 h. p. capacity each are used. The controllers are fitted with the company's electrical emergency brakes. The fenders are of the Hudson-Bowring make. The steps are folded up by hand, they cannot be forgotten as the motorman must do the folding before he can close his guard gate. There are ten of these cars on this road, making the service an efficient one for the summer season.

About two-thirds of the complete length and width of the roadway running from Yarmouth Station to Gorleston is paved with the Karrijarrah Co's. specially treated wood block paving, and for this distance the roadway is level; the remaining portion of the road has numerous grades and is paved with granite sets for the benefit of heavy traffic. Some of the gradients are severe, that on the Lowestoft road reaching 1 in 27.

Part of the road is a single track line and very crooked. To guard against two cars entering any section from opposite ends, an automatic system of lamp signalling is used, no car entering the section while the lamps are glowing. Great care has to be taken by the motorman in rounding steep curves on this part of the line.

The electrical current, which is supplied by the Yarmouth Lighting Corporation, and is carried under the Yare River to the Gorleston side through three Callendar cables, is charged for at the rate of five cents per unit for the first 100,000; after that the price will be four cents per unit.

From an engineering point of view this cable-laying feat is interesting, there being several initial difficulties. For 14 years various plans have been proposed for getting current across the Yare River, overhead, subway and transporter-bridge schemes have all in turn been discussed, and it has fallen to the Callender Co. to solve the problem. It should be noted that at the crossing point the river is 270 ft. wide and that the tide is extremely swift. Two weeks' time was taken to dredge a trench 7 feet deep from bank to bank; 6,000 tons of excavated material was removed by the dredge. A taut line was then stretched across the channel, running centrally with the trench, and a lighter holding three cable drums placed in position with an outrigger to guide the cables. Just a few minutes before high tide all had to be ready to complete the operation with a dash, for being caught by the tide meant a failure. The actual crossing and laying, under the superintendence of Mr. Hastings, the assistant contract manager of the Callender Co., was successfully effected in ten minutes from the start. Divers then completed the bedding and fixing work, the whole of which has proved to have been satisfactorily done.

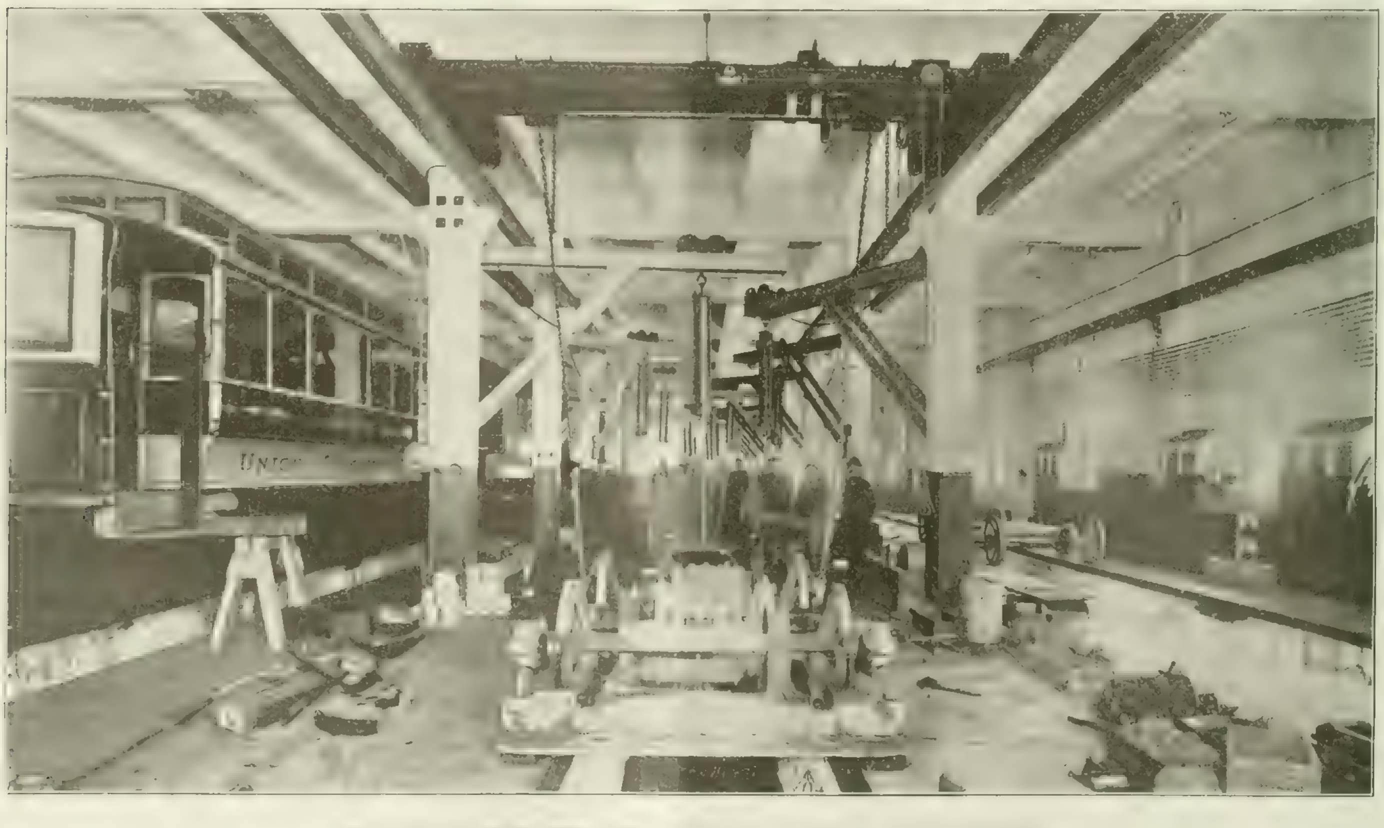
Mr. Frederick L. Turner is general manager of this road and its construction was carried out under his guidance.

Kensington Ave. Shops, Philadelphia Rapid Transit Co.

There are about 1,800 cars required to fill the average schedules on the lines of the Philadelphia Rapid Transit Co. At the present time the repair work for all the company's cars is done at one of the two shops; one of these is located at Eighth and Dauphin Sts.; the other at the intersection of Kensington and Cumberland Aves. To the Kensington Ave. shop which was described in the "Review" April 20, 1903, page 221, has been added a new section of a late type of reinforced concrete fireproof construction.

One of the accompanying illustrations is a view across the second story of the new shop building, and clearly shows the concrete beam construction used for supporting the roof and floors. The posts which are seen supporting the heavy main girders are of concrete reinforced with four vertical steel bars tied together with short pieces of strap iron having holes punched in the ends so that these pieces may be slipped over the pairs of bars. The transfer table shown is of a size to accommodate any of the company's rolling stock and operates across the width of the second floor of the building. Current for driving the motor which moves the transfer table is obtained from a contact rail buried in the concrete floor structure.

The entire space of this second floor is used as a paint shop



REPAIR SHOP, KENSINGTON AVE. SHOPS, PHILADELPHIA RAPID TRANSIT CO.

PAINT SHOP, KENSINGTON AVE. SHOPS

There are six tracks extending throughout the entire length of the building and the floor is all open as one room. These tracks will accommodate 50 cars. The paint shop is lighted by four large sky lights located over the two middle tracks along the center line of the roof. Both of the sides and one of the end walls of the paint shop are almost entirely made up of windows reaching from a point about 4 ft. above the floor to the ceiling. The sashes used to hold the glass are of galvanized iron. Wired glass is used throughout for the windows in the side walls and the skylights. In the entire room there is absolutely no inflammable material except that in the cars which may be standing on the tracks. The building is heated by steam from boilers located in the old portion of the shops. Throughout the paint shop there are two sets of coils; one set of coils, as may be seen in the illustration, is placed at an elevation above the roofs of the cars and along the supporting columns of the building. These coils suffice for heating the building except in the most severe weather. When needed, however, there is an extra set of heating pipes located, as is customary, near the floor around the outside walls.

A portion of the north end of this second floor is divided by concrete walls into several small rooms, one of which is used as a locker and washroom for the employes. The small room at the northwest corner of the building is equipped with racks for holding the supply tanks for the paint materials. Adjacent to this room is the mixing room in which is mixed all the paint used by the 50 painters who work in the large paint shop. All the facilities for car painting are provided here so that during working hours it is not necessary for any of the painters to leave the second floor. Each painter is given a kit of tools for which the company holds him responsible. He is also supplied with a numbered steel box 10 x 10 x 14 in. in size. Each man has his individual key for the lock on his box. At night after locking up his kit of tools in the box he delivers it to a clerk who is responsible for the keeping of these boxes during the night. A room with several rows of steel shelves for the storing of these boxes adjoins the paint mixing room.

The first floor of the addition to the shops is divided in half by a transfer table which is of the same type as that in the paint shop above and serves all the tracks in both the new and old parts of the shops. There are five tracks on the first floor which extend throughout the length of the new shop; the three center tracks terminate inside the building at each end wall and the two outside tracks nearest the side walls extend through openings in front of the building to connect with the track work in the street. These openings are provided with Kinnear rolling steel doors.

At the west side of the building, about half way back on the entrance track from the door, and near the transfer table, the tracks in the floor are arranged for running any desired car upon the platform of a hydraulic elevator operating between the first and second floor levels. This elevator, which is of the hydraulic plunger type, was manufactured by F. T. Bates, of Philadelphia. The motor-driven pumps, storage tank and piping are all enclosed in a concrete pit below the level of the first floor.

The first floor of the new shop building is used entirely for truck repairing and for overhauling purposes. The cars are run into the building on either one of the wall tracks and by means of the transfer table taken to any desired point in the shop. If truck or motor repairs are to be made the car bodies are raised and supported on horses. Then the trucks are transferred to one of the repair tracks.

For moving trucks about the building a novel and ingeniously designed storage-battery electric locomotive is used.

An accompanying illustration shows one of the repair tracks with the jib and overhead cranes which serve all the tracks in this shop. The overhead cranes are of the company's own manufacture and are equipped with driving motors taken from National Electric Co. air-compressor sets. There are four such cranes over each of the tracks in this shop, two on either side of the transfer table. With two of these cranes a car body may quickly be lifted from the trucks and placed on horses. The supporting columns for the second story floor system are of such a distance apart that the space between them will accommodate two pairs of trucks. Each column supports a jib crane with a Curtis air hoist hung from the crane carriage. The dimensions of the parts of these cranes and the arrangement along the track are such that there is one crane for each pair of trucks that can be placed on the repair tracks.

In the street end of the first floor are the offices of the master mechanic. A private exchange with 10 telephones placed about the shops serves to furnish telephone connection from these points in the shops with any other points in the shop or throughout the Rapid Transit company's extensive telephone system. The shops are provided with watchman's clocks and a fire alarm system. All the wiring for lighting, power, telephones, patrol and fire alarm boxes is carried through metal conduits bedded in the concrete floors and walls of the buildings.

THE STREET RAILWAY REVIEW

AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE

KENFIELD PUBLISHING CO.,

45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:

New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:

Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV OCTOBER 15, 1905 No. 10

CONTENTS OF THIS NUMBER.

AN AUTUMN DANGER.

With the arrival of the fall season the danger of slippery tracks again confronts the street railway man, and the importance of providing plenty of sand on cars and keeping the brakes in perfect condition can scarcely be exaggerated. In the steam railroad field the grades are usually moderate enough to furnish in themselves a certain security against collisions on slippery rails, and the larger intervals between trains materially adds to the general safety of operation. The grades often run as high as 400 ft. per mile in street railway work and even steeper grades are not uncommon. In such cases when cars are run at short intervals, it is highly important that frost covered and leaf strewn tracks be kept as free as possible from these objectionable conditions.

Sand and brushes are often ineffective when used upon a mushy coating of wet leaves on the rails. Possibly a brush made up of stiff steel springs similar to the steel third-rail brushes used in elevated practice might do better, but experience seems to show that the surest way to prevent collisions on heavy grades is to station a man with a broom on the worst sections during the few weeks that are open to trouble from falling leaves. The cost of such a course is a small matter in comparison with the damage account of a single bad collision.

CHICAGO TRACTION SITUATION.

The recent developments in the Chicago Traction situation show an unusual activity and point to an immediate and satisfactory solution of the problem.

On September 26th, the Chicago City Railway Co. submitted terms in which it asks a 20-year franchise and in which it agrees to interchange transfers and route through cars over north and west side lines; to rehabilitate the lines and furnish such service as required by the city council; to change all cable lines for operation by trolley; to sweep and sprinkle streets occupied by its lines; to fill, grade, pave and repair 16 feet of these streets; to make public reports of its earnings; to pay compensation to the city on a percentage basis; and to accept a 20-year franchise in lieu of all present rights and let the city purchase after a stated time. This proposition was endorsed by the receivers of the Chicago Union Traction Co., who presented similar terms, so far as applicable to its system, with such other provisions as pertain to its tunnels, to the Transportation Committee, Thursday, October 12.

On October 7th a joint plan was presented to the Transportation Commitee of the city council, in which nine through routes for both south side and north and west side lines and eleven down-town loops are offered by the Chicago City Railway Co. and the Chicago Union Traction Co

On October 8th, Mayor Dunne issued a message giving 13 reasons why he considered the plan objectionable and made it plain that he was opposed to the proposed ordinance, both as to its form and spirit, denying the right of the council to grant a franchise to any company, styling it a "bold and bald defiance of the will of the people" as expressed at the last municipal election. On the following evening Mayor Dunne forced his "contract plan" for municipal ownership to an issue at the city council meeting and the result practically defeated this "contract plan." It is expected that the mayor will abandon this plan and bring in its place his alternative or "city plan," which contemplates the acquirement, by purchase or condemnation, of all the lines of the existing companies.

On October 9th, a motion was made in the U. S. Supreme Court in the case of the 99-year acts to advance them on the calendar and secure an early hearing, the decision of the court being reserved to October 16th. A motion will be made at that time to also advance the tunnel cases for an early hearing. The right of the people to maintain the quo warranto proceedings which have been begun against the local street railway companies is upheld and the pleas of the street railway companies are attacked in a demurrer filed in the Supreme Court by Attorney General Stead, State's Attorney Healy and the attorneys who are associated with them in the fight on the franchises of the street railway companies. Two separate demurrers were filed, one answering the pleas made by the Chicago Union Traction Co. to the quo warranto proceedings, while the other is an answer to the Chicago City Railway Co. Those may also be read on October 16th.

It now seems to be the understanding and wish of those interested that the plan of settlement, before it becomes an ordinance or contract of any kind, be submitted to the judgment of the people of Chicago at an election to be held next spring.

THE DIRECT CURRENT STEAM TURBINE.

One of the most important problems now confronting the designer of prime movers is the production of a standard commercial line of direct current steam turbines suited to the requirements of electric railway service. The development of the turbo-alternator during the past five years has been little short of marvelous and although no unprejudiced observer has reason to predict the forthcoming abdication of the reciprocating engine from the power plant field, there is no doubt that in many of the later installations the steam turbine is giving a hard rub to its predecessor. Now that turbo-alternators have been built in capacities up to 8,000-kw. normal rating, with two-hour overload capacities reaching 16,000 h.p. in single units, it would seem to be worth while to attack the direct current problem with renewed vigor and to determine definitely the limiting conditions of design for the benefit of the engineering world at large.

What is needed is not so much the production of enormous machines rivaling in output the large alternators mentioned, as it is the adaptation of the steam turbine to the conditions found in the smaller street railway plants operating with direct current. The majority of the street railways in this country derive their power from plants of small or medium size, in which a two- or three thousand-kilowatt generator is about the limiting size of unit; while in many localities a few hundred kilowatts constitute the total capacity required for the rolling stock propulsion on the entire system. Such plants suffer economically in the first place from small capacity and in the second place from poor load factors. It has long been established that even small plants can frequently be operated with high economy provided low and fluctuating load factors can be avoided, but on the average direct current street railway system of moderate size this condition is seldom easily obtained. A well-designed alternating current plant with sub-stations skillfully located with respect to the load requirements stands a better chance of maintaining a good load factor, and with the advent of the single-phase motor still higher efficiency may be anticipated. On the direct current side of the fence, however, there is a real demand for the light load economy of the steam turbine, and if the problems of commutation and balancing become satisfactorily settled there is no question but that the direct current turbo-generator has an assured future. The gas engine is also rapidly coming to the front, and each year witnesses keener competition in the prime mover market, not only on account of the evolution in machinery but because of the tendency of fuel cost to rise.

As a matter of fact, the direct current turbine has been making considerable headway of late. In train lighting and isolated plant service some very interesting machines have been doing effective work, and in sizes up to about 300-kw. practice has become fairly settled. In Europe quite a number of plants are being operated with turbo-generators of the continuous current type, and in this country their general adoption cannot long be postponed. One of the prominent turbine makers has advertised 500-kw. turbo-generators for some months, and machines of this size will soon be installed at the train power plant of the Portland (Me.) Railroad Co. The Boston Elevated Railway Co. has also purchased a 2,000-kw. direct current turbine, and although the particulars of this machine are not available at this writing, it is understood that the speed will be about 750 r.p.m. and the economy equal to if not better than the best compound engine practice within a similar range of output.

The difficulties of commutation and balancing are not to be easily brushed aside, but in view of late experience in both these directions it seems doubtful if any lasting trouble will be found, after the machines are accepted. It is not so many years since the building of a commutator with a peripheral speed in excess of 3,500 ft. per minute was regarded as of very doubtful design. The production of thousands of dynamos and motors under the expert supervision of the manufacturers' engineering departments, reinforced by detailed knowledge of the behavior of the machines in commercial service, has furnished designs well nigh faultless from the consumers' standpoint [illegible] commutation [illegible]

In the matter of [illegible] [illegible] the simple rotating field and collecting ring structure of the turbo-alternator [illegible]

[illegible] can be successfully operated from 3,000 r.p.m. up to 25,000 r.p.m., [illegible] the line, the apparatus driven is geared to the prime mover. The construction of armatures capable of withstanding the enormous centrifugal [illegible] railway units mentioned is certainly a triumph in dynamo design.

As to operating economy, there is no apparent reason why the steam consumption of a turbine driving a direct-current generator should be any different from that obtained with an alternating machine as load. In the smaller sizes of turbines the friction losses constitute a larger proportion of the output, and the efficiency falls off somewhat more rapidly than in large units. It is important to remember, however, that in the steam turbine indicated horse power is unknown, and in comparing steam engine units of the reciprocating type with turbines, the steam consumption per kilowatt hour or per electrical horse power hour is the proper basis of balancing.

Small direct current turbo-generators are needed more than large units for the reason that with large plants the load factor can be kept well up, and by using superheated steam about as good economy can be secured with large engines as with turbines. That the small floor space per kilowatt capacity of the turbine unit reduces to a minimum the building and land cost is an important advantage of the turbo-generator. The problem is after all a question of electrical design. The uniform angular velocity, operating simplicity, high steam economy at fluctuating loads and at all loads, low cost of attendance, use of condensing water over and over again when desired, permanence of adjustment and low steam consumption common to previous turbo-alternator combinations should prove of great advantage to the direct current road which adopts the continuous current turbine in future power house installations. The behavior of the machines now under contract will be watched with interest by electric railway engineers throughout the country, and the results promise to be significant in the evolution of the modern power station.

THE TWENTY-FOURTH ANNUAL CONVENTION.

The recent convention of the allied street railway associations in Philadelphia was undoubtedly the most notable one which has ever occurred in the history of this organization, and the adoption of a new constitution was naturally the most important feature of the convention. The movement which resulted in the present organization has been under consideration for the last two years, and its details have been carefully and thoroughly studied by the most prominent and influential members of the different associations. The status of the association now compared to that of a few years ago portrays perhaps better than anything else the relative importance of the street railway business now and a few years ago. From the considerations of the feeding and care of horses, which occupied the attentions of a comparatively small number of members at the early conventions, the American Street and Interurban Railway Association has by successive advances become an important technical association, whose membership includes engineers of the highest rank. For a time the multiplication of branches threatened to detract from the importance of the main organization, and at the same time to introduce rivalry between the different branches which eventually could not fail to affect the usefulness of the organization as a whole; but the very happy solution of these difficulties by the amalgamation of all the departmental associations with the parent association has resulted in a harmonious body which can hardly fail to be of the greatest value to all of its membership.

The election of President Ely for a third term was a specially well-deserved tribute to his excellent administration during the past two years, and as the present constitution has been formulated largely under his guidance, no one is better qualified to start the association on its new career.

The convention papers and committee reports were of an un-

usually interesting nature, and were more carefully prepared, perhaps, than any set of papers previously read before the association. The discussions were also carried on with vigor and interest which promises well for future meetings. The proceedings of the associations were promptly presented to our readers in the "Daily Street Railway Review," excepting the Accountants' proceedings, which are covered in this issue, with the exception of Mr. Tingley's paper on the cost of carrying passengers, which has been unavoidably withheld.

The question boxes of both the Accountants' Association and the Mechanical and Electrical Association deserve special mention on account of the very thorough way in which they were prepared. Both of them contain a great deal of condensed information, and instead of answering most of the questions by "yes" and "no," the answers have been given in sufficient detail to show that the questions were given careful consideration. The publication of the question box of the Mechanical and Electrical Association is commenced in this issue of the "Review."

The accommodations which Philadelphia afforded for the convention were unsurpassed, and were the subjects of general and favorable comment. The exhibit hall was not only conveniently located, but was of ample proportions, and the exhibits were more numerous and more carefully studied than usual. The entertainments provided by the Manufacturers' Association for each day of the convention were much appreciated, and were happily arranged so as not to interfere with the most serious business before the associations.

This year also marked the first active business session of the Claim Agents' Association. This, we believe, should form a very important organization, as the attempted fraudulent claims against street railway companies are constantly attaining larger proportions, and it needs unanimous and well directed efforts on the part of the claim departments for the suppression of this evil.

The establishment of permanent offices for the secretary of the association in New York City, and the selection of a secretary who will devote his whole time to the business of this office, is undoubtedly one of the most effective moves that has ever been made towards making the association valuable to its membership. The compilation of useful information and data of all kinds which this office will contain and which will be available at all times to members of the association, will add greatly to the value of membership in the association. We trust that this feature will grow in usefulness and importance to such an extent that even the smallest road in the country will feel the necessity and the profit of being a member of the association.

STREET CAR VENTILATION.

With the approach of winter the much discussed problem of street car ventilation is forced upon the attention of street railway managers, who are called upon annually to satisfy all sorts and conditions of tastes on the part of street railway patrons in regard to the temperature and ventilation of street cars. The street railway manager does not, however, enjoy a monopoly of the complaints in regard to ventilation, as the steam railroad car of the ordinary type, and even the Pullman sleeper, are frequently denounced for their poor ventilation, and often with good reason. The conditions under which street cars operate, however, make the question of ventilation on these cars a much more difficult problem than it is on steam roads, because the trolley cars are as a rule very much smaller and carry a far greater number of passengers in proportion to their size.

There is no question but that the matter of proper ventilation is a very important one, affecting as it does not only the comfort but the health of passengers. A sufficient supply of pure air of a suitable temperature is very reasonably demanded by patrons of the street railways; but it is just here that the management is confronted by a wide variety of tastes. One passenger will not be satisfied with a temperature of less than 75 degrees, while another one will consider the car hot and stuffy if its temperature rises above 55 or 60 degrees. So far as the temperature is concerned, therefore, the only feasible plan would seem to be to select an average figure between the two extremes and to keep the car as near this temperature as possible. This can be easily accomplished by merely installing thermometers on the cars and regulating the heaters according to the thermometers.

However much disparity of opinion may exist in regard to the proper temperature, there can be but one opinion in regard to the desirability of pure, fresh air in the cars. From experiments it seems certain that some simple mechanical device will soon be forthcoming by means of which the supply of fresh air to the cars can be regulated to a nicety. In the meantime, until such an automatic device comes into general use, the ventilation of the cars must rest very largely upon the operative force. Ventilators of some sort are provided on all street cars, and it rests with the conductors to see that they are used. On crowded city lines where both front and rear doors of the cars are used for entrance and exit of passengers, the question of ventilation is not a difficult one, as the frequent opening of both front and rear doors keeps these cars well supplied with fresh air and frequently with uncomfortably cold air. Where the front doors are kept closed, however, which is the rule on a good many roads during the winter months, the conductors should be instructed to keep at least a minimum number of ventilators open, even in the most severe weather.

Another thing which is closely connected with the subject of ventilation is the question of cleaning and airing the cars after they are taken out of service at night. Cars which are not thoroughly cleaned and aired will soon become saturated with foul odors, which will counteract the most careful attempts at ventilation.

The Transportation Department and the A. S. & I. R. A.

Editor "Review:"

A most successful meeting of electric railway men has just closed, much of interest has transpired, the re-christening of the association in recognition of the importance of the interurban lines has taken place. The parent organization deliberated on gas engines as applied to railway work, the new single phase system, and other timely topics. The claim agents discussed ways and means of defeating the plans of their arch-enemy, the accident fakir; the master mechanics and power station men discussed power distribution, load factors, controlling devices and other subjects pertinent to their work. The accountants wrestled with the problems of classification, standard form of reports, ticket accounting, and debated at length on the value of that unknown quantity "Depreciation," all of which was eminently right and proper, as each department is an important factor in the operation of a railway property. However, there is another department which it seems should have some recognition and a subject or two on the intellectual bill of fare, and that is the transportation department.

Conversation with traffic men at the convention brought forth the fact that there is a feeling that there are many important problems confronting the transportation officials today and that we should get to work on them. Training and disciplining of motormen and conductors, testing of sight and hearing, construction of schedules, labor troubles, inspections, standardization of physical requirements and various other subjects call for consideration at the hands of the transportation man.

Why not have a "Traffic Managers' Association." Section XII of the constitution of the A. S. & I. R. A. provides for a helping hand to such associations as are engaged in the work of investigating "technical matters connected with the railway construction and operation." The work of the transportation department may not be strictly technical in character, but its importance cannot be discounted. Vast things are required of the operating department daily. It is the one that deals with the public, the action of its employes has much to do with the balance sheet at the end of the year, its schedules and the observance or non-observance of them are great molders of public opinion. The traffic official must be ready to meet the emergencies that are constantly cropping up at various points along the line. The hiring of men to operate the cars is of vital importance, and upon traffic official's judgment in selecting men may depend largely whether or not the road will be free of labor troubles.

The fact that the transportation pay roll is anywhere from 30 to 45 per cent of the total pay roll expense, is a reason in itself why this important department should have recognition.

Let us have a good, live "Traffic Managers' Association"—if not by that name, then by some other name, but let us get together.

J. W. Brown.

Connellsville, Pa. Supt. Trans., West. Penn. Rys.

October Meeting of the Indiana Electric Railway Association.

The October meeting of the Indiana Electric Railway Association was called to order in the palm room of the Claypool hotel, Indianapolis, at 10:30 a. m., October 12th, with President Henry in the chair. In the absence of the secretary the president appointed T. E. Morgan, secretary pro tem., who read the minutes of the last previous meeting, which were approved.

The president then appointed a committee to frame a set of resolutions expressing the feeling of great sorrow of the association at the loss of the late John W. Chipman, of the Indianapolis & Eastern Railway Co., whose death recently occurred at Boston.

The following paper was then read:

Claim Department.

BY ELLIS C. CARPENTER, CLAIM ADJUSTER, INDIANA UNION TRACTION CO.

Claim departments were created and exist by reason of the misfortune of others; but so long as motormen will run their cars into each other in broad daylight and women persist in getting off cars backwards, the necessity for the departments will remain and they must be maintained, although I feel certain that even claim adjusters would welcome the day if the causes could be removed so that the claim departments could be disbanded.

What we shall say in this paper will be said in the light of what our experience and observation has taught us, yet realizing that we have not attained perfection.

Every claim department should be furnished with certain blank forms for reporting accidents, the forms being prepared to cover local conditions. It is not possible to have a blank form of report that will cover all accidents and not be confusing, but a blank form of report should cover such important features that experience has shown are most likely to occur in the more frequent accidents.

We are now using a form of accident statement, our form No. 401, which we prepared about a year ago that has proved very satisfactory and answers our purpose, where accidents occur on city as well interurban lines. This blank is placed in the hands of our agents and reports are to be made out by the agent, the information being given to him by the train crew reporting the accident. We find we get clearer information in reports where one person at each terminal has been instructed regarding taking reports, get the details from the train crew and fill out the report, but reports are always signed by the train crew.

We are also using a form of report for employes, form No. 416, which is intended to cover accidents to employes in departments of road-master, electrical, shops, power house and construction. This blank is especially prepared with a view of ascertaining the familiarity of the injured party with the duties being performed and condition of tools, staging, etc., at the time of the accident. Reports of accidents of this character are to be made out by the foreman in direct charge of the work at the time of the accident.

In case of serious or fatal accident, immediate notice should be given the claim department either direct or through the train despatcher, and for this purpose we are using a telephone accident report, form No. 417, which is intended to cover only important facts that can be gathered quickly. This report is given to the despatcher by the train crew out along the line, and is sent in immediately by the despatcher to the claim department.

We are also using a short form of report, No. C. D. 403, that conductors must carry with them to report all trouble occurring on cars, such as ejectments, controversy over tickets, etc. Conductors are also required to carry small printed tabs so they can quickly have passengers write down their names and addresses when collecting this information in case of accident. Our agents are provided with blank reports for delayed baggage. The first part of report to be made out when complaint is made; the second part or receipt, to be taken when baggage is delivered, the agent filling out the "Agent's Report" as soon as baggage is delivered and forwarding report with baggage checks attached to claim department. We have for the use of section men a form of report for stock killed or injured.

The claim department [illegible] ing report of [illegible] release blanks for use in making settlement with injured parties, and a special form [illegible] a correct policy to require all employes injured in any manner to execute a release to the company before being permitted to return to work, it being left to the judgment of the claim department as to whether or not there should be any consideration paid in settlement other than re-employment, and insasmuch as a large percentage of accidents to employes occur by reason of their own negligence, and are settled upon the basis of re-employment, we use in connection with this form a blank addressed to the head of the department where the employe was injured, showing that the injured employe has executed a release and the foreman must upon this endorse the date upon which the injured employe returned to work, and return this information to the claim department for permanent filing, this making a complete record of each case and showing the fulfillment of the contract by each party.

When a report of an accident is received by the claim department we immediately note the date and the hour of its receipt, and index in a book for that purpose, under the name if given showing date, location and kind of accident; a space being left for entry of settlement when made. The report should then be placed before the head of the claim department and he can order inquiries mailed to witnesses or assign it for personal investigation, after which reports are filed alphabetically according to date in special files for the purpose.

For effective work thorough organization is essential and every department of the service should co-operate with the claim department. The prompt report of accidents means much, for if the information regarding accidents is slow in reaching the claim department, many times important information may be missed and much time and expense made necessary in looking it up, when if a prompt report had been made the matter could have been determined and proper action taken. Information in full regarding accidents cannot reach the claim department too soon. It is necessary in many instances, in case of serious accident, to have the employes report to the claim department in person as soon after an accident occurs as possible. In case of fatal accident this rule should always be observed, so that not only full details may be reported to the company, but the main facts may be prepared in the form of an affidavit ready for the signatures of the train crew so that the affidavits may be taken to the coroner and sworn to before him. By following this plan such important details can be kept from the coroner's records and the public as an over inquisitive officer might bring out and be troublesome in court.

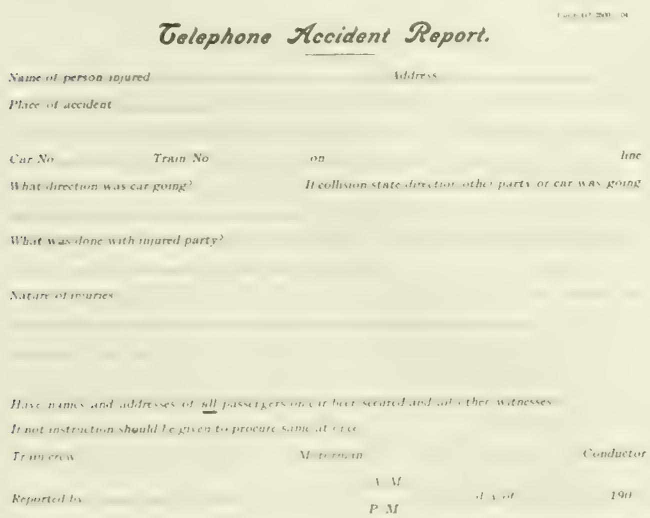
One of the most important features relating to accidents and which is so often looked upon lightly by the transportation department, is the prompt securing of full names and addresses of witnesses to accidents or persons near the scene of an accident. It is difficult to make men in charge of cars realize the importance of doing this and securing this information, and how to get them to do it is worthy of our best thought, for when a serious accident occurs, such as a collision where possibly 100 to 200 persons may be more or less injured, I know of no more important service a train crew can render the company, even if the entire system should be stopped for half an hour, than to secure the name and address of every individual on the car, for in every accident of this kind you will find some designing person who will gladly welcome an opportunity to filch money from the company upon some real or imaginary injury, and we have known cases where claims have been made by persons who were not on the cars at the time of the accident, but who claimed they were, thinking it would not be possible to detect them.

There are two ways of keeping this matter before the men. One by general rules governing this question printed in the train schedules, and the other by explaining to the men in meetings arranged for the purpose, the importance of this as well as other matters pertaining to the claim department. These meetings should be held at least twice a year so as to include all new employes and keep

them informed regarding these matters. No man, however, should be placed on a car in the capacity of motorman or conductor without first in his preliminary examination being able to intelligently answer a few pertinent questions as to what is necessary to be done in case of an accident.

With the carmen understanding these matters and placing the main facts with the witnesses promptly before the claim department, the matter of ascertaining from disinterested persons their version of accidents should be promptly done by expert investigators. We find that young married men are best for this work. They should be of good address, pleasant and courteous, with judgment as to when to get down to business and touch the vital matters.

Written statements signed by parties are best and a shrewd investigator can weave into a general conversation about an accident the vital points and get what he wants. He should always want facts and bring them out as clearly as he can get them, and never mislead a witness into an intentionally wrong statement. If a written statement is prepared along the line of the conversation, using as nearly as possible the language or peculiar expression of the witness, it is indeed seldom that he will refuse to sign and afterwards, if necessary, testify in court as to the occurrence in accordance with the statement after he has been permitted to see the signed statement and refresh his memory.



Telephone Accident Report.

Name of person injured — Address

Place of accident

Car No — Train No — on — line

What direction was car going? — If collision state direction other party or car was going

What was done with injured party?

Nature of injuries

Have names and addresses of all passengers on car been secured and all other witnesses

If not instruction should be given to procure same at once

Train crew — Motorman — Conductor

Reported by — A. M. / P. M. — day of — 190

Information transmitted to Mr — of Claim Department — day of — 190 — A. M. / P. M.

Signed

NOTE IN CASE OF FATAL ACCIDENT OR SERIOUS INJURY NOTIFY CLAIM ADJUSTER AT ONCE AND FORWARD THIS REPORT TO HIS OFFICE

Received by Claim Department — day of — 190 — A. M. / P. M.

In investigation of accidents the question as to the negligence of either or both parties to an accident should be borne in mind, and the circumstances surrounding accidents should be reported as accurately as possible. As an illustration, suppose a car collided with a wagon at a crossing, which is of frequent occurrence. The distance the wagon was from the car track as well as from the car when the motorman first saw the wagon, the speed of car, condition of car and track, and whether or not the party driving looked, how he was driving, speed, kind of wagon, etc., all should be fully and carefully given.

It takes a person of more than ordinary ability to obtain in the best way written statements from witnesses and at the same time to couch the statements in such language as to make a plausible statement of an occurrence and omit conflicting or derogatory statements so that, if necessary to use the statements in court, they will have a good effect with the jury and with this in view, statements should always be read over to witnesses and asked if correct before signing.

It is necessary for a successful investigator to be somewhat familiar with every department of the service in order to make intelligent inquiry as to the running of cars, condition of shops or machinery, power plant, or whatever may be involved in an accident. A cheap man is an abomination for he will make more blunders than two good ones can correct.

Good, active, intelligent men, capable of understanding the requirements, should only be used in this work. They should be assigned and required to do a liberal amount of work and to do it thoroughly and be well compensated for it.

If the work of the investigator is well done and reliable information is placed before the adjuster, it can soon be rightly determined whether or not a claim should be settled or contested.

In dealing with the question of the adjustment of claims, claim adjusters must of course be governed by the policy of their company. Some companies adopt the policy of fighting everything. This is wrong. It not only makes enemies of the claimants, but an atmosphere of antagonism is created that pervades every community through which a line passes and affects travel, the public traveling with you only when really necessary.

Then there is the very liberal policy of settling practically everything out of court and abhoring a law suit and paying liberally to escape having a suit filed against your company. This, too, is wrong. The public in general and lawyers in particular soon learn of this and take undue advantage of you and you have many claims filed and unreasonable demands made.

There is, to my mind, but one right policy, and that is this: permit every case to stand upon its own merits. If the company is liable for an injury done, pay what is reasonable. If not liable, or unjust demands are made, stand upon the rights the law affords. The only exception to this should be in case of fatal accident, where parties appreciate there is no liability, then settlement should be made upon the basis of a reasonable allowance for funeral expenses where surviving parties are too poor to stand the expense. You may rest assured that this is not money thrown away, but really brings better returns, although indirectly, than settlements made in most any other form. For instance, a man is killed, his family is in meager circumstances, the company is not liable, you pay fifty or one hundred dollars and take a release. That family has its friends who know of this allowance. You are afterwards engaged in a law suit. A friend of this family sits as a juror when the case is determined. Don't you believe the friendly feeling of this juror will mean dollars saved to the company? I do most assuredly.

The question of making adjustment of claims is one for which there can be no fixed rule and a company must depend largely upon the ability of its adjuster to negotiate settlements upon the most advantageous terms, considering the question as to the liability or non-liability of the company, the nature and extent of injuries, the temperament, position and station in life of the claimant as well as the surroundings in which he finds his claimant, all these as well as many other minor matters a well informed adjuster will be quick to note and use in the proper way.

The matter of dealing with persons injured is something one cannot well describe. No two persons are alike and you must judge your individual when you see him. A successful adjuster must almost be a "jack of all trades and master of them, too," for it is often necessary to discuss with the lawyer the legal phases of a proposition upon which a claim is based. He must be able to talk intelligently with the physician about the physical condition of his patient so as to obtain as favorable a report as possible on a claimant. He should be a farmer, if farming interests his man; a merchant, if this is what gets his attention; a mechanic or what not, in fact anything that will interest the party with whom he is dealing, even to the extent of flattering the ladies where the necessity exists.

In order to illustrate the uncertainties of an adjuster, I will relate a story: An Irishman was born in France and one day he got into an argument with a Frenchman, the Irishman contending that it made no difference where he had been born, that he was Irish just the same. The Frenchman took the position that, if Pat was born in France that he was necessarily a Frenchman. In order to disprove this statement Pat said: "If the old cat had kittens in the oven would they be biscuits?"

A claim adjuster never knows until he sees his man whether he will find "kittens" or "biscuits."

The discussion was opened by O. P. Spillman, of the Indianapolis & Northwestern Traction Co., who stated that in his earlier experience he was associated with a railroad company which, for ten years, fought all accident claims, and took the position that if there was any liability against the company absolutely proved,

the claim would be paid, but if the company's attorney had any doubt as to the liability, the claim would always be fought. A change in attorneys occurred, the new attorney gained much by utilizing every opportunity for making friends with patrons of the road. To illustrate this, Mr. Spillman related the circumstance of an accident in which a man with horse and wagon was run down by one of the cars, the crew of which was plainly in no way to blame. To maintain his policy of friendship, the new attorney told the man whose horse and wagon had been injured, that although the company was not at fault on account of its method of operation, or from carelessness of its crew, it would pay him a sufficient amount to make up a portion of his loss. This action gained the friendship of the injured man and his friends. A similar policy was pursued for five years, by this attorney, which resulted in decreasing damage claims paid yearly by the railroad, 65 per cent of the original amount.

When questioned, C. C. Reynolds outlined the method which the Indianapolis & Northwestern Traction Co. has for caring for injured employes during the period between the time of an accident and settlement. An association for this purpose was formed, to which all members pay regular dues, and to which nearly all employes of the railroad belong. When a member is disabled from any cause, the treasurer of the association pays him a weekly benefit nearly equal in amount to the wages which he would have earned in the company's employ. The association has added to its funds by giving dances and several kinds of entertainments, thus lessening the dues necessary to be paid by the men and placing it on a sound financial basis. Some of the benefits of this scheme are that it does away with the usual subscription list, passed around among the men when one of their friends is injured; it helps to ease the minds of men working for the company, by assuring them that in case of disablement they and their families will be provided with some means of living while the wage-earner is unemployed and it also eases any strained feeling between the employes and the management of the company that may exist at the time of an accident.

Mr. Henry remarked as to the careful consideration that should be given before deciding as to whether or not any particular claim should be settled in or out of court. He believed that it is a very good practice for each company to have a competent company surgeon at each important point along the line, this man rendering himself of much value at the time of accidents.

The association voted its thanks for and acceptance of an invitation of Mr. Henry to hold its next session in Rushville. It is planned that the delegates will take a special car, leaving the Indianapolis Traction & Terminal building at nine o'clock on the morning of the next meeting day and visit the single phase transformer stations along the line between Indianapolis and Rushville.

As a result of a motion passed, the Chair appointed Mr. Charles G. Lohman, Indiana Railway Co.; Mr. Fred Rapp, Fort Wayne & Wabash Valley Traction Company, and Mr. Guy H. Kelsey, Indiana Union Traction Co., as a Question Box Committee. The chair suggested that all members having questions which they desire discussed at the November meeting, forward them to Mr. Lohman.

It was decided by the association that the manufacturers' sales representatives be invited to exhibit whatever supplies they wish at the regular meeting next May.

President Henry stated that he desired all members of the association to acquaint themselves with the advisability of having a bureau to act upon freight and passenger rates.

The meeting then adjourned.

The Western Massachusetts Street Railway Co. recently began operating its cars over its line between Westfield and Huntington, Mass., a distance of 12 miles. The company proposes to extend its line to East Lee, Mass., a distance of 21 miles, where it will connect with the Berkshire Street Railway Co.'s line.

The York County Traction Co. will build a large storage car barn near the present structure. L. C. Mayer, civil engineer for the company, has prepared plans and specifications which call for a brick structure 235x63 ft. and one story in height. The foundations and floor of the pit will be made of concrete. The interior of the building will be equipped with trackage sufficient to hold 30 of the large suburban cars and 40 of the smaller cars.

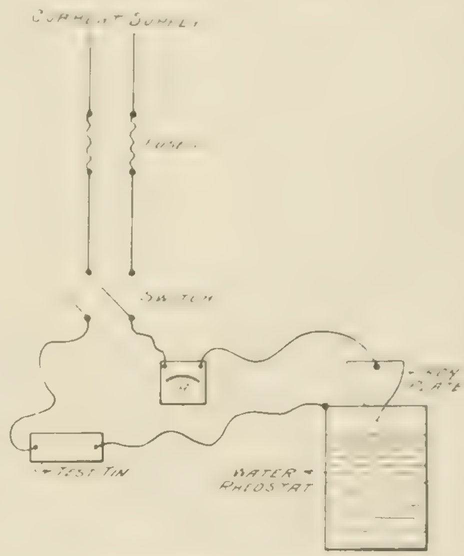
Insulating Paints.

BY ARTHUR B. [illegible]

There are many insulating paints, good, bad and indifferent, on the market today; some are clear, some black, others a combination of both. Almost every paint or varnish factory in the country has made or is making a so-called insulating varnish, often without the slightest knowledge of its requirements. Some makes are better than others, though similar in appearance. To the average man, insulating varnish is an unknown quantity; and he is as liable as not to buy a cheap and inferior article, thinking it a bargain, because it looks like the good. The mere looks cannot distinguish the good from the bad, nor the simple act of rubbing between the fingers test the viscosity.

There is as much or more difference in insulating varnishes than in furniture varnishes. Some contain as high as 32 per cent of resin. Anyone knows that "permanent elasticity" cannot be obtained by the use of resin, and that resin offers no great resistance to electric current.

A special make of varnish is required, if used on insulating cloth. The material must be very pliable and elastic, and remain so while



CONNECTIONS FOR BAKING TEST.

in stock. Some claim that such material will never become brittle, no matter how long it is used; this, however, depends upon the severity of the service, and therefore is a very bold assertion.

Beware of the clear varnish whose manufacturer says it will not cause corrosion. This corrosion results in the green which gets into the cotton insulation, and is caused by free acid in the varnish. Clear varnishes are all made from linseed oil, more or less pure; but however pure, none is free from acid. This is a fact beyond dispute. Some varnishes may not show up as green as others in a certain specified time, but sooner or later they all will discolor.

There is such a dislike to this discoloration that many firms have entirely given up the use of clear varnish, and are using black insulating paint. Some have used black for years and have found it all that could be desired. Other users of coils refuse to accept black coils, thinking that the concern which does their repairing may not do the work carefully, and will overcharge, since the defects can be covered over with the black paint. This is unjust to a reliable repair company, and also speaks ill for the judgment of the coil users; because it should be known before shipping to what extent a coil is damaged, and a letter would ascertain the cost of repairing.

There are some very good insulating paints on the market, both air drying and baking, but there is no especial reason for baking armature coils, if they first have been dried in an oven and then dipped while hot into a good air drying paint. Such a paint should have plastic qualities sufficient to cement the wires of the coils and not become brittle, even after baking for many days. Baking, then, is the best test for a black air drying insulating paint.

Not many shops are equipped for extensive tests, such as puncture

and heat tests, but there are simpler ones which can easily be made. Tests should be made of both black and clear varnishes, baking samples of each on saturated canvas. Allow the baking to proceed continuously for several days, and in order that the insulation of coils be not damaged, the temperature of an oven should not exceed 195° F. One varnish which has come to the writer's notice has withstood a temperature of 240° F. for over 24 hours, and the chances are it would have continued to do so indefinitely without becoming brittle. This varnish, black, protected the paper on which it was placed from carbonization. A bit of plain paper subjected to that temperature would have burned to a crisp. However, some baking varnishes are so oily that it is next to impossible to bake the coils dry without decreasing the efficiency of the insulation. These are made oily so that they will be elastic, it is claimed, but this feature is exceedingly objectionable from the coil maker's point of view. Elasticity is very desirable, but not when obtained in this way.

There are certain clear and black paints which are decidedly too brittle. Hang up pieces of paper or cloth dipped in these and let them air dry; also bake a few. The brittleness shows up in from a few days to two or three months. The two extremes in insulating varnish are here shown—too soft and too brittle. There is a medium condition, however, which has been met.

Should one wish an insulating paint which will give a finely finished appearance as well as high insulation, it is to be obtained in a special baking varnish.

Where a good air drying black paint is desired, and its finish is not sufficiently glossy, a coat of finishing paint can be afterward applied with a brush. The ideal finishing paint should be air drying, and should be sufficiently hard in an hour to be handled, if required. Its finish should be glossy, and it should not become brittle after a short time. Should brittleness occur, the finishing paint does not furnish the proper protection to the armature or field coil, a fact which is often lost sight of.

If the paint dries hard and does not chip off, the effect is the same, provided also that it does not crack, but such conditions are not very likely to be met with in alcohol shellac varnishes, either clear or black. Asphaltums do not solve the problem, nor do air drying asphaltum japans. Some fine appearing finishing paints after a few weeks exposure are as brittle as glass and utterly worthless. Some firms have met the coil varnish problem reasonably well. but have put a poor finishing paint on the market. The poor article is the one which advertises the firm.

Why should the finishing paint be air drying?

1. Because nothing is gained by baking, when the same results can be attained by means of an air drying paint.

2. Air drying finishing paint decreases the cost of construction and repairs.

3. An armature coil or field coil gets plenty of baking when in actual service, and baking in ovens, as ordinarily done, lowers the insulation resistance.

The following experiment shows the actual condition of the paint on a working coil.

Take a strip of sheet iron a few inches long and from ½ to ¾ in. wide. Punch a hole at each end for a ¼ in. stove bolt. Procure a water rheostat or similar resistance, with connections as shown in the accompanying illustration. Cover the piece of tin with the paint which is to be tested, and after it has dried pass current through the tin. Note ammeter readings, and by means of a tube thermometer placed on the tin and covered with waste at the point of contact, note the temperature readings. There is necessarily considerable variation in these readings, but they are sufficiently accurate to show the results desired. Pass a current which will produce 195° F. and keep it as steady as possible for some time. Note that the ideal paint becomes plastic. Shut off current for a time. The paint becomes hard again. This shows the actual working conditions going on in each coil. More paint is used on the sample of tin, of course, than would be used on a coil; hence the coil would not become as soft or spongy. Repeat this experiment many times, and gradually raise the temperature to 240° F. This will classify the paints, and some of the "permanently flexible" paints and varnishes can be discarded.

Plastic paints which show up nicely on cloth, and have the appearance of patent leather, cannot by any process of drying present this same appearance on the interior of a coil. The same is true of clear varnished coils; thus the most desired quality, apparently, is but skin deep.

Quality is not always the winner. Sometimes an insulating paint leads the race merely because of a lower price. Not often will a high grade material win over the less expensive ones, where the master mechanic is not aware of the poor quality of the latter. If the purchasing agent has the authority to place orders overruling the master mechanic, quality is quite likely to be out of the race, because the word of the varnish agent is often taken before that of the head of the department. This is doubtless not a common condition with well regulated concerns, but it does exist. Varnish agents are out to sell, and like other salesmen place their materials where they can; yet their argument, however well worded and strong, will not finally hold unless made good by the material. The agent who knows the qualities of his article from experience and tests, stands a better chance of holding his trade, and is not likely to misrepresent its qualities.

There is something wrong with the materials when a road with half the equipment of another is paying out twice as much for field and armature upkeep, while its running conditions, curves, grades, etc., are no worse; this is in the event that both roads are buying different insulating paints and making their own coils.

It is quite possible to be too economical in the use of insulating paints, and also to make a practice of using more than is necessary. Both extremes should be avoided. Thin the material sufficiently to thoroughly penetrate the coil to its interior and carry some body with it. In coil making, much depends upon the tape and other insulating mediums used, so do not attempt to make the insulating varnish thick enough to answer the purpose of these. Such results will not be satisfactory.

Oily varnish is all right for insulating papers, but a varnish which is entirely satisfactory for this work is not likely to dry when put on coils. Grain alcohol shellac is better, but there have been great advances made over shellac, and by systematic tests the right materials can be obtained.

One man says: "I have been using So-and-so's paints for the last twenty years, and they suit me all right." This argument is all right in a way, but if carried too far is a mistake. So with the users of varnishes; the man who does not recognize some of the good paints made in recent times may be losing money because his coils are not giving satisfaction, or the service which those of his competitors give. It is costly to experiment and test—yes, but in most cases money will be saved in the end.

High puncture tests are a fallacy if not carried on with common sense. Of what use is a high puncture test on fresh material, when in a month or so this same material will have dried out so that the same coils will not stand a test one-half or even one-quarter as severe? Look to the paint for elastic and longer lasting qualities And beware of the man with a formula to sell. He has been successful with many, and is always on the lookout for fresh fields. He has copied his formulas from receipt books printed years ago, and has nothing to offer which represents any advancement in the varnish making art.

Central Electric Light and Power Stations.

The Bureau of the Census of the Department of Commerce and Labor has recently published in book form special reports on central electric light and power stations, 1902, prepared under the supervision of William M. Steuart, chief statistician for manufactures. This report is the third of a series of reports on the generation and utilization of electric current, the first relating to street and electric railways; the second to municipal electric fire alarm and police patrol service; the fourth is now in course of preparation and relates to telephones, telegraphs and ocean cables. The publication includes the scope and method of investigation, summary and analysis of results, financial operations, employes, salaries and wages, physical equipment, output of stations, franchises and a history of the development of electric lighting, including 98 tables and a large number of illustrations.

The Consolidated Railway Co has secured control of the Willimantic Traction Co., which operates an electric railway between Willimantic and Baltic, Conn., a distance of ten miles.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since [illegible] have been published separately by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible] to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, [illegible]. Vol. V [illegible]. Price: Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram, four volumes, $6.50; single volume, $2.00.]

VALID RESTRICTION AS TO REPAIRS IN UNPAVED STREET.

Dunbar vs. Old Colony Street Railway Co. (Mass.), 74 N. E. Rep. 352. May 20, 1905.

The effect of laying tracks in an unpaved street, the supreme judicial court of Massachusetts says, manifestly results in the street outside the rails, and particularly the part immediately next to the rails, being unduly worn down; thus imposing on the town in question an additional burden in the repair of that way. So, likewise, the space between the rails is subject to a different use from an ordinary road or from the rest of such a road. To require the railway to keep that portion of the way "included between the tracks and for a distance of eighteen inches outside thereof at all times flush up to the top of the track" and in repair is, in effect, to restrict the company from so operating its railway under the location as to cast an additional burden upon the town in respect to repairs of the public ways on which the railway is located and operated. It follows that such a restriction as to repairs in an original location is valid although it adds something to the burden imposed by the general laws.

DUTY OF MOTORMAN AS TO SEEING PASSENGERS GETTING ON OR OFF WHERE THERE IS NO CONDUCTOR.

Cramer vs. Springfield Traction Co. (Mo. App.), 87 S. W. Rep. 24. May 2, 1905. Rehearing denied May 16, 1905.

Where there was no conductor on a car to look after passengers and the motorman was required to do double service, the St. Louis court of appeals says that his station was on the front platform of the car, where he was bound to remain for the purpose of using and controlling the appliances for the operation and control of the car; and if, from his station, he made the best observation possible to see that no one was getting on or off the car, and then sounded the gong as notice of his intention to start, the court can see no room to declare, as a matter of law, that he was negligent in failing to see the plaintiff in the act of getting off. It was not his duty, under the circumstances, to specially observe the plaintiff, for she had not communicated to him her intention to get off, but to watch the rear platform, where passengers were accustomed to get on and off, and see that no one was in the act of getting on or off before starting his car.

CARE REQUIRED OF PASSENGER RIDING ON RUNNING BOARD.

Fraser vs. California Street Cable Railroad Co. (Cal.), 81 Pac. Rep. 29. May 9, 1905.

The plaintiff, a young man with some two years' experience in riding on these same cars, taking a standing position on the right hand rear foot or running board just above the ground that the passengers use in getting on and off the cars, holding to the stanchion with one or both hands, was injured by his body coming into collision with the front footboard, otherwise called the dashboard, of a heavy wagon that was standing stationary back into the curb, not exactly square. The supreme court commissioners of California state, in their opinion, that they do not mean to say that it is negligence per se (by itself) for a passenger to ride where the plaintiff rode; but they think that common prudence required that he should while riding there either keep his body well within the lines of the car, or if he was disposed to swing out beyond those lines he should have kept a diligent lookout to avoid coming in contact with other vehicles. It is common knowledge that [illegible] the streets of a city like San Francisco the street [illegible] passing other vehicles even closer than 12 inches and the plaintiff must have known of that fact. The facts and [illegible] to be drawn therefrom were for the jury, and it cannot be said as a matter of law that they were not supported in [illegible] the evidence that the plaintiff's injury was the proximate result of his own negligence.

VALIDITY OF REQUIREMENT AS TO LIGHTING STREET.

Cunningham vs. Boston & Worcester Street Railway Co. (Mass.), 74 N. E. Rep. 355. May 20, 1905.

The restriction in the location in this case as to lights, the supreme judicial court of Massachusetts says, was of the same character as that as to watering in [illegible] vs. Boston & Worcester Street Railway (IV Street Railway Law, 198; 67 N. E. Rep. 42), and that as to repairs in Dunbar vs. Old Colony Street Railway (74 N. E. Rep. 352). Electric cars in a reserved space ordinarily are run at such a rate of speed that it might be thought that a grant of the right to run them makes it necessary to have 100 lights, of 25 candle power each, in the distance of five miles. It is not necessary to consider whether the fact that such lights might be thought necessary for the accommodation of people wishing to take the defendant's cars could be considered by the selectmen in making this requirement. The defendant argued that it was forbidden to use its electricity for lighting purposes by Revised Laws, chapters 121, 122, calling especial attention to sections 24 and 26 of chapter 121, and section 1 of chapter 122. But the court is of the opinion that it is not forbidden to use electricity for lighting as an incident to its business. It may use it to light its cars. And in the court's opinion it may as properly use it to light the streets through which its cars run as to light its cars while running through those streets.

CHILD RUNNING IN FRONT OF CAR—FAILURE TO STOP CAR IN AS SHORT A DISTANCE AS POSSIBLE.

Miller vs. St. Charles Street Railroad Co. (La.), 38 So. Rep. 401 Mar. 13, 1905. Rehearing denied April 10, 1905.

A street railway company, the supreme court of Louisiana holds, will not be held responsible for the death of a child 2½ years old which has suddenly and unexpectedly run upon the track 5 to 10 feet ahead of an electric car moving rapidly through a narrow street. In such a case, the fact that the car was not brought to a full stop within as short a distance as the evidence shows it is possible to bring such a car to a full stop is insignificant, in view of the fact that, even if it had been done, the fatal result would not have been avoided.

STOPPING FOR FUNERAL PROCESSION TO PASS—CARE REQUIRED IN DESCENDING GRADE TO CROSSING—COMPARATIVE WEIGHT OF EVIDENCE AS TO BELL RINGING OR NOT RINGING.

Foulk vs. Wilmington City Railway Co. (Del.), 60 Atl. Rep. 973. June 2, 1905.

The superior court of Delaware, speaking through Lore, C. J. (charging jury), among other things, says: We know of no law requiring a trolley car to stop at the intersection of streets and wait until a funeral procession has passed, nor of any law giving to a funeral procession the right of way over cars or other vehicles or persons properly using a highway of this state. If by courtesy such privilege has been given by trolley cars and by others using the

highway, such courtesy imposes no duty upon the person extending the courtesy, nor does it in any manner relieve such persons from all reasonable care and precaution in so using the highway as to prevent accident or injury. If you should find from the evidence in this case that the uniform and continuous usage or practice of the defendant company had been to stop its cars at crossings and wait until a funeral procession passed by, and that such usage was known to, and reasonably relied upon by, the driver of the injured team at the time of the accident, we say to you that such method of dealing with the public on the part of the company, and so known to the driver, may be taken into account by you in estimating the degree of diligence required of the driver in looking out for an approaching car before he crossed the railway track, for in such case he might reasonably presume to infer the continuance of that usage. To justify such presumption, however, such usage must have been uniform and continuous. Even then the failure to observe such usage would not amount to negligence on the part of the defendant company. It would not relieve the driver of reasonable care in making such crossing. He would have no right so to presume, if he actually saw the car coming down upon him, or if by the reasonable use of his senses he might have known of its approach. It may be stated as a general rule that no legal right can grow out of mere courtesy, however uniform and long continued, nor will such courtesy impose a legal obligation upon the person extending it.

It is conceded in this case that the grade of Fourth street between West and Tatnall streets, is quite a steep down grade to the Tatnall street crossing. While the speed of trolley cars is not limited by law, yet, in approaching such crossing it was the duty of the motorman to make the descent at such reasonable speed as not to put the car beyond his control; and, as the danger of collision increased, if he saw or could see the danger, it was his duty to use all the means in his power to check or stop the car. This does not impose upon the motorman, however, an impossibility. If he in fact did all that he could to control the speed of the car, under the circumstances, the company would not be liable. It was, however, equally the duty of the driver of the injured team to use all reasonable care and precaution to prevent the accident. Both the company and the driver of the team in this case were required to use such reasonable care as the circumstances demanded, an increase of care on the part of both being required when there is an increase of danger.

Some of the witnesses have testified that they heard the car bell ring, coming down the hill; others, that they did not hear it ring. The testimony of the former witnesses is, of course, of more weight than that of those who merely say they did not hear the bell ring, which might reasonably be attributed to a want of attention at the time. Such negative testimony is usually of little value.

CONSTRUCTION OF INTERLOCKING WORKS NOT TO BE DELAYED FOR LITIGATION OVER AWARD—CONSTITUTIONALITY OF LAW—NO INJUNCTION TO PREVENT REMOVAL OF TRACK OF COMPANY IN DEFAULT.

Chicago, Indianapolis & Louisville Railway Co. vs. Indianapolis & Northwestern Traction Co. (Ind.), 74 N. E. Rep. 513. May 23, 1905.

The provisions of the act of 1903, "in relation to the crossings of street railroads, interurban street railroads and railroads," for the construction and maintenance of interlocking works and derailing apparatus, the supreme court of Indiana says, were primarily designed to guard the safety of the traveling public. The act provides in plain and unmistakable language that "the company desiring to cross shall, within six months after it commences to use such crossing, at its own expense, maintain and operate a system of full interlocking works," etc. No intent to postpone performance of this duty to the public until after a final disposition of exceptions to the award of damages is manifest from the language employed, and the court is not warranted in implying any such intent on the part of the legislature. Such a construction would be in opposition to the unambiguous terms of the statute, and for an indefinite length of time defeat its obvious purpose, by subjecting the public to a helpless peril until parties to a private controversy should see fit to conclude their litigation. A summary method of hearing and finally settling all objections to the particular point of crossing chosen is provided. The company desiring to cross is given the option of paying into court the amount of the award, and enjoying the use of the crossing at once, or of awaiting the result of the litigation upon exceptions to such award, before making payment for and taking possession of the rights and privileges to be appropriated. If it elects to deposit the amount of the award with the clerk of the court and enjoy the use of the crossing pending the litigation upon exceptions, it must also respect the rights of the public, and make such provisions for their safety during such use as the law requires.

Again, the court says that the general assembly had undoubted authority to require such interlocking works at the crossings of railroads as would protect the safety of the public. If the traction company had furnished such interlocking apparatus as was reasonably calculated to prevent collisions at the crossing in question, and appeared fairly adequate to accomplish the object and purpose of the law, it might then in a proper case raise the constitutional question as to whether or not such apparatus must also meet and pass the approval of the auditor of state. But in this collateral proceeding (brought to prevent the threatened removal of its track from the railway company's right of way), in which the state was not represented, and while the traction company was wholly in default, that constitutional question must be regarded in the nature of a moot question, which this court would not consider. This statute does not make the traction company's failure to furnish interlocking works punishable as a crime, but its default in that respect did authorize the railway company to do the acts which the traction company sought to prevent by injunction. The facts which it in its complaint admitted to be true prohibited a court of equity from granting the aid which it sought. It followed that it was error to overrule the railway company's motion to dissolve the temporary restraining order issued.

WIFE FOR WHOM HUSBAND PAYS FARE A PASSENGER ENTITLED TO TRANSFER — WHO "AGGRIEVED PARTY."

Section 104 of the New York railway law provides: "Every such corporation shall, upon demand and without extra charge, give to each passenger paying one single fare, a transfer entitling such passenger to one continuous trip to any point or portion of any railroad embraced in such contract. * * * For every refusal to comply with the requirements of this section the corporation so refusing shall forfeit fifty dollars to the aggrieved party." The fare of the plaintiff was paid by her husband, and the point was raised that she was not a passenger paying a fare within the language of this section, nor was she in any wise an "aggrieved party" entitling her to maintain an action against the defendant for the recovery of $50 as therein prescribed. But, taking the latter question first, the appellate term of the supreme court of New York holds that the "aggrieved party" within the meaning of the act has reference to the passenger" previously described in the same section.

It is obvious, the court says, that it was wholly immaterial whether plaintiff paid her fare personally or through her husband. The payment of the fare constituted her a passenger. Being a passenger under section 104, she was entitled, as such passenger, "without extra charge," to a "transfer entitling" her "to one continuous trip to any point or portion of any railroad embraced in the contract" or leases under which it was conceded the defendant was operating both lines of cars in question.

Again, the defendant argued that the words, "each passenger paying one single fare," in the act, forbade the plaintiff in this case from maintaining this action. Such a construction, the court, however, says, would be a forced and narrow one, and not justified by the context. As matter of fact, the plaintiff did pay her fare, through her husband. The payment of the fare by the husband was either as the plaintiff's agent or a gift. In the former case she would, by the strictest interpretation of the act, be the person who paid the fare. If a gift, then the delivery of her fare to the defendant and her acceptance by the defendant as a passenger made the gift to her complete, so as to entitle her to all the benefits and advantages of a passenger under the act as though her husband had given her five cents with which to pay her fare, and she had personally handed that sum over to the conductor as fare.

LIABILITY FOR CONDUCTOR FALLING UPON PASSENGER — COMPANY CANNOT BE REQUIRED TO DIVULGE CONTENTS OF REPORT.

Spinney vs. Boston Elevated Railway Co. (Mass.), 73 N. E. Rep. 1021. Apr. 7, 1905.

The supreme judicial court of Massachusetts holds erroneous instructions which tended to induce the jury to believe that, even if they found that the plaintiff was hurt by the negligence of the conductor in carelessly allowing himself to be thrown against her, the defendant was not answerable unless it knew or had reason to know that he was incompetent. It says that correct and sufficient instructions as to the responsibility of the defendant for the conductor's acts had been given to the jury by the presiding judge. After stating the conflicting evidence upon the point, he said: "If the conductor's conduct was negligent and unfit for the duties of his position, resulting in the plaintiff's harm, then that is negligence for which the defendant company would be responsible. But if he did on that occasion what is reasonable to expect—if, while he was standing collecting fares at the other end of the car, this sudden jerk or jolt came, and he was thrown beyond his personal power to prevent it, and he managed his person and his steps and his plunge (if he made a plunge) as well as he could, as well as was reasonable to expect under circumstances of that character—then the company would not be liable * * * on account of his personal conduct." The movements and acts of the conductor in their bearing upon the safety of the plaintiff as a passenger were, the court goes on to say, as between her and the defendant, acts concerning their undertaking with her to use the proper degree of care in all respects to carry her safely. So to speak, his conduct in the car was official conduct, as it regarded a passenger, and could not be looked at in a light merely personal to himself. If it was in any respect wanting in due care, and that negligence caused injury to the plaintiff's person, it was negligence for which the defendant was answerable, whether the conductor was competent or incompetent, and whether or not the company might reasonably have known his incompetency.

By filing interrogatories to the president of the defendant corporation it was sought to compel the defendant to disclose the contents of a certain report of the accident signed by the conductor and the motorman of the car, containing an account of the accident and the names of persons who were present. But the court holds that this could not be done on account of the provision of section 63 of chapter 173 of the revised laws of Massachusetts that "the party interrogated shall not be obliged * * * to disclose the names of the witnesses by whom, or that the manner in which he proposes to prove his own case." It says that it seems to it that to have compelled the defendant to file the report or to allow an examination of it by the plaintiff's attorneys, or to have compelled the defendant of have disclosed the account of the accident given in the report, or the statements given in it of the names and addresses of the persons who witnessed the accident, would practically have been to compel the defendant to get up the plaintiff's own case, and practically to compel the defendant to disclose the names of the persons by whom and the manner in which it proposed to prove its own case. Indeed, the argument of the plaintiff was that knowledge on the part of her attorneys of the names of the motorman and the conductor and of the other persons who witnessed the accident would have helped in the preparation of her case. The court does not think the defendant could have been compelled properly to give her that information.

DUTY TOWARD TRESPASSERS, ESPECIALLY THOSE OF TENDER YEARS, AND TO PROVIDE COMPETENT MOTORMEN AND SERVANTS—LIABILITY FOR FRIGHTENING TRESPASSING CHILD INTO JUMPING FROM MOVING CAR, CAUSING INJURY.

Goldstein vs. People's Railway Co. (Del.), 60 Atl. Rep. 975. Feb. 20, 1905.

A railway company is not required, the superior court of Delaware holds, to anticipate the presence of children on its cars who may not come on as passengers or by invitation, and the company is not an insurer of the safety of infant trespassers. If a child of tender years gets upon the platform or step of a car while standing, or when a [illegible] of the company [illegible] in the management of the car [illegible] jumps off or [illegible] injured, without [illegible] of the company [illegible]

Street railway companies, as towards trespassers or mere licensees, must exercise such care and diligence as a reasonably prudent man would ordinarily use under similar circumstances and conditions, and which it would be gross negligence and carelessness not to use. It is not so high a degree of care and diligence as the company would be required to use for the protection of persons lawfully and rightfully on its cars. It is not such care and diligence as make it necessary for a railway company to so guard its cars as to prevent a trespassing child from getting off or on while in motion; neither is it such care and diligence as would interfere with the usual and ordinary running of its cars, or in the proper and faithful discharge by the servants of the company of their duties in operating the cars, but only such as would be reasonable and proper under all the circumstances and conditions surrounding the case at the particular time.

It is the duty of a railway company, in operating its cars, to provide competent and careful motormen and servants, and a disregard of this duty would constitute negligence on the part of the company; and, if a servant of the company discover an infant upon his car, he should exercise such care and caution for the safety and protection of the infant as would be reasonable under all the circumstances, considering the age and maturity of the infant and his capacity to comprehend and appreciate the danger of his surroundings. And the jury were told that if they found, from the evidence, that the servants of the defendant saw the boy fatally injured in this case in a perilous position on the car before the accident, and could have prevented the accident, but made no effort to do so, then there was such a lack of care as would constitute gross negligence; and even though he was not actually seen by the servants of the company, yet if he and they were so situated as that he might have been seen, and must have been seen, if they had used proper care under the circumstances, there was such a want of care and diligence as would amount to gross negligence. If the jury found that the motorman of the defendant saw the boy in a dangerous position upon the front platform of the car while it was in motion, and that he was then an infant of about the age of five years, and that by an order or threat of the said motorman he was frightened to such an extent as to cause him to jump or fall from the said car while it was in motion, and that the accident and injury to him was caused thereby, the defendant would be liable.

POWER TO LIMIT TERM OF FRANCHISE—CONSOLIDATION AND FORMATION OF SYSTEM DOES NOT MAKE FRANCHISES CO-DETERMINATE—TERMINATION OF RIGHT TO OPERATE LINE RELIEVES OF TRANSFER DUTY—CLEARNESS REQUIRED TO CONFER RIGHTS—FRANCHISE OF SYSTEM NOT EXTENDED BY GRANT FOR EXTENSION OF LINE.

Cleveland Electric Railway Co. vs. City of Cleveland (U. S. C. C., Ohio), 137 Fed. Rep. 111. Apr. 24, 1905.

The legislature of Ohio having, prior to the act of May 14, 1878, given to municipal councils the general power to consent to the use of their streets by street railroads, and to prescribe the terms and conditions of such use, the United States circuit court, in Ohio, holds that the council of the city of Cleveland had full power to limit the term of a street railroad's franchise to occupy the streets, although prior to the law of 1878 the legislature had not undertaken to use the authority which it possessed to put any limit upon the time which might be granted by a municipal corporation to the right of a street railroad company to occupy streets.

The argument was advanced that by reason of the consolidation of companies, and the creation of a "system" over which there was a right to ride for one fare for a continuous passage, however long, with certain transfer rights, the system must be considered as a unit, with a period of expiration fixed at the date of the last expiring franchise. But as to the effect of the consolidation and the creation of a system, the court says that it is not at all impressed with the force of this claim. Of course, there are many and obvious

advantages in the development of a system. Unity of management and of fares, as well as unity of responsibility, is a thing much to be desired; and the proposition that, on that account, renewals of franchises might come by implication, would be more plausible if it were not for the consequences which would manifestly follow. It is true that with a system, in so far as it is essential that all of its constituent parts should be unified, the right to operate it and all of its parts ought to be co-determinate; but two observations conclusively answer the contention of the complainant: First, that, if there is any control over the life of the system and of its parts, it is the life of the system which must control the life of its parts, not the part the system; second, it is far from the truth that, physically or practically or legally, any one part of the system is essential to the operation and life of the system.

The council could not have intended, by requiring the complainant to transfer passengers to its Garden street line, that such transfers be made by the complainant when the complainant had no Garden street line; and, if it had so intended and had so declared, it would have been invalid. To assume that the city could terminate the right to operate the Garden street line, and make it impossible for the complainant to transfer passengers at the intersection, and then hold the complainant responsible for not transferring them, is to assume an impossibility.

The public cannot be held to have parted with its fundamental rights, except by clear and explicit language, or by implication equally clear.

If it be true that to grant the right to build an extension, and permit its operation as such, in connection with the system of which it forms a part, for a period beyond the duration of the system's franchise, is to extend to that date the franchise of the system, then we must conclude that the council may give away the public's property and the rights of the community, without knowing that it is doing so, and while striving not to do so.

THE SUPREME COURT OF THE UNITED STATES ON THE CONSTITUTIONALITY OF A TAXATION OF SPECIAL FRANCHISES.

People of the State of New York ex rel. Metropolitan Street Railway Co. vs. State Board of Tax Commissioners (U. S., N. Y.), 25 S. C. Rep. 705. May 29, 1905.

The supreme court of the United States says that the main contention in this case was that the tax legislation in question with regard to the taxation of franchises impaired the obligation of contracts. It must be borne in mind that presumptively all property within the territorial limits of a state is subject to its taxing power. Whoever insists that any particular property is not so subject has the burden of proof, and must make it entirely clear that, by contract or otherwise, the property is beyond its reach. This rule is akin to, if not part of, the broad proposition, now universally accepted, that in grants from the public nothing passes by implication.

All that could be extracted from the language used in the contracts involved in this case was a grant of privileges and a payment therefor. It would not be doubted that, if a grant was of specific tangible property, like a tract of land, and the payment therefor was a gross sum, no implication of an exemption from taxation would arise. Whether the amount paid was large or small, greater or less than the real value, if the payment was distinctly the consideration of a grant, that which was granted would pass into the bulk of private property, and, like all other such property, be subject to taxation. Nor would this result be altered by the fact that the payment for the thing granted was to be made annually instead of in a single sum in gross. If it was real estate it would be equivalent to the conveyance of the tract subject to ground rent, and the grantee taking the title would hold it liable to taxation upon its value. If this be true in reference to a grant of tangible property, it is equally true in respect to a grant of a franchise, for a franchise, though intangible, is none the less property, and oftentimes property of great value. Indeed, growing out of the conditions of modern business, a large proportion of valuable property is to be found in intangible things like franchises.

Nor does the court agree with the contention that when the public grants a privilege on condition of the payment of an annual sum the contract implies that the public shall exact no larger amount for that privilege, that to impose a tax is simply increasing the price which the grantee is called upon to pay for the privilege.

It was contended that there had been a recognition and practical construction in respect to the grants of these franchises, and on these grounds: First, no attempt had been made to legislate in respect to their taxation until 1899, although some of them had been in existence for many years; second, Governor Cleveland, in one of his messages, called the amount required to be paid by the contract a tax, and Governor Roosevelt also spoke of existing "taxes;" third, section 46 of the legislation authorizing the tax upon these franchises provided that "any sum based upon a percentage of gross earnings, or any other income, or any license fee, or any sum of money on account of such special franchise, granted to or possessed by such person, copartnership, association, or corporation, which payment was in the nature of a tax, all amounts so paid for the exclusive use of such city, town, or village, except money paid or expended for paving or repairing of pavement of any street, highway, or public place, shall be deducted from any tax based on the assessment made by the state board of tax commissioners for city, town, or village purposes, but not otherwise; and the remainder shall be the tax on such special franchise payable for city, town, or village purposes;" fourth, the court of appeals of New York in Heewagen v. Crosstown Street R. Co., 179 N. Y. 99, 104, said: "In the first place, both in statutes and in judicial decisions, the term 'tax' is frequently used in a much more comprehensive sense than that which we have stated to be its accurate meaning. It is not used so broadly as to include the revenue from private property which the state or one of its political divisions may hold for emolument, the same as other owners; but it certainly is used to comprehend exactions for the privilege of exercising franchise rights, which latter are often, especially in the case of foreign corporations, merely the consideration received for privileges which the state is at liberty to grant or to withhold at pleasure."

The supreme court says that it is not disposed to undervalue the force of these suggestions, but it would be giving them undue significance to hold that they were potent to displace the power of the state to subject to the burden of taxation property within its limits. In short, the court is of the opinion that no contract right of the street railway company was impaired by the legislation in question.

It was further insisted, however, that the special franchise tax law denied the company the equal protection of the laws and due process in three separate and distinct aspects, namely: (1) In that it added to the obligations of their various contracts while preserving all of the burdens of those contracts; (2) in that it provided for the deduction of annual payments covered by existing contracts from the amount of tax levied, by reason of which deduction those who agreed to pay for their franchises lump sums or annual amounts less than the new tax were discriminated against; and (3) in that it discriminated against them and subjected them to taxation, while their competitors, operating under the surfaces of many of the same streets, were to be exempted.

The first specification the supreme court says was answered by the conclusion reached in respect to the claim of an impairment of contract obligations; for if there was no such impairment, the fact that the companies had escaped the burden for these many years was their good fortune, and in no manner discharged them from the ordinary burdens of taxation which the present law imposes.

With respect to the second specification, it might be observed that the lump sum was so obviously a payment for the franchise that it could not be considered in any just sense as possessing the nature of a tax. Further, this whole matter of allowing a reduction on account of that which is spoken of as "in the nature of a tax," is a matter of grace on the part of the legislature. The franchises granted were subject to taxation, and the fact that, upon equitable considerations, the state had consented that a certain reduction should, in some cases, be made, did not entitle every holder of a franchise to a like reduction. It was akin to an exemption, and there is nothing in the federal constitution to prevent a state from granting exemptions from taxation.

With regard to the third contention, it may be said that there is a difference between surface and subsurface street railroad sufficient to justify a diversity in the mode and extent of taxation.

Piping and Power Station Systems.—X.*

BY WILLIAM L. MORRIS, M. E.

OIL PURIFYING SYSTEMS

The filters shown in Fig. 60 are in the path of the return drips to tank B and C. If the beds in these filters are close laid and suitable for effective filtration, then in case of flooding journals, the filter will be flooded and overflow onto the floor. Anyone contemplating the use of filters in a return system must provide for a flow through them somewhat greater than the maximum flow fed to the engines. It is safe to estimate that this flow will equal the greatest capacity of the pipe lines which supply the cups. In designing station work it is useless to design for only that which is essential. If one part of the oiling system is designed to deliver four barrels of oil an hour to the bearings, then the return part of the system should have a like capacity. In station operation it is not an uncommon thing to see an operator drag a hole through the filtering material, "so the oil can get through," as he will say. Usually this is the only practical thing to do.

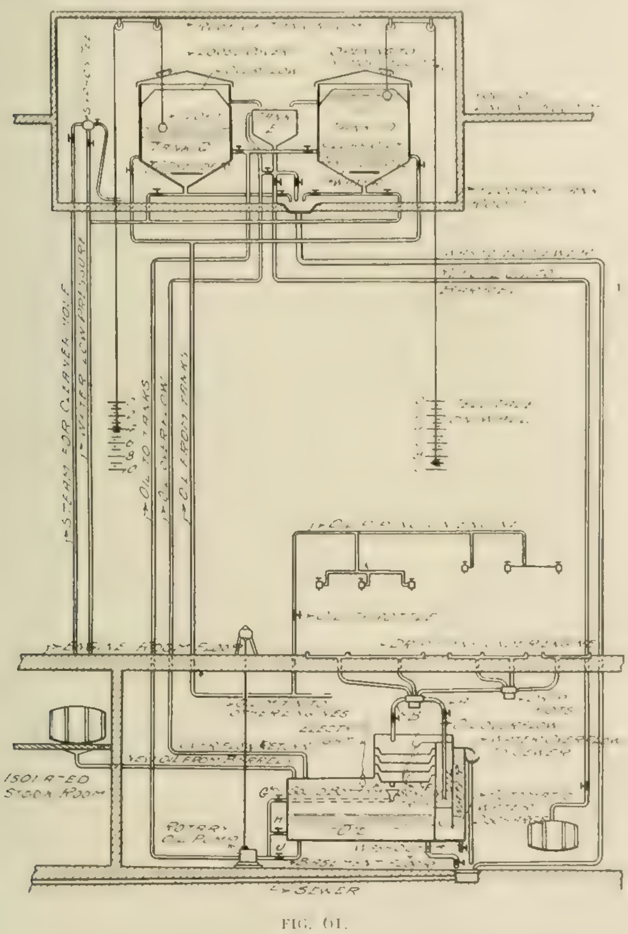


FIG. 61.

In oil cleansing apparatus using filtering material, a satisfactory design is to enclose this material in a receptacle similar to a galvanized iron tub. This tank or tub should have a perforated bottom and a perforated plate laid on top to retain the filtering material. In case the filtering material is 6 in. deep and the sides of the tub are 18 in. high, then if these 12 in. of oil pressure on top the filtering material are not enough to force the oil through it can spill over the edges of the tub into a tank in which the tub should be set. This may seem to be a crude method, but it is far more effective than to attempt to force oil under a high head through [illegible] higher pressure washes the previously strained impurities through the filtering material and back into the oil mains. Such is not the case with the "tub" plan. The tub filter will remove whatever impurities it can and the others will flow over the sides with the oil and be [illegible]

The additional [illegible]

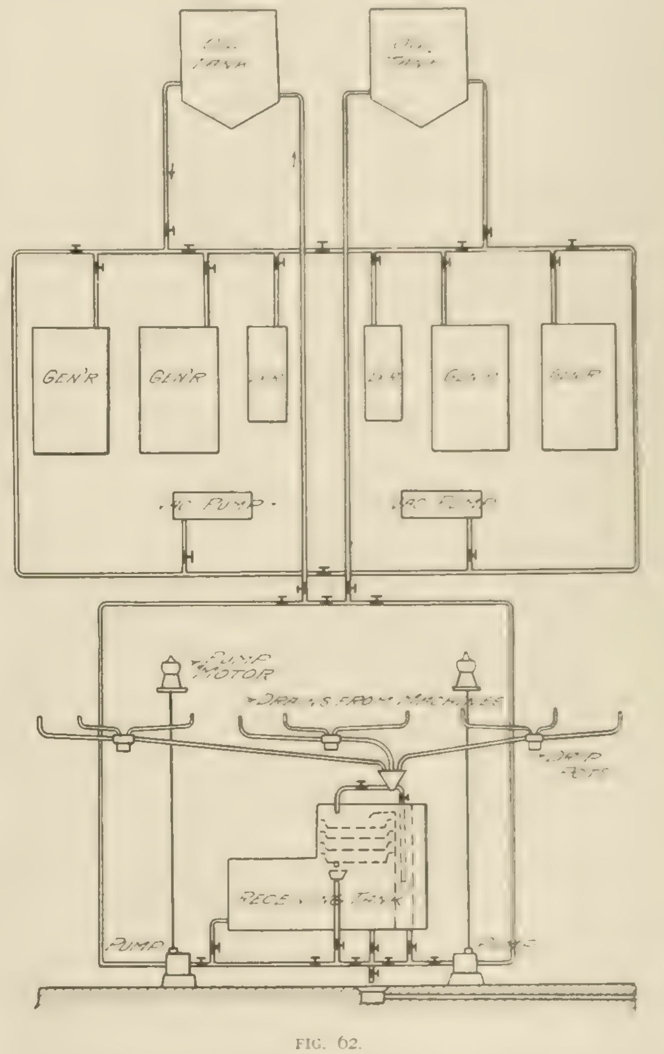


FIG. 62.

strated by a simple test. If two sample bottles of oil are taken, one drawn immediately after it has passed through the filter, and the other taken before being filtered, the latter first having been passed through a fine "milk strainer" wire sieve to remove foreign bodies, such as lint, scale, etc., then let these bottles stand undisturbed for a week's time. Examine them closely and note the marked amount of clarifying that has taken place as a result of precipitation. The observer need not be surprised if he cannot tell which of the two samples of oil is the clearer. He should note carefully the results of precipitation, observing the large amount of separation that has taken place while in the meantime he has been trying to get equal results from the filter. If a bottle of oil can, in this manner, be so thoroughly purified, why not subject all the lubricating oil to this same treatment?

To accomplish this successfully it will be necessary to take part of the oil out of circulation and allow it to remain quiet while precipitating. Means must be provided for drawing off the clear oil for use in the system and for leading into an empty barrel the heavy, fatty oil lying between the clear oil and the water. The piping should be arranged so that the water can be run from the precipitation tank to the sewer and the tank thoroughly cleaned. After cleaning, the tank can be filled with clear oil and the valves closed. Then the "batch" of oil that has in the meantime been serving the machinery, can be subjected to the same process of precipitation with like results. The heavy, fatty oil which forms in a layer in the precipitating tank is wholly unfit for lubricating purposes, but can possibly be made use of elsewhere. Ordinarily much of this heavy, fatty oil is lost in cleaning out the closed tank.

An oil supply system using precipitating tanks is shown in Fig. 61. The two precipitating tanks are alternately used, one as a

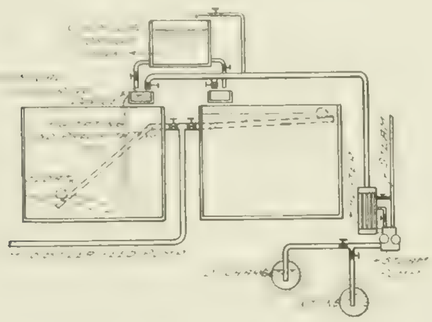


FIG. 63.

gravity tank, and the other as a precipitating tank. From the pans under the engines the drips are separately carried to drip pots. The lower part of this type of drip pot is held against the upper portion by a stud bolt passing through the center of the top. The joints between the two sections should be ground and no gaskets used. The purpose of these drip pots is to catch such heavy precipitation as would lodge and choke the pipes. These pots also take the place of T's and the angles are turned with bends in place of L's. With this construction there are no corners or edges around which the drips must pass on their way to the pot and therefore little chance for clogging. The common practice of using crosses and plugs also increases the liability for clogging. The bent pipe avoids these obstructing edges and corners and furnishes a pipe line that can readily be cleaned with a wire, from the inlet all the way through to the drip pot.

There are two discharges into the receiving tank; A is the regular inlet and B the special connection to be used when the automatic water discharge is being cleaned. The oil drips are conducted to a point low down in the water separator and the cross discharge pipe is perforated, with the openings looking down. The water overflow is located 2 in. lower than the oil overflow. This allows 20 in. of oil over the water in the separator. The three upper trays shown in Fig. 61 are provided with screen wire bottoms. The lower screen tray has a brass wire gauze of very fine mesh. These trays are arranged with the screens graded from coarse at the top to the very fine mesh at the bottom so that each removes its particular size of impurities. If the top one becomes blocked the oil will then run over the edges and be strained in a lower one. The bottom tray has but one opening. This is located over the funnel leading to the oil pump suction. The tank in which these trays are placed should be provided with doors in its sides to facilitate the removal of the trays for cleaning. In this way the trays can be cleaned, one at a time, during regular operation. The trays should be set back sufficiently far from the cleaning door to enable an operator to inspect the bottom of the tank without disturbing the position of the trays. To aid inspection an electric light should be placed inside the tank as shown in the figure. The edge of the water overflow must be long, say 18 in. or more, to avoid building up a head on this edge when discharging a large volume of water as would be the case when the drips were being flushed with hot water. To care for a flow of three or four barrels of oil an hour, the overflow edge between the separator and the tank should be not less than 12 in. long.

A small pump is shown with its direct connected motor of the slow speed type placed above the pump on the engine room floor. This pump should be of the slow speed rotary type so that it will cause the least amount of agitation and frothing of the oil. Telltales are shown connected to the tanks overhead and in view from the engine room. The elevated tanks should have light, loose covers the full size of the top of the tank with suitable openings in these covers for the removal of the telltale floats during that time when the tanks are being cleaned. Around the tops of these tanks, on the inside, there should be overflow rings with the overflow levels about 4 in. below the upper edges of the tank shells. In the figure, tank C is shown in use as a gravity tank and D as a precipitating tank. Tank E would be of small capacity, not over half a barrel; this tank is used in connection of the overflowing of the large tanks after precipitation. A water connection is run to the under side of the tanks. By this means the contents of the precipitating tanks can be raised as gradually as desired. A perforated disk is placed

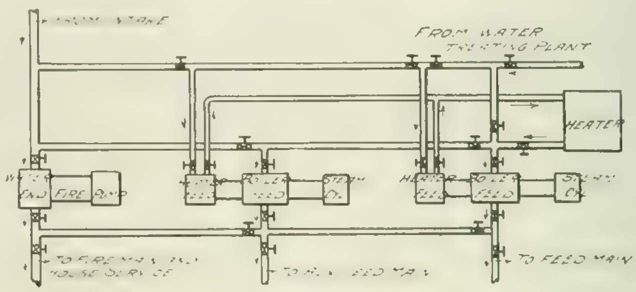


FIG. 64

in the bottom of the tank to dissipate the flow of the incoming water and thus avoid disturbing the precipitate.

Previous to the withdrawing of the clear oil from a precipitated tank, the drip lines and receiving tank should have been well cleaned out, and the clear oil thrown into tank C, the suction at the bottom of the receiving tank being opened to remove all deposits. For illustrative purposes tank C will then be considered as furnishing clear oil to the bearings. The suction to the receiving tank would next be closed and oil would be drawn from the lower tight bottom tray F through suction G, closing suctions H and J. The pressure of the pumps will keep the dirty oil out of the receiving tank and allow the clean oil from the precipitating tank to run into the receiving tank. Thus the precipitating tank will be made ready to receive the clear oil back again. The suction of the pump is then changed from G to H and the discharge is reversed from tank C to tank D, and as soon as oil is over the opening, the oil main discharge of tank C is closed and D is opened. By this cycle of operations the system has been cleaned and tank C is now out of service, full of oil and ready to remain undisturbed while the impurities precipitate. Funnels are placed under the tank washouts to enable inspection while drawing off water and to avoid losing oil. Steam is carried up to the gravity tank to be united with water for cleaning purposes. The size of tank E is such that it will hold the refuse oil, thus giving the attendant an opportunity to draw off this oil from the precipitating tank before going to the basement to arrange for the discharge of this refuse into a storage barrel.

The operation of this system is continuous and if the pump is run all the time there will be no occasion for watching any portion of the system. Even though the pump be shut down, the telltale would show plainly at all times and the pump motor starting box would be convenient for starting or stopping the motor at any time. The pump should be located below the oil tank so that its suction will always be filled with oil. The gravity tank can be filled only to one height. At this level the oil will overflow into tank E. When the latter tank is filled it will overflow and the excess oil be returned to the receiving tank. There should be no valves in the return overflow.

This system covers the requirements very thoroughly, the only additional precaution that might be advisable would be to place a small steam pump or another duplicate motor driven pump in this system. The additional pump would serve as a reserve and permit repairs to the regular motor driven pump while the oiling system

was in regular operation. The precipitating tanks would be of sufficient size to hold enough oil to run the plant possibly three or four hours.

In Fig. 62 a more detailed system is shown for the arrangement of lines essential to continued operation. It will be noted that two pumps are shown. In fact it is not possible to lay out a systematic plan for continued operation having but one machine for any particular service. One of these pumps could be steam driven and answer all demands except convenience of operation; a small steam pump is generally a nuisance as the cylinders become filled with condensation, the packings at the rods are constantly leaking, and due to the fact that the pumps should be placed below the receiving tank this ordinarily locates the little pump in the dark out of the way place so that it gets little inspection and thus a

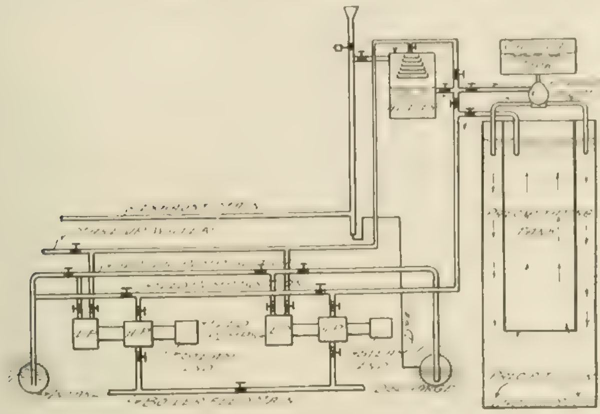


FIG. 65.

close watch must be kept of the telltale to be sure that the pump is running properly. With a rotary pump in the basement at the tank and the motor on the engine room floor it is very evident what the pump is doing.

Fig. 62 shows the drips of each unit, collected and run separately to a funnel on the receiving tank. This is the most reliable method as it is thus quite possible to clean all the pipes of an engine while out of service or to take down any one of them without interfering with the operation of the other drips. The loop system for drips is not practical since the drips require a fall to aid in keeping the pipes clean. An oiling system is a class of service that is difficult to systematize and it is a service that may block up and give trouble at almost any time. The lines should all be as free from valves and fittings as is possible.

Perhaps a better detail for a long drip main could be made by using a heavy galvanized iron open top gutter well supported and being covered with sectional lipped covers. This gutter could be cleaned out readily while the plant was in operation and by having separate connections to the tanks it would be possible to quickly throw out the tank in use and use the precipitating tank, possibly drawing off the precipitated water before doing so. There is no serious objection, on a score of continued operation, to the using of but one receiving tank, because there are two separate compartments in the tank with separate discharges into each and separate suctions. With the system shown in Fig. 62 it is possible while changing over the precipitating tank to run one pump on the bottom tray, delivering back to the tank that has been in use, and use the other pump to raise clear oil from the receiving tank back into the clean gravity tank, both pumps being run during this period. In fact, there are too many advantages in the use of two oil pumps to endeavor to run but one and the cost is too slight to call for a different mode of operation. If it is found necessary at any time to stop the pumps for a considerable period, this condition may find the plant running short handed and cause much disorganization among the operators. This is one of the chief objects to keep in mind in designing systematic station layouts—that is, to arrange the details so that it will be possible to make repairs at any time and not interfere with the regular work and hours of labor as assigned to the station help.

Water Treating Plants.

There is another class of station piping systems that as yet has not been considered; this is the system of water treating plants. There are virtually three styles of water treating systems: the intermittent open, the continuous open, and the closed continuous system. These systems will not be discussed in detail except in regard to their piping. The open systems are very large and are customarily placed outside of the power plant proper. The pressure system is ordinarily placed indoors and conveniently close to pumps, heater, etc. The open systems are operated with cold or warm water; the higher the temperature of the water the more quickly will the chemical reaction take place. The advocates of cold water feeding systems argue that a station may not at all times be able to furnish warm water, therefore the treatment plan should meet this condition. And also, if a plant has capacity for part of the time with cold water, it can always be operated at this or a greater capacity; hence it is not necessary to heat water any of the time.

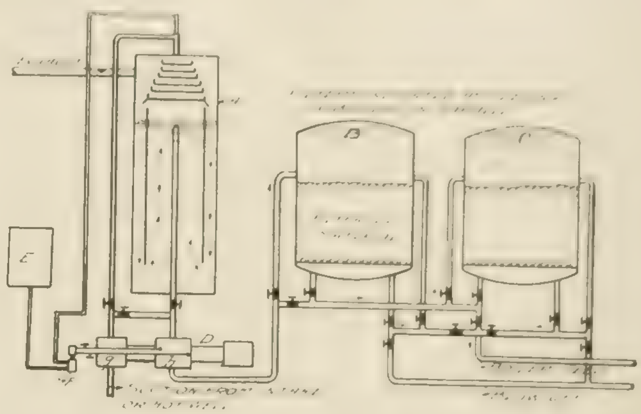


FIG. 66.

The open systems require elevating water to the upper mixing tanks, from where it flows by gravity through the different stages until it reaches the settling tank. In all the water treatment systems the boiler feed is drawn off close to the upper surface, since the lower water is in the path of the descending precipitates.

The builders of water treating plants are willing to use steam from a steam pump that handles the water for treating service because steam is always available from this source while the treating plant is in operation. In case condenser discharge water is customarily used and the size of the treating plant has been determined with regard to the temperature of this water, if at any time the condensers were not in operation, then means would be required to raise incoming cold water to the same or higher temperature. The higher temperature required is on account of the fact that the engines would use more steam and thus the boilers need more treated water when the plant was running non-condensing. As the demand for water increases beyond the capacity of the tanks, it is necessary to increase this capacity by raising the temperature of the water, and for every given temperature of water there is for the same water a given ultimate capacity. If it were possible to raise the temperature of the water to that of steam by the means of an open live steam heater, the reaction would be very quick; in fact, the high temperature alone, without chemical reagents, will precipitate the carbonates and sulphates of lime and magnesia if allowed sufficient time and if ample surface exposure is provided for liberating the gas that holds the impurities in solution.

An open intermittent system is shown in Fig. 63. This arrangement requires a greater amount of room and possibly a little more attention than the others, but it possesses points of merit that cannot otherwise be obtained. A predetermined amount of chemical is run from the upper tank into a tank full of water, then thoroughly agitated, then left entirely alone and undisturbed while precipitation takes place.

The success of chemical treatment is dependent upon two conditions, absolute proportioning of chemicals and water throughout the entire mass, and perfect precipitation. The continuous treatment requires constant measuring of chemicals and water and also a constant flow of water during the time precipitation is taking place. It will be noted in Fig. 63 that the exhaust from the steam pump is run to a closed heater, and a live steam connection is also provided, which may be used in case of an increased demand for water, but it should be remembered that too small a plant will increase the

[illegible] steam. If ground space is extremely valuable, the high type of continuous system will be a more suitable arrangement. Should there be no space available outside of the plant, then the pressure system will show to an advantage.

The piping plan for the intermittent open systems should be similar to that shown in Fig. 64 in case it is to be applied to the power station plans previously considered, and shown in Fig. 19. If an intermittent open system is used, it would be advisable to install the open heater as shown in Fig. 64.

As in the case of continuous systems, if the water were running constantly through the treating plant the exhaust heater could be differently placed, as shown in Fig. 65; then all the atmospheric steam would be used to heat the water, say to 160° or 170° before passing the water through the chemical treatment. By this arrangement the low pressure pump attached to the feed pump would deliver water into the heater and the heater would overflow into the treating plant. The boiler feed pump would then take the treated water by suction. This arrangement of piping supplies a by-pass around the heater and another around the treating plant. The treating plant piping should be as simple as possible; this plant is merely to improve the efficiency of the station, and in case of repair may be shut down at any time.

The mixer shown is operated generally by the flow or weight of the incoming water; it operates on the plan that 10 lb. of water will pump or otherwise discharge into the incoming water one ounce of liquid chemical, or such other volume as the device is set for. The pressure chemical treating plants are evidently all designed with the single idea of "compactness," and since this is their excuse for existence, it may also be called their advantage.

Figure 66 shows a [illegible] system. The [illegible] heater A is arranged with the precipitating chamber a part of and beneath it. B and C are the filters. D is the pump with a double water end, one cylinder g arranged to pump water up into the heater, the other cylinder h designed to pump through the filters to the boilers. The tank E is for diluted chemicals which are pumped by the chemical pump F. Instead of driving the cylinder of pump F by an ordinary steam cylinder, the cylinder is arranged with no valve, but having a hole under each end and a pipe run from each hole to the proper end of the boiler feed pump cylinders. Thus the little chemical pump is operated by and in unison with the feed pump, feeding one cylinder of chemical compound to one of feed water.

The regular operation of the filters is to feed through the top of the tanks and discharge from the bottom to the feed main. The filters may be run in series or in parallel. When cleaning a filter, the feed main connection is closed, as are the heater or small pump connections; the blow-offs are to exhaust across the top of the filter bed, underneath, and up through the filter bed. Filters are used for this system because tanks of their size would be too small to allow water to come to a state of rest and permit the impurities to precipitate. For this same reason filters are also necessary for an open intermittent or continuous system, if ample time for precipitation is not to be had.

There are some interesting details in connection with the different systems previously shown. These will be considered in the same order as the diagrams. There are various minor systems that will not be further considered except in connection with later detail work. It would be useless to endeavor to plan diagrams that could be used as model layouts and suitable for duplication in regular work. No two engineers have even similar ideas in regard to a general layout of station requirements; in fact, no engineer would duplicate his own previous work. It is only by planning and executing that which is not right that we learn what to evade on other work, and each evasion of previous difficulties only brings us in contact with new ones. The chief object in showing these various systems and diagrams has been to illustrate what not to do rather than what to do. There is a great laxity in the methods employed in laying out station work in general, and if these diagrams suggest a method of securing a more perfect system this article will have accomplished all that is anticipated for it.

(To be continued.)

The Austin (Texas) Electric Railway Co. has recently distributed among its patrons, neat leather cases or purses for ticket books. With each case is a neat celluloid calendar for the years 1905 and 1906.

Double Tracking in Battle Creek, Mich.

To facilitate the handling of increased traffic between Potsomville and Monument Square in Battle Creek, Mich., some two years ago the Michigan Traction Co. double-tracked its line between these points, 70-lb. T-rails being used in the construction. About the same time, the company also double-tracked its Lake Ave. line to Goguac Lake, a resort some two miles from the heart of Battle Creek. Last May, the company began double-tracking its lines in Battle Creek and at this time has completed four miles of double-track in this part of the city. All of the work this season has been done in the paved district.

The track is built entirely of 7-in. 70-lb. T-rails, the special track work being of the hard-center type and furnished by the Lorain Steel Co. and the Paige Iron Works. The rails are laid on 6 x 8-in. x 8-ft. white oak ties, placed two feet center to center, and well ballasted with gravel and filled to within 11 in. of the surface of the pavement. All joints are suspended and under the ties where the rails are joined, an excavation was made to depth of at least 8 in. and filled with concrete, as shown in the accompanying illustration. The same construction was followed under the ties at all special track work. A 6-in. layer of concrete was laid on the tie, then a 1-in. cushion of sand and on the top of this layer of Nelsonville paving blocks. The groove or flangeway was formed by the use of the Nelsonville filler block and stretcher block. This construction provides an easy slope so that vehicles may be able to get

VIEW OF TRACK CONSTRUCTION

off the track without damage to their wheels and also throws the bearing of the wheel squarely on the center of the base and forms a groove which is self cleaning and does not wear the wheel flanges. The track was bonded with two Chase-Shawmut No. 0000 soldered rail bonds under the plates at each joint.

Mr. A. L. Marhoff, chief engineer of the company, had charge of the entire work of double-tracking and we are indebted to him for the information and the accompanying illustration.

Annual Meeting of Colorado Association.

The third annual meeting of the Colorado Electric Light, Power & Railway Association was held at Glenwood Springs, Colo., September 18th, 19th and 20th, and was attended by a large number of the members. The papers read before the association and the discussions following were very interesting, particularly, from the standpoint of the smaller central station manager. The membership of the association comprises about 50 per cent of the electric light, power and railway companies, operating in the state of Colorado, all of which are taking considerable interest in the work of the association.

The following officers were elected for the ensuing year:

President, F. W. Fruneauff, general manager, Denver Gas & Electric Co., Denver, Colo.; vice-president, William Mayher, manager, Greeley Power & Light Co., Greeley, Colo.; secretary and treasurer, George B. Tripp, general manager, Colorado Springs Electric Co., Colorado Springs. The executive committee comprises the above officers and J. A. Beeler, president, Denver City Tramway Co., Denver, Colo., and J. F. Vail, general manager, Pueblo & Suburban Traction & Lighting Co., Pueblo, Colo.

A dispatch from Omaha, Neb., states that the Union Pacific motor car No. 2, in an official test made a trip of 62 miles, during the course of which a speed of 63.2 miles per hour was recorded for a distance of three miles, while a speed of 50 miles an hour was easily maintained.

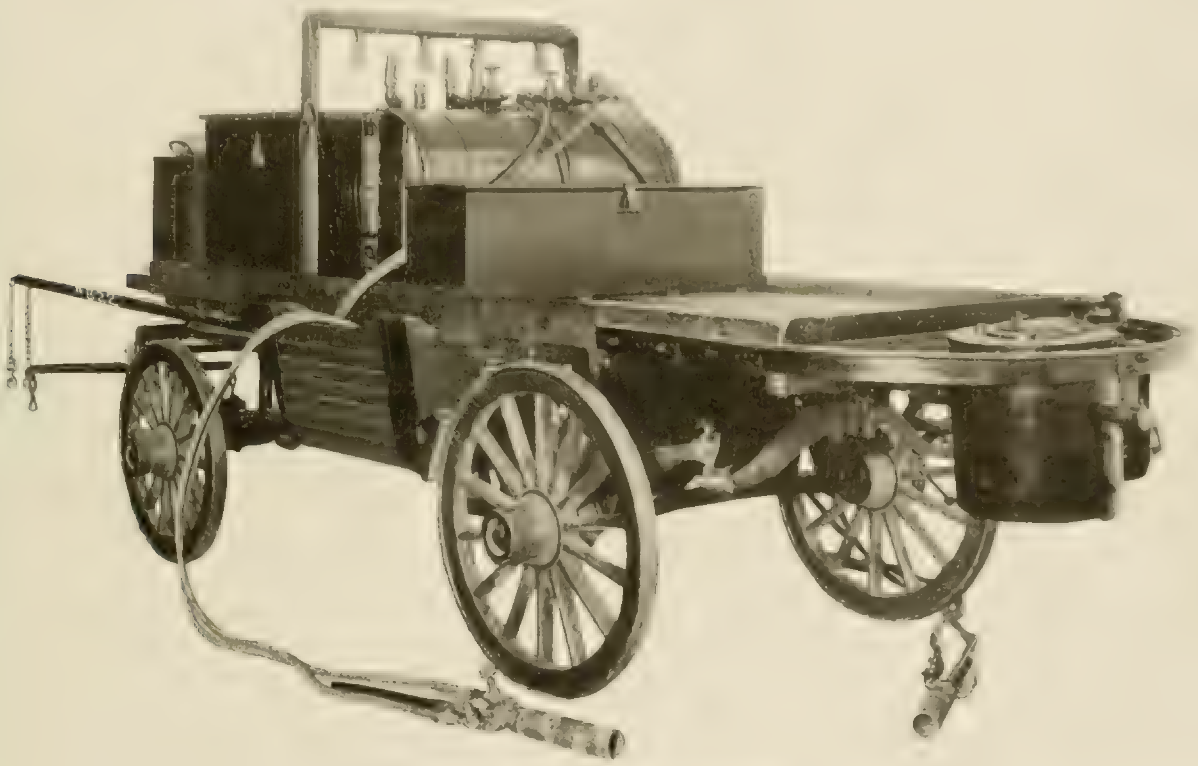
Track and Track Tools of the Philadelphia Rapid Transit Co.

The Philadelphia Rapid Transit Co. has 382 miles of single track (including 28 miles of car barn track) and 172 miles of second track making a total of 554 miles of single track operated by the company. As a means of recording the sections making up this large total the roadway department has published a track mileage record book. This book is made up of 228 pages, 6 x 9 in. in size. On each page is a detailed statement of the lengths of the single and double track on the particular street whose name heads the page. The arrangement of the items on a portion of one of these pages is reproduced. The upper one of the items given on the page is the name of the intersecting street at which the track on the street whose name heads the page begins. The other items arranged below are the names of intersecting streets from this starting street along the track whose length is being recorded and opposite the name of each intersecting street is noted the number of feet of single, second and third track from this street back to the end of the track from which measurements are taken. With this arrangement the length opposite the last named item is the total track length on the street recorded on the page. These pages, one for each street, are arranged in the book in alphabetical order.

Once each year this book is corrected and all the items adjusted to suit the existing mileage at the time of correcting. In place of issuing a new book each year new pages are issued for those streets on which the track mileage has been changed during the period. These pages are arranged in the same manner as the original pages of the book, but are printed on thin paper with a margin arranged for attaching to the pages which they supersede. On this margin is stated the number of the page in the book to which the new page is to be attached and at the top of the page under the name of the street is the statement that for convenience in taking of measurements the new page should be used in place of the old one, the number of which latter page is given. At the bottom of the insert pages is printed in red ink a statement of the changes made during the year and also the date on which the supplementary page was issued. These books are thus kept up to date and copies furnished the offices of the president, general manager, purchasing agent, superintendent of transportation and roadway department.

The standard track of the P[illegible] is laid with the Lorain [illegible] high and has an end section as shown [illegible] section of standard track. The weight of this rail is 137 lb. per yd.

The company's standard "composite" joint is used with this rail. After the rails have been placed on the ties, but before they are spiked, the ends are all thoroughly cleaned by a portable sand blast apparatus. Two [illegible] are also cleaned by sand blast and then placed on the rail ends and held in position by two steel drift pins. [illegible] on the head of the rail and the tread of the two rails brought to an even surface by wedging. Temporary bolts are then placed in four of the holes in the rails and plates and the remaining holes are reamed out to 1 1-32 in. in diameter by a portable pneumatic reamer. The twelve 1-in. rivets are then driven by a portable pneumatic riveter, clamping the plates solidly to the web of the rail, but leaving, owing to the special shape of the plates, a space under the head, the tram, and around the foot of the rail. Iron clamps furnished with asbestos cloth pads and clay dams are then placed at the ends of the plates and the whole joint warmed by fuel oil burners to a temperature of 300 to 400 degrees, after which molten zinc is poured into these hollow places.



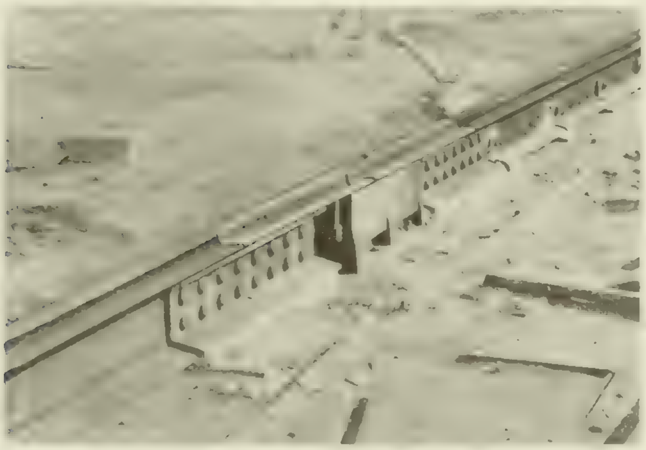
SPECIAL TRACK WORK REPAIR WAGON

The claim is that the introduction of this metal in a fluid state fills up the smallest interstices between the fish plate and the rail, giving a continuous solid bearing throughout which was impossible with the old style of plate, while the crystalline nature of the zinc prevents any flowing or peening under continuous shock and vibration. It is also claimed that the zinc being poured on the hot clean metallic surface of the rail plates will practically amalgamate with them and give a true electrical joint into which water and corrosion will not penetrate.

An electrical test was recently made of some 20 rail joints which had been in use since October, 1901, on Third St., where the wagon traffic is very severe and more than 1,000 cars per day pass over the joints. All but four in this test showed that the joints had less resistance than the rail, which properly speaking they should, as the section of metal is greater at the joint; and even the four that

showed differently were almost 90 per cent of the conductivity of the rail.

The apparatus used for making these joints is largely of a kind which can be easily constructed from material used by the larger street railways for other purposes, and is all of a kind which can easily be kept in order by the average grade of workman, none of the processes requiring any special skill, as they are all those in common use. This joint has an advantage over either of the other continuous rail joints mentioned being easily removed and replaced and the material removed does not become scrap, but is immediately



EXPANSION JOINT.

available for use in other joints with the exception of the rivets, thus making the initial cost a permanent investment.

The standard sub-structure for track in paved streets is shown in the drawing of the track cross-section. The object of this type of sub-structure is to furnish a simple and certain method for holding the track rail to a permanent bed. The paving of granite blocks or other material rests on a bed of concrete on top of which is a layer of a dry mixture of concrete and sand. The rails rest upon the solid body of the concrete, which extends across the horizontal surface of the trench and into the side of the trench cut longitudinally beneath the rails. This mass of concrete is continuous along the line of the track and at intervals has imbedded in it reinforcing rods ¾ in. in diameter and 6 ft. 4 in. long. These rods are spaced 5 ft. apart and have their ends bent down into the side trenches to gain an anchorage in the side bodies. At intervals of 5 ft. in each body of concrete, a yoke is imbedded consisting of an open cast iron frame with flanged sides, and provided at its upper end with opposite lugs through which work adjusting screws. These screws confine between them the holding-blocks and vertical blocks and the rail is, therefore, adjustable to gage by manipulating the screws.

In setting the rails a trench is first excavated and surfaced. This trench has the dimensions shown in the illustration. Temporary ties about 10 ft. apart laid across the trenches consist of 6 ft. long channels to which short wooden planks are fastened by means of lag screws. The channels have at each end two diagonally spaced holes of a bulb shape. The distance between the two pairs of holes is such that when the rails are bolted to the channels by means of cast iron clamps they are practically in gage. The rails are first laid on the ties between the two longitudinal trenches, and the joint formed, after which the rails are moved out towards the ends of the ties and clamped to them by clips. The cast iron chairs are hung on the base of the rails at intervals of 5 ft., they thus being suspended in the trenches. U-shaped round iron rods with the short U-legs downward are also tied on the base of the rail. These are for the purpose of holding the concrete stringers against the possibility of spreading. The wooden parts of the ties which come between the trenches are then tamped so as to bring the track to a practically true line and a perfect surface. The trenches are then filled in with coarse concrete to within about 1 in. of the base of the rail and allowed to set for several hours so as to permit the chairs to sustain the rails. The temporary clips are then taken off and the ties removed. The 1-in. space under the foot of the rail as well as for 1½-in. above the rail race is then filled with fine granite. The cast iron chairs have two sets of bolts; two vertical bolts pass through permanent clips which hold the rail down on the roadbed, and two bolts pressing against the clips in a horizontal direction are for the final adjustment of the rails to gage and line. Before the chairs are attached to the rails steel shims about 3-32 in. thick are placed between them and the base of the rail. This is done because the concrete shrinks slightly in setting, and when the shims are removed and the vertical bolts tightened, it insures a thorough and continuous support for the base of the rails. A solid sheet of concrete is now filled in between the two rails and for about 2 ft. outside of the rails to form a permanent foundation for the paving. Specially formed concrete blocks are also placed between the webs of the rails and the paving.

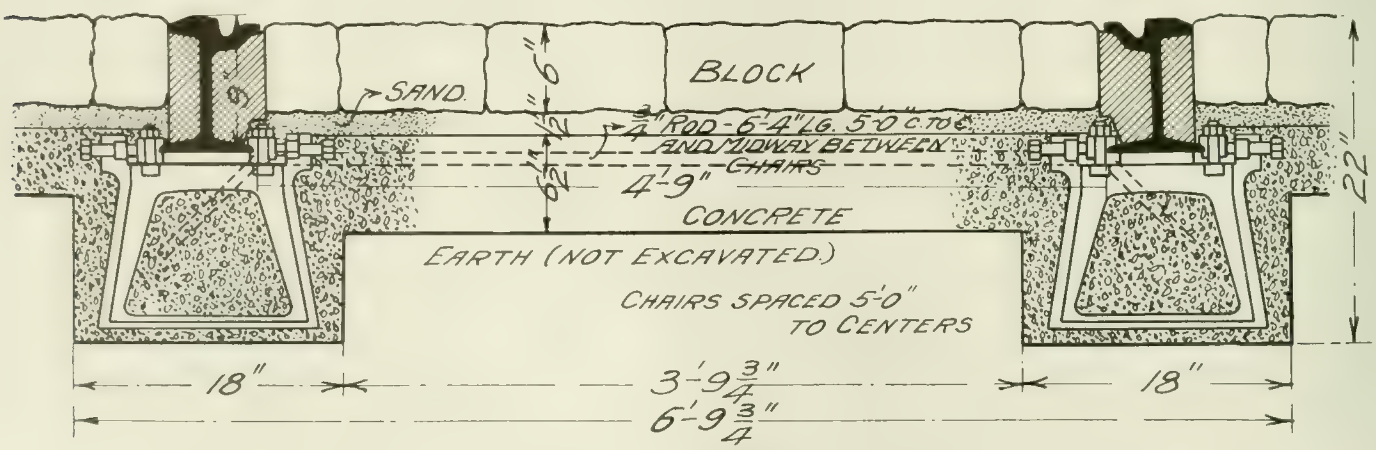
Special Track Work Repair Wagon.

The repair wagon shown in the engraving is used for renewal and repair of company's hardened steel centers in special work. It was built in the company's shop and designed to meet all possible emergencies that may arise in such repair work.

On a substantial running gear is supported by leaf springs a broad wagon platform strengthened by angle iron around the sides. Mounted over the front axle of the wagon is a 4-D National Electric Co. air compressor operated by its direct-connected motor. This compressor set is enclosed in a sheet iron box extending the full width across the wagon platform. The compressor exhausts into two storage air tanks each 48 in. long by 16 in. in diameter, hung under the floor of the wagon. The compressor maintains an air pressure of 20 to 25 lb. per sq. in. in these tanks.

On top of the wagon, close to the motor-compressor set, is a steel fuel-oil tank 24 in. in diameter and 48 in. long. At one end of this tank is a gage glass for observing the height of the oil in the tank. By means of a reducing valve between the storage air tanks and the fuel tank a pressure of 5 lb. per sq. in. is maintained on the oil. The fuel oil tank is protected from accidental excessive pressure by a safety valve fitted in its top.

From this tank oil is forced through flexible hose to two fuel oil burners for portable use within the radius of the length of the hose.



CROSS-SECTION OF STANDARD TRACK.

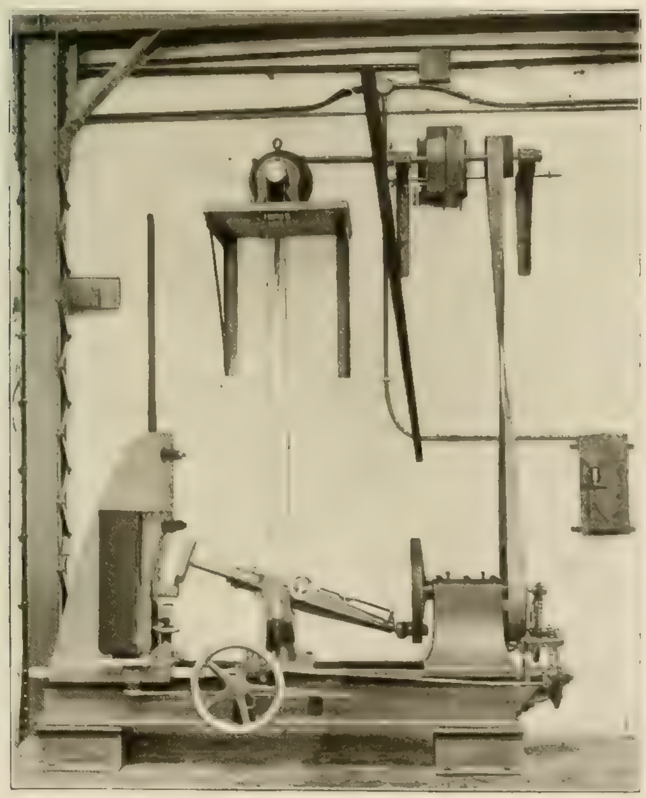
Wooden pockets are provided on each side of the wagon platform for the storage of this flexible hose and the burners while the wagon is being moved. At the burner the oil under 5 lb. pressure mixes with air fed from the storage air tanks by similar flexible hose at the pressure of the tanks, which is about 20 lb. per sq. in. Air from this storage tank is also found useful for cleaning the steel surfaces to be worked upon.

A third fuel-oil burner fed from these tanks serves to heat a zinc melting pot at the rear of the wagon. An angle iron bent in a circle shape and bolted to the sides of the rear end of the wagon platform supports the trunions on which the melting pot is hung. This pot has a capacity of 100 lb. of zinc, which under average conditions can be melted in 15 minutes. An air tight cover seals the top of the receptacle containing the zinc so that oxidation is prevented during the melting of the metal. By means of a spout leading from the crucible in which the metal is heated the molten zinc can be drawn off by swinging the pot on the trunions. Over the point where the flame from the burner enters the side of the pivoted melting pot is a cradle built to support the portable crucibles used for carrying the metal from the melting pot to the objective point at the track. When the wagon is in operation a crucible is kept in this cradle and thus heated by the burner. By using heated crucible for carrying the molten zinc the high temperature of the zinc as it comes from the pot is not suddenly reduced by striking a cold crucible.

The seat on the front of the wagon is built as a sheet steel box in which all smaller tools may be carried. An angle iron arch over the center of the wagon supports a bank of lights for night use. Current for the lights and motor is taken from any nearby trolley wire by a flexible cable fastened to a fish pole.

The Special Grinding Tool.

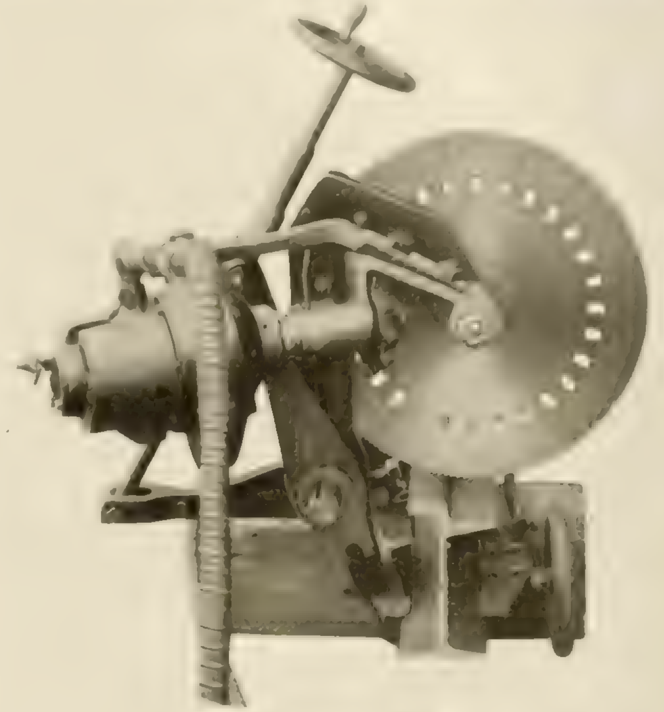
The points used in the switches of the Philadelphia Rapid Transit Co's. track work are cast of manganese steel. This material can only be worked by grinding and as it is necessary to true up



SPECIAL GRINDING TOOL.

the switch point pins as they become worn, the grinding tool illustrated has been designed and built for this work.

This tool consists of an ordinary lathe bed with a face plate on a shaft driven by the usual type of belt. A chain gear operating a worm shaft serves to move a carriage along the bed of the machine. On a fixed pedestal at the center of the bed frame is supported a universal joint with one axis perpendicular and the other in a horizontal plane. The [illegible] supports a bearing box and the feeding [illegible] of an emery wheel, the arrangement of [illegible]. This emery wheel is driven by a small belt from an electric motor placed on a bracket above the machine. At [illegible] wheel, the [illegible] and it



AIR-DRIVEN PORTABLE RAIL SAW.

feeding adjustment is fitted with a ball and socket joint, the socket of which is bolted to the face plate of the tool.

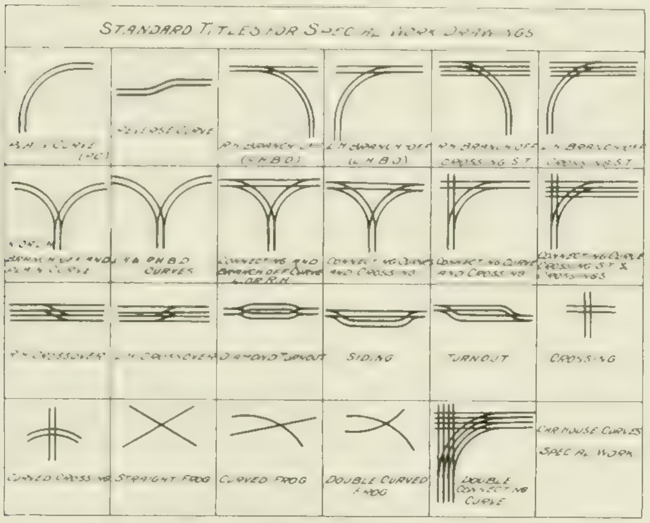
With both belts driving the machine the emery wheel revolves on its own axis, which in turn is moved by the ball and socket joint connection at the face plate so that any point in it describes a circle and the revolving shaft itself becomes the generatrix of a cone.

The switch point whose pin is to be ground is centered by means of a yoke and adjusting wheel so that it is on an exact line with the center of the face plate of the machine. By means of four large bolts and two clamps the tongue is held rigidly in the vertical position shown. When adjusted to take a cut over the surface of the pin, the gears are thrown in and the emery wheel, due to its peculiar motion moves around the pin, revolving on its own axis and cutting as it moves, and the longitudinal feed of the carriage moves the work to and from the wheel as in the ordinary process of a simple lathe. In this manner the emery wheel grinds any depressions from the pin of the switch point and leaves the pin in a polished cylindrical form perpendicular to the switch point. This machine illustrated is installed in the extensive special work shop of the Philadelphia Rapid Transit Co. and was designed and built by the roadway department engineers.

Air-driven Portable Rail Saw.

The use of air for driving field tools is practiced quite extensively by the Philadelphia Rapid Transit Co. One of the engravings shows a portable circular rail saw driven by a standard type of air motor. This tool consists of a clamp with adjusting wheel for securing the frame of the machine to the base of the rail which it is desired to cut. As a part of this clamp, is an upright arm supporting the adjustable portions of the saw frame. The arm terminates in a journal box, which, when the clamp is adjusted, takes a position parallel with the gage line of the rail. The upper half of the journal box is hinged so that the shaft which it supports may easily be removed by loosening a single bolt. The interior opening is square in section with a view to lessening any trouble which might arise from particles of steel getting in between the shaft and the bearing or on account of wear. This box shape also facilitates the adjusting of the journal so that any wear may be readily taken up and the alignment of the shaft remain undisturbed. This wear should be

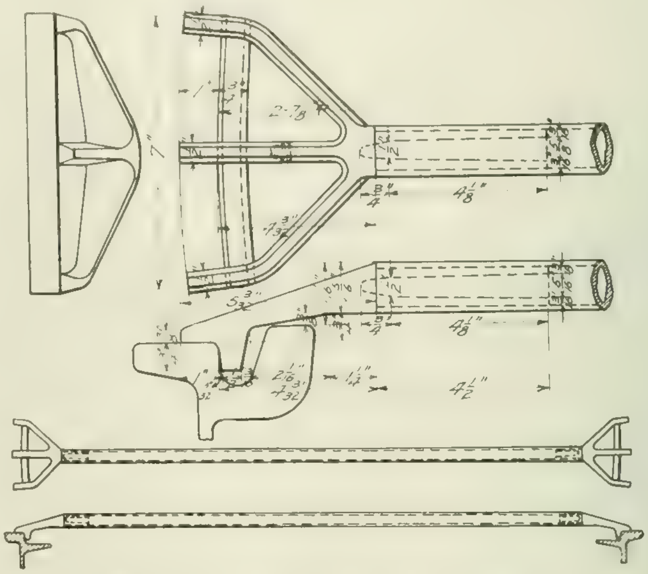
small since the shaft moves in the box only at times when the saw is tipped back to allow cars to pass, or when the saw is slowly fed. Mounted on the short section of steel shaft in the journal box is the frame carrying the saw which is a Z-shaped steel casting. The lateral adjustment of the saw is about 6 inches. This is accomplished by loosening the single bolt holding the upper portion of the journal box. The shaft and the saw may then be slid to the desired position and the box again clamped to hold the shaft firmly in that



SPECIAL WORK TITLES

location. The feeding of the saw into the cut is accomplished by a long screw with a wheel and handle at its top. The lower end of this screw is keyed to the horizontal arm of the cast steel Z-frame which supports the saw. At about the middle point of the screw shaft there is clamped about it a threaded block, held rigidly in a fixed location with reference to the clamp and bottom framework of the tool by a cast steel arm. The turning of this screw with one end fast and the threaded block moving along it draws the ends of the two arms together or forces them apart. As one of the

adjustment. A Higley saw gearing mechanism is used as shown in the illustration. This saw has a ring of openings cut in it for the reception of the teeth of the driving pinion on the air-motor shaft. A slow running motor manufactured by the Chicago Pneumatic Tool Co., drives the saw at a speed of 10 r. p. m. The motor is mounted on the square shank of the pinion; on the feed screw is a friction socket to prevent breakage of the parts if the saw is fed into the



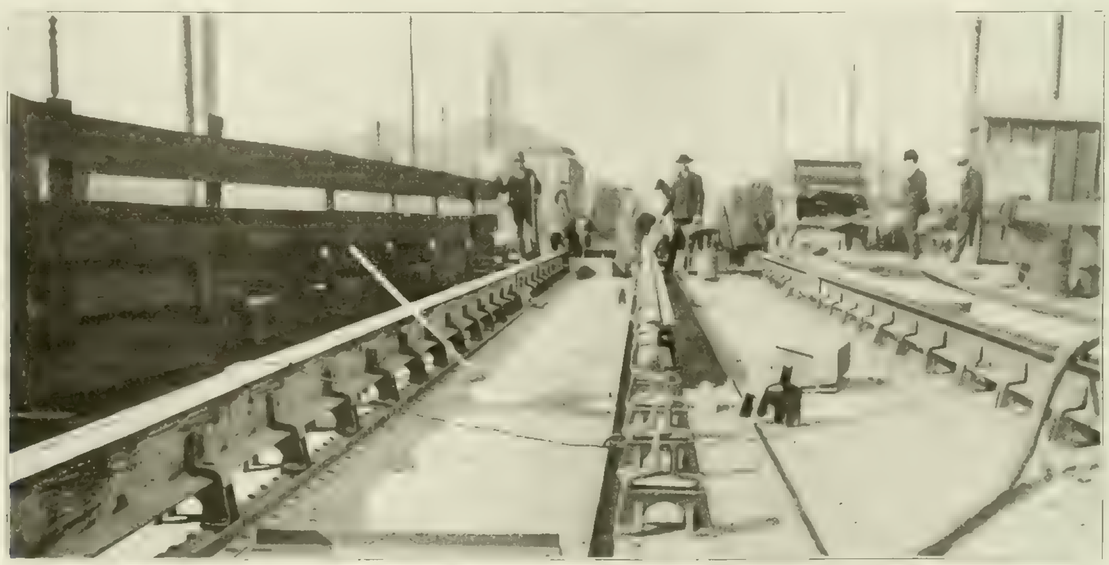
TRACK GAGE—SAMPLE PAGE FROM TOOL BOOK.

cut too fast or if it encounters a hard point in the rail.

This tool was designed and constructed in the shops of the company and has been found to do its work successfully. The adjustable portions of the tool, including the saw and its frame, weigh about 45 lb.

Track Records.

Nearly all of the tools and appliances in the roadway department have been standardized and working drawings of each made on a standard sized tracing, 12 x 9 in. A margin, 1¼ in. wide adapts



TRACK CONSTRUCTION ON MARKET ST. BRIDGE.

arms is rigid and the other a part of the saw frame is moving any desired adjustment of the saw in the cut is thus made.

The parts of the tool above the shaft are held in their proper cutting positions by a T-iron sliding in the framework on which the adjustment arm rests. By moving this key the saw, adjustment arms and motor can all be tipped down and away from the rail to allow a car to pass; this does not alter the feed. When the parts are tipped back to their cutting position and the T moved back in position, the saw is in cut ready to operate without further

these standard sheets for loose leaf filing or binding. The line drawing of a track gage which is shown is typical of the information presented on each of the many sheets which make up the standard tool book. It will seem that this is a working drawing from which any part of the tool could be ordered and the proper dimensions given a mechanic for building any part of the entire tool. In the "Review" for August, 1905, page 512, is shown the information contained on one of these sheets which illustrates the Philadelphia Rapid Transit Co's. standard method of piling rails.

Complete sets of these pages of standard tools and appliances are furnished to division engineers, purchasing department, general office and order clerks so that whenever a certain tool, machine or part is under discussion or being ordered reference can be made to the standard sheets and misunderstandings avoided.

As a means of standardizing the titles for different special track work construction, the roadway department has tabulated a set of standard titles as shown in the illustration. These are issued in a blue-print form on a page of a size suitable for binding in the standard tool book of the roadway department.

On the Philadelphia Rapid Transit system there are 1,800 separate locations at which special work joins intersecting tracks. At these locations there are 3,200 separate special work layouts. This number includes 1,100 street railway crossings but does not include the car barn special work. There are in all 30 car barn layouts.

For reference purposes the roadway department has a guide map of each location where its lines intersect steam railroads drawn to a suitable size, so that blue prints from tracings of the map can be bound and the data made available. The pages of this book of sketches, showing the location of track special work, are 7½ x 6½ in. in size. At the top of any particular page are the names of the companies owning the tracks whose intersection is maped underneath. There is also indicated on the drawing by means of conventional lines the name of the company which maintains the special work.

ELMWOOD AVENUE.

	Single Track	2d Track
From center of Gibson Avenue	0	0
To " 58th	1455	1455
" " 61st	3064	3064
" " 62d	3695	3695
" " 63d	4163	4163
" " 64th	4680	4680
" " 65th	5150	5150
" " 67th	6123	6123
" " 71st	8448	8448
" " 72d	8964	8964
" " 73d	9488	9488
" E. H. L. Island Road	10084	10084
TOTAL	10084	10084

TRACK RECORD BOOK. (ORIGINAL 6 X 9 IN.)

Track on Market St. Bridge.

The Philadelphia Rapid Transit Co's. double-track line across the Market St. bridge has recently been laid in a thorough and very interesting manner. This bridge has a steel floor which carries the paving of the street. The track across the bridge is laid with the 137-lb., 9-in. girder rails, connected by the standard "composite" joint. The rails are held to the floor of the bridge by the steel chairs shown in the illustration. These chairs are riveted to the steel plate floor of the bridge and the rail is held to line and gage in them by means of bolts and a filing of babbitt metal locking the chair about the foot and web of the rail. At the end of the bridge shown in the illustration it was necessary to increase the height of the chair in order to adjust the surface of the rails to the grade of the pavement as recently changed on account of the neighboring subway construction. Throughout the length of the bridge, except at the ends, the chairs hold the base of the rail about ½ in. above the steel deck of the bridge.

At the expansion points of the bridge expansion joints similar to the one shown in the illustration are placed. This joint is made up of two cast steel rail sections similar to the adjoining rail. These sections are joined to the adjacent rails by means of the standard riveted zinc joint. A cast steel box riveted to the plate floor of the bridge furnishes a chair in which the beveled points may slide.

At the thirteenth annual convention of the Traveling Engineers' Association, held at Detroit, September 12th to 15th, a resolution was offered making electricians and others in charge of electric motormen eligible to membership and the subject of admission of such members was referred to the executive committee for report next year.

Improvements in the Brooklyn Rapid Transit Systems.

Last spring the Brooklyn R[illegible] [illegible] motor cars and 200 [illegible] has also recently added to [illegible] [illegible] of $[illegible],000 [illegible] order 150 additional surface cars of the new convertible type, at a cost of $850,000. This brings the total cost of the above modernized equipment up to nearly $3,400,000. It is well known, however, that the policy of adding betterments to the property and the general order of improvement is being pushed vigorously. This is shown in several localities on the Brooklyn Rapid Transit system at present, where much work is being done.

Extensive work has been made [illegible] Ave. depot, located at 9th Ave. and 20th St., where the increasing of the storage facilities in the depot and vast improvement of facilities for handling cars there, are now well under way. This depot in the past has been very cramped for space, it being possible to handle but 200 cars. Under the new arrangement the capacity will be doubled and there will be facilities for the handling of 400 cars. The total cost of these alterations and improvements will amount to over $400,000.

Some very important improvements are also to be made at the Ridgewood incline and storage yard consisting of new steel work, concrete and earth work, new track work on the structure and on the surface, while on the Lutheran Cemetery line there will be some special work at Freshpond Road which will require some blasting for new track. At the storage yard on the Lutheran line more than $100,000 will be spent in new track work, inspection pits, and a new inspection shop to cost $65,000, also on a new bridge, and there will be several thousand dollars worth of new overhead work. This is but part of the general policy that President Winter instituted some months ago and will largely increase the company's present facilities.

The rearranging of the 36th St. and 5th Ave. terminal is progressing rapidly, the total cost of the improved facilities there will be in the neighborhood of $350,000, which includes the arranging of the surface yard with inspection pits, the elevated yard with a new inspection shop, new machine shop, boiler house with new retaining walls and extensive alterations in the Union Station building.

The semi-annual change of the great number of the cars on the Brooklyn Rapid Transit system from the summer to the winter equipment, which is no small undertaking in itself, will have been completed by the 15th of October.

Trolley Merger in Eastern Ohio.

A report states that rights of way are now being asked in East Liverpool for a double track street railway, which is to extend from the present terminus of the East Liverpool line to the state of Pennsylvania, about nine miles in all. Condemnation proceedings have been begun at Lisbon for rights of way for this line which the company was unable to purchase from the owners. The East Liverpool & Wellsville Interurban Electric Ry. was recently granted a charter at Columbus, and condemnation proceedings are entered in its behalf. Behind these moves is said to be a merger of local street railway and electric lighting interests of this portion of the Ohio valley. The properties to be taken over are: the East Liverpool Ry., and its branches, the East Liverpool & Rock Springs street railway, running from East Liverpool to Chester, W. Va., the electric lighting plants and power houses of the United Power Co. in East Liverpool and Wellsville; the suspension bridge between East Liverpool and Chester, and Rock Springs Park, a large and valuable pleasure resort at Chester. The new incorporation is known as the East Liverpool Traction & Light Co. and its officers are: President, Van Horn Ely, Buffalo; vice-president, C. A. Smith, East Liverpool; secretary and treasurer, Edward McDonnell; directors, Van Horn Ely, C. A. Smith, Edward McConnell, M. J. McGraw, George H. A. Hunt, N. B. Billingsley and U. C. DeFord. The Ohio Valley Finance Co., organized in W[illegible] financing the company.

Accounting with Four Departments.*

BY [illegible], SECRETARY AND TREASURER [illegible] WATER, LIGHT & RAILWAY CO., ELMIRA, N. Y.

In presenting a short outline of the methods pursued in my own company I have in mind about the same idea that the maker of a motion sometimes has in a parliamentary body; that is, to get the question before the house so that it may be discussed, amendments offered, etc., and the whole matter be crystallized and put finally into the best possible form. I hope, therefore, that these notes will bring out comments and amendments which will go further than the paper itself goes in suggesting a simple, compact method of handling the accounts of companies having more than one department. Our system may be of interest because I believe that to our company belongs the distinction of being the first to combine into one operating company, water, gas, electric light and railroad properties, and in addition to these four mentioned divisions I may say that we also operate a race track under the head of a driving park department, and a summer theater under a separate department; both of these, however, being operated through the railroad department, but each one having its own set of accounts and showing its own profit or loss at the end of the year.

When the combined company was first organized and the old companies were wiped out of existence, it was probably but natural that the use of a separate set of books for each department was continued, following out the method of a set for each company. The cash account for each department was kept distinct from that of every other department. Each department had its own stores account and the whole system was practically the same as when the companies were operated separately. This was almost immediately abandoned, however, as it was realized that there was really only one unit, one pocket to put the money into, and one pocket from which to pay the bills.

The next system put in force, and the present system as well, of course, retained the distinction between departments, as it is absolutely necessary to know the standing of each department regardless of the other departments and to know whether or not each particular department is being operated at a profit, and what that percentage of profit is. The machinery for arriving at this knowledge, however, is quite different today from that orginally started when the first set of books was discovered to be impracticable. Ledger No. 3, which is in use to day is practically the same as ledger No. 2, except as to size. It is a wide book, ruled with four main columns, one each for water, gas, electricity and railroad, each main column having the customary ledger rulings for date, description, folio, and debit and credit amounts. Each department also continues the use of a journal. This is now a very small book and the entries are so summarized that two or three pages per month cover the entire business which has to go through this book. Each department has its own invoice or sales book, which was formerly carefully journalized before posting at a great expense of time and labor. Postings are now made directly from this invoice book to either the main ledger or the consumers' ledger, as the case may be, and the invoice book is summarized at the end of the month and the credits are posted directly from this summary to offset the various debits during the month.

The second system inaugurated made use of a distribution journal for each department, on which all invoices were entered, charging the various operating expense accounts and crediting the seller of the goods, each one of whom had his own open account on the ledger. This account, of course, after receiving a credit in this manner, had to be debited with the check which was drawn in payment for the goods. This distribution journal is now superseded by a distribution cash book, in which all checks for payment of goods are entered, and the cash account is credited from the total of this cash book each month, and each operating expense or other account is charged with the total of all entries made in its particular column during the month. This does away with the opening of ledger accounts with the various consignors of goods, but by means of an index of the distribution cash book the complete account of any consignor is readily looked up. All invoices are numbered consecutively and the number of each invoice is entered in the distribution cash book. Sample sheets of this book, I believe, are in the exhibit of the secretary of the association. This distribution cash book takes the place of the distribution journal and also of the credit side of the old cash book. The debit side of the cash book has remained practically the same through all the changes. As now printed, however, the so-called cash book contains only the cash debit. It is ruled with four main columns, one for each department, each column being subdivided according to the needs of the department. On gas, electric, and water departments there is a column for credits to consumer's ledger which are entered each day according to the total of the stubs chopped off by the cashier, who lists each day separately. There is a column for the forfeited discounts in each of these three departments for cash deposits and for sundry credits. In the railroad division there is a column for passenger receipts, receipts from chartered cars, freight, tickets, driving park, theater, and sundries.

In addition to the working set, there was formerly another set consisting of journal and ledger only, upon which all of the other work was summarized into the usual balance sheet accounts; that is, under assets; construction, material and supplies on hand, prepaid taxes and insurance, accounts receivable, bills receivable, and cash on hand; then on the other side, under liabilities; capital stock, bonds, accrued interest, bills payable, accounts payable and surplus. This summarizing was done by taking each department journal and distribution journal and the cash book and summing up all the entries under the above various classifications into one entry on this "company" journal, which was then posted into the ledger and the balance sheet drawn off from this ledger. This outside, or so-called company set, has now been entirely abolished, and the entries for capital stock, bonds, accrued interest, bills payable, and surplus transferred to the working set.

A prominent auditing company was responsible for the second outfit installed, and while the system was perfect theoretically, it proved unnecessarily cumbersome and expensive. The present, or third system, you will note, is largely a growth, by elimination, from the second system, the eliminations being entirely upon the idea of saving time and expense. As three-fifths of our entire business, measured by cash receipts, is done by the three departments other than the railroad department, I will take up first some of the changes made in handling those accounts.

The greatest saving made was in adopting the consumer's ledger, as a means of carrying miscellaneous accounts, instead of opening accounts on a regular ledger and carrying them there. This was accomplished by the insertion of one more column for dollars and cents in each month's ruling; and the posting into that column of all sales of gas ranges, charges for laying gas and water services, charges for wiring, and sale of lamps in the electrical department. Each department, of course, has its own consumer's ledger, and its own invoice book from which charges are posted. The charges in the invoice book art totaled each month and are debited to the consumer's ledger account in the main ledger along with the total of the gas bills or electric bills, as the case may be, thus making two charges to that account each month instead of one. But the point is, that every man who buys a gas range is a gas consumer, or will be, and will have an account on the consumer's ledger; must have, in fact. Having this account, why is it necessary to open another account in another ledger just because the commodity purchased is not gas? Furthermore, the account is under your bookkeeper's eyes every month, and if not paid can be added to the next month's bill for gas by simply inserting the amount opposite the printed word "Sundries" on the bill. This insures a prompt collection of all outside bills and saves making and mailing of other statements than the regular monthly bill.

In taking up the methods of ordering goods, auditing and paying bills, it must be borne in mind that although we have but one cash account, we are very careful to keep the earnings and operating expenses of the four departments entirely separate and distinct. One of the aids to this end is the adoption of a different color for the stationery of each department, and this is carried through from the original superintendent's requisition for the goods to the check which finally pays for them.

It is not necessary, of course, to describe any of the details of ordering goods and checking the bills and the receipt of the goods, as it differs in no wise from the method which would be employed in a one department company, except for those things which we are able to buy from ourselves, and for these things no formal order approved by the general manager is issued, the superintendent's requi-

*Read before the Street Railway Accountants' Association, Philadelphia, Sept. 29, 1905.

sitions being sufficient authority for the obtaining of goods from other departments. For instance, our railroad department can buy tar for tar walks at the park from the gas department, and the water department can get the picks used by its street gang in laying water mains sharpened and tempered at the blacksmith shop in the car barn. The goods bought or labor supplied are billed from one department to the other, just as they would be billed to any other person, but, of course, at cost price. This interchange between departments is quite a feature of the company, and always seems to be a great stumbling block to a new bookkeeper. It is very simple, however, when it is once understood, and as stated above, it simply involves a billing similar to that which would be employed in selling to any outsider. To give other instances of this interchange: The electric department having need to use more horses than the other departments, carries the entire stable account, and men paid by the electric department assume all the care of the horses and do the driving, and the electric department charges the other departments for all hauling done at a fixed price per hour. The water department sells water for power to the electric plant and the electric plant sells steam for power to the gas department, and steam for heating the car barns to the railroad department. The railroad department furnishes badges for transportation to the men in the other departments who read meters, inspect services, etc., at a fixed price per month, and last, but by no means least, the electric department sells to the railroad department its motive power. Monthly bills are rendered for all these services, and except for regular monthly charges, a bill from one department to another must show the superintendent's order number and be checked as carefully as though it came from outside.

In addition to the above class of services which are interchanged upon a cost basis, there is another class which are for convenience put upon the basis of an equal division into fourths. For all of this class, which includes office rent, some office expenses, and some of the salaries, one department pays the bills and charges one-fourth at the end of each month to each of the other departments by bill duly rendered. This account is carried in the water department, and is called "General Office Expense." There is a column for it on the distribution cash book, and the total of this column is divided at the end of each month. There is another account which is carried in the water department which is called a "Departments Account." This covers charges which are to be divided among other departments, but not according to any fixed ratio, and is analyzed carefully at the end of each month and the other departments are charged with their due proportion of the account. "Taxes" is one of the items which is carried in this account. We get one tax bill from the city, which is itemized, of course, but we draw a check on the water department to pay these taxes, charge the amount which belongs to the water department strictly to "Taxes Payable" and the balance of the check goes into the department account. At the end of the month the different amounts chargeable to the gas, electric, and railroad departments are sifted out and billed and settled for by the other departments.

Our stores and supplies are all kept at one point, and "Stores Account" is handled by the water department. There is a special form of requisition for stores, and the checks for payment are drawn on the white checks of the water department. At the end of each month the store keeper sends in four reports, one for each department, with the value of the stores used duly distributed between the various operating expense accounts. On the water department journal, the report for the water department is entered, simply charging the various operating expense accounts and crediting stores; also on the water department journal the other departments are debited with the amount used by them, and stores are credited. On the journals in the other departments the reports are entered up by debiting the various operating expense accounts and crediting the water department the total.

In handling the cash, even after the separate bank account for each department was abandoned, the fiction was kept up for some time, of a separate cash balance in the cashier's hands for each department, and although he might make but one deposit to the bank in a day, say of $2,000, he would figure that he took a certain amount of this from each department and would enter on his book a balance carried forward to the next day for each department. The system now is much simpler, as he starts in the day with but one amount on hand, he enters on his blotter the various amounts received under each department, [illegible] the entire receipts, deduct the bank deposit [illegible] to the next day. We have a page in our blotter for each day, properly ruled and printed, and the keeping of the cash seems to be at present a very simple matter.

As to the disbursements, it was stated earlier that all bills for goods were consecutively numbered [illegible] that each department has its own series of numbers. The invoice is known by its number all the way through the accounts. The entry of the bill number is made on the order, along with the date of the receipt of the goods. On the goods received report, the number also appears, and along with the date of the bill and consignor's bill number, if he has one, appears our bill number on the check we use. On the back of the bill we stamp a form which has spaces for entering the order number, date of receipt of the goods, account chargeable, and page on which the check is entered for payment. The object being, of course, to be able to trace a bill clear through, backwards or forwards, no matter where we tap into the circle. Our check is of the voucher form, very simple, very compact, contains all the information, is very like an ordinary check in appearance, and to my mind, eminently satisfactory. The checks are numbered consecutively by months, each month beginning with No. 1, in each department.

The method of getting at any firm's account would be like this: Take the General Electric Co., for instance; we would turn to our index for the various distribution cash books, and under the heading General Electric Co. we would find, say, W-28-8-05, W-14-8-05, R-16-8-05, E-50-8-05 and so on. These numbers would mean that on the water department distribution cash book under August, 1905, we would find a check to the General Electric Co. No. 28, and also on the same page one numbered 14. On the railroad department book we would find on the same month check No. 16, and on the electric department check No. 50; the amount, of course, of the check would be given, and its distribution to the various expense accounts. There would also be in the column provided for them the invoice numbers which were pasted onto the bills for the amounts given.

By means of the system which has here been partially outlined, we are now able to handle the entire business of the company, which has increased 25 or 30 per cent in the last three or four years, with an expenditure for office help about 40 per cent lower than had been required up to the time the system was inaugurated. There are one or two imperfections which we hope to have eliminated very soon, but on the whole it works very well, and we can commend the prominent features most thoroughly for a small company like ours.

Railways Protective Association.

From time to time railroad companies, after having settled suits or claims for damages, learn that the claim was a fake one. At other times, the claim is so small and the cost of an investigation is so great in comparison to the claim, that the company settles the claim rather that fight it. A central bureau, to which all railroad companies can report claims made against them for damages, and from this bureau immediately receive notification of all previous claims by the person then making the claim, is furnished by the Railways Protective Association, No. 1 Ann St., New York City. It gathers a record of all claims made against members of the association and keeps these on file, thus being ready to furnish to a member, reporting a claim, any previous claim by the then claimant. Members report the names, addresses, kind of accident, witnesses of the claimant and a close description of claimant, and all this information is carefully filed away for immediate reference.

As accident fakirs often use the same injury or same kind of injury, this has frequently been the cause of their downfall. Therefore it is only logical to use the injury, reported by them, as a means of identification.

When one accident fakir is caught, particularly where an example is made of him, this means the deterring of others from similar practice. This association issues frequent bulletins describing late claimants and the circumstances of the accidents in which they appeared. The cost for the service of the offices of this association and the bulletins is five dollars a year.

The Dayton, Covington & Piqua Traction Co. has under consideration the construction of a branch line to Phillipsburg, O.

Interurban Ticket Accounting.[*]

By J. H. Pardee, General Manager, Rochester & Eastern Rapid Ry., Canandaigua, N. Y.

A very few years ago the questions involving electric railway ticket accounting were confined simply to one denomination of tickets, or in other words, all tickets issued had the same transportation value and it was not necessary to use any special methods in the issuance or accounting of them. As electric railways have more nearly approached steam roads in methods of train and traffic operation, it has become obviously advantageous to abolish the five-cent fare zone and adopt the steam road system of fares based on mileage. With the adoption of that system and the establishment of ticket offices at all the principal stations, single and round trip, excursion and special rate tickets are necessary between each and every other station on the line and instead of one form of ticket, there are hundreds, and the accounting takes on a more serious aspect. It is almost unnecessary to state that the theory of modern accounting is to record in the simplest and most convenient form such data and computations as will preserve and accurately show a complete history of any financial transaction.

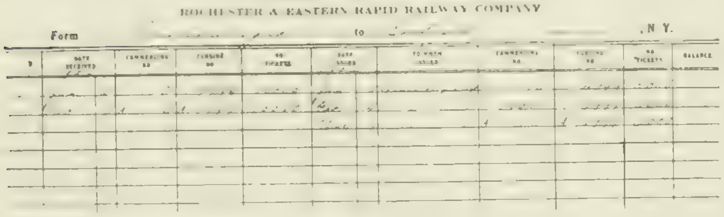
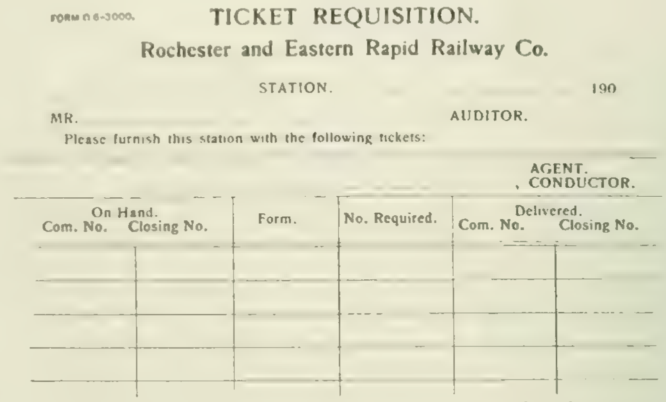

TICKET STOCK RECORD.
ROCHESTER & EASTERN RAPID RAILWAY COMPANY
Form to , N. Y.

FIG. 1.—TICKET STOCK RECORD. (ORIGINAL 10 X 12 IN.)

This paper will simply and briefly describe the methods of ticket accounting on one interurban road, and if the facts presented are sufficiently interesting to provoke thought, criticism and discussion and thus developes simpler, more convenient, and better methods, its object will have been attained.

The principle of this method is that tickets are considered the same as cash, as currency or silver of different denominations, and every employe handling tickets, must either produce the ticket or the cash.

Each kind of ticket, irrespective of stations named thereon, has the same form number, and all tickets of the same form number reading between the same stations are numbered consecutively from 0 to 9999 and then a new series is started by prefixing a letter of the alphabet, and thus large numbers are avoided. All regular single and round trip tickets are of regulation card size to fit


FORM O 6-3000.
TICKET REQUISITION.
Rochester and Eastern Rapid Railway Co.
STATION. 190
MR. AUDITOR.
Please furnish this station with the following tickets:
AGENT.
, CONDUCTOR.

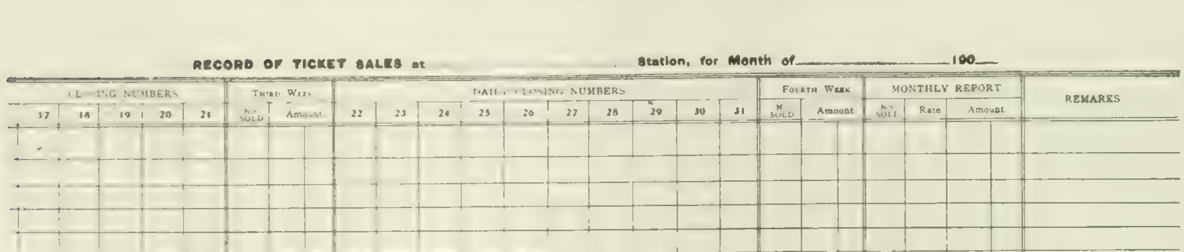
On Hand. Com. No.	Closing No.	Form.	No. Required.	Delivered. Com. No.	Closing No.

FIG. 2.—TICKET REQUISITION. (ORIGINAL 5 X 8 IN.)

the ordinary grooves in a regular railway ticket case. Special coupon and interline tickets are somewhat larger and are hung on pins in the rear part of the ticket case. Mileage books in denominations of 100, 500, and 1,000 miles are of ordinary form, except smaller than used on steam roads and are treated the same as tickets. When a supply of tickets is received from the printer, the ticket accountant checks them against the invoice and enters them on a loose leaf ledger in which a page (see Fig. 1) or more is devoted to each form for each station. The date received, commencing number, closing number, and total number of tickets received are shown on the debit side and the same data of tickets disbursed shown on the credit side.

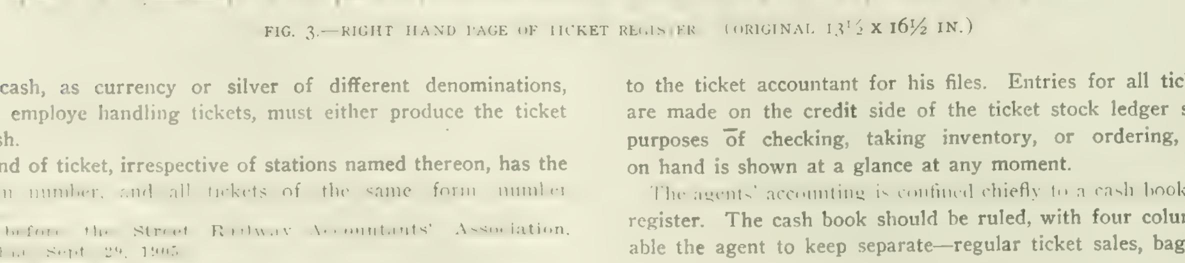
Tickets are issued to agents on a requisition (Fig. 2). This requisition is issued by the agent and shows the form, commencing and closing numbers of tickets then on hand and the number wanted. The tickets are furnished and the commencing and closing numbers of same are entered on the requisition, which is sent back with the tickets to the agent for his receipt, and is then returned by him to the ticket accountant for his files. Entries for all tickets issued are made on the credit side of the ticket stock ledger so that for purposes of checking, taking inventory, or ordering, the stock on hand is shown at a glance at any moment.

The agents' accounting is confined chiefly to a cash book and ticket register. The cash book should be ruled, with four columns, to enable the agent to keep separate—regular ticket sales, baggage check


FORM O—7
THE ROCHESTER AND EASTERN RAPID RAILWAY COMPANY.

STATIONS		Daily Closing Numbers 1	2	3	4	5	6	7	First Week No. Sold	Amount	Daily Closing Numbers 8	9	10	11	12	13	14	Second Week No. Sold	Amount	Daily 15	16

LEFT HAND PAGE OF TICKET REGISTER. (ORIGINAL 13½ X 16½ IN.)


RECORD OF TICKET SALES at Station, for Month of 190

Closing Numbers 17	18	19	20	21	Third Week No. Sold	Amount	Daily Closing Numbers 22	23	24	25	26	27	28	29	30	31	Fourth Week No. Sold	Amount	Monthly Report No. Sold	Rate	Amount	REMARKS

FIG. 3.—RIGHT HAND PAGE OF TICKET REGISTER. (ORIGINAL 13½ X 16½ IN.)

[*] Read before the Street Railway Accountants' Association, Philadelphia, Sept. 29, 1905.

sales, interline ticket sales, and chartered car revenue. The ticket register (Fig. 3) is a special ruled book having column to show the different forms of tickets, commencing numbers at beginning of month, daily closing numbers, weekly revenue, total number of tickets sold during month, and monthly revenue for each form.

At the close of each day's business, the closing number of each form of ticket is entered in ticket register and the number of tickets sold ascertained by comparing the present closing number with that of the previous day. After that has been computed, the agent makes an entry on the debit side of the cash book showing the number of tickets sold of each form, and the rates, entering the ex-

ROCHESTER & EASTERN RAPID RAILWAY.
AGENT'S DAILY CASH REPORT.

DATE 190

TICKET SALES		
CHARTERED CARS		
BAGGAGE		
FREIGHT AND EXPRESS		
TOTAL		

AGENT.

FIG. 4.—AGENT'S DAILY CASH REPORT. (ORIGINAL 3 X 5 IN.)

tensions in the proper columns. When this has been done, the remittance for the total amount of the day's business, as shown by the debit side of the cash book, is made up, and the agent's cash report (Fig. 4), showing the distribution of the receipts, is filled out and corresponding entries made on the credit side of cash book. The month's business is computed in the same manner: comparing the commencing numbers at the first of the month with the closing numbers at the end of the month, and making out monthly ticket report (Fig. 5), showing in detail the commencing and closing numbers of tickets on hand.

Monthly ticket reports, accompanied by ticket requisition for tickets needed, should be sent to ticket accountant not later than the second day after the close of the month's business.

TICKET REPORT.
ROCHESTER & EASTERN RAPID RAILWAY COMPANY.

At .... Station. Month of .... , 190

TICKET FORM.	ON HAND 190			SOLD			RATE	AMOUNT
	COM. NO.	CLOSING NO.	NO. TKTS.	COM. NO.	CLOSING NO.	TKTS SOLD		

FIG. 5.—TICKET REPORT. (ORIGINAL 8½ X 11 IN.)

Monthly ticket reports are checked against inventory and ticket stock ledger and by these methods every ticket is accounted for in an easy and simple manner from the time that it is received by the printer to its issuance to a passenger and the absolute record that the company has received the proper amount of cash therefor. The tickets turned in by the conductors in their trip envelopes are counted to ascertain number of passengers carried, and inspected to see that all are good for transportation on that particular date. At this point, ticket accounting, except for some special purposes mentioned later ends. It is not necessary to account, at considerable expense, and ascertain the number of sold but unused tickets, for all limited tickets expire by their own limitation, and other tickets constitute simply a liability which is unimportant except in case of sale of property, and never yet has that been considered.

Clerical errors will occur, but it is almost impossible for them to remain undetected more than 24 hours. The agent can readily prove this [illegible] minutes check up any ticket office at any time.

Another very valuable [illegible] the ease with which traffic reports can be made up. For instance, the receipts of some particular ticket [illegible] certain days, and a comparative report can be prepared in a few minutes which will show in what particular tickets and between what particular points the decrease arose.

Accounting is reduced to a minimum and all records necessary are preserved simply and in convenient form.

Interurban Fare Collections.*

[illegible], AUDITOR, [illegible]

"Interurban Tickets, or Fare Collections," has been the subject of a great deal of thought by every operator of interurban lines, and the brightest minds have for years been trained on this subject, devising schemes and tickets by which an absolute check could be made on conductors, so that all the revenue collected by employes would find its way into the treasury of the company.

The ideal sytem, in my estimation, is the one in effect in part by our friends, the steam railroads; and they have been working on this same problem for upwards of half a century. They have in effect in the larger cities a system whereby a passenger purchases a ticket from an agent, and, before getting to his train, he passes a gateman who punches his ticket, which indicates that the passenger has used it in that way.

Of course, it is not possible to have all this machinery in connection with our electric lines, where the cars stop at crossroads, street corners, flag stations, and in fact at almost any place where a passenger wishes to board a car.

My experience with interurban fares is to sell as many tickets through agents as possible. My reason for this is that you have an absolute check upon your agent as to the number of tickets sold, and it is much better for one man to handle the revenue than to have it divided among 25 or 50 conductors. Another reason is that a conductor can collect his fares more readily by collecting tickets than he can if he has to make change with each passenger.

I have been on heavily loaded interurban cars where runs were made into the country for 25 miles, and destination was nearly reached before all the fares were collected—the car in each instance being operated by a good man.

The system of collecting interurban fares in effect on the Detroit United Railway system is briefly outlined as follows:

The general passenger agent is the custodian of all interurban tickets, and supplies of same are sent direct to each car house foreman of the different lines. At the car houses we have large cases. divided into 31 compartments, so as to keep the tickets for each day of the month separate. In starting out the cars for any one day, the conductors are given a certain number of these tickets, and upon a blank prepared for that purpose a record is kept of the number and the consecutive numbers of the tickets delivered to each conductor. When the conductor's day's work is completed, the car house foreman credits the conductor with the number returned upon the blank just referred to, and this is then forwarded to the auditor's office. The blank is then checked by the accounting department, and the number of tickets used by each conductor must be accounted for in his report. In addition to this, the car house foreman reports at the close of each day the number of tickets in stock for that day, and this is also checked in the accounting department, to ascertain that every ticket of that day that has been charged to any particular car house has been accounted for, either in the car house foreman's report or in the conductor's returns. In other words, a complete record is at all times kept in the accounting department of the number and the consecutive numbers of all tickets for each day of the month in each car house.

Registers are placed in all interurban cars, and all five-cent fares, employes' tickets, and free transportation are registered. Conductors are required to first collect all fares on rear platform of car and then go to front end of car and collect—at all times facing the passenger when collecting and issuing tickets.

*Read before the Street Railway [illegible], Philadelphia, Sept. 29, 1905.

One type of ticket used on one of this company's divisions is a tear ticket printed in two colors—yellow, "good going north only," and blue, "good going south only." When this ticket is sold to a passenger it is torn off by the conductor, indicating the stations from and to which the passenger is traveling, and the amount of fare paid is indicated in heavy type in the lower left-hand corner of the portion held by the passenger. The part retained by the conductor is forwarded to the auditor's office, and he ascertains the amount for which the ticket was sold by the small ending figures which appear in the upper corner of the ticket where it is torn off. These tickets are consecutively numbered, and the day of the month is indicated in the circle at the bottom.

A duplex ticket used on one of our divisions has four different tints of colors—two of which are "good going north only," one for even days of the month and one for odd days of the month; and the other two colors are "good going south only," one for odd and the other for even days of the month. These tickets are all consecutively numbered, and the day of the month is indicated in the circle. A conductor in issuing one of these duplex tickets is required to punch the station from and to which the passenger is traveling, the month in which the ticket is issued, and the amount of fare paid—giving one-half of the duplex to the passenger and returning the other half to the auditor's office.

Exchange Duplex Ticket.

On one of our divisions all agents sell one way tickets to all stations, and round trip tickets to all stations where the round trip rate is less than single fare each way. They also sell single and round trip coupon tickets, good over boat lines going north and east from Detroit. The exchange duplex ticket is issued by the conductor to passengers holding a local agent's ticket or a foreign agent's coupon, a trip pass, or special ticket, the conductor taking up the transportation presented by the passenger and issuing an exchange duplex ticket. These exchange duplex tickets are printed in two colors—one "good going north only" and the other "good going south only." The conductor is required to punch out the station from and to which the passenger is going, the day of the month, and the form of transportation. The passenger retains his half of the exchange ticket to indicate to what station he has paid his fare. The conductor's half, with the transportation collected, is forwarded to the auditor's office. The feature of this ticket is to avoid, as far as possible, substitution.

Agents' one way duplex and round trip tickets are sold at all stations where there are agents on our rapid railway system. [The agents' tickets were illustrated in the "Street Railway Review," July 15, 1905, page 421.] These are the regular form of duplex and triplex tickets, except they are printed without date. The agent when issuing them punches out the station to which the passenger desires to go. He also punches out the amount of fare collected, and stamps them on the back with a dating stamp, which indicates the date and station. The one way coupon can be sold to any station where the fare is ten cents or more. The round trip tickets are sold to such stations where round trip rates are in effect. The round trip ticket has two coupons—one printed as the "first, or going coupon," and the other "second, or return coupon."

The agent makes daily return of his sales to the auditor, sending in the auditor's portion of the tickets sold, and these are checked with the conductors' returns or the passengers' portions of the tickets.

The object of this form of an agent's ticket is its simplicity—only two forms, one way and round trip. When a supply of these tickets is issued to any station, before sending same the station to which they are sent is stamped by the general passenger agent on the ticket where it reads "From .... Station."

We formerly used coupon and card tickets with the station printed in. This meant a complete set of coupon and card tickets for each station and a multiplicity of forms; but with this system, as we have said before, we have but two forms, and this ticket will soon be in effect on all of our interurban lines.

In addition to the tickets enumerated above, we have a few commutation tickets, to encourage summer travel to summer resorts; but these concessions are voluntary on the part of the company. Then we have some school tickets, required by franchise regulations for a reduced rate of fare in townships for school children—good only during school hours and on school days.

In the use of the present duplex and tear tickets we do not claim perfection; but our system is the best we have found applicable to our conditions, especially as a means of aiding inspectors in checking the conductors. The common practice of conductors all over the country is the re-issuing of the tickets, whether tear or duplex; but with our different colors—only good going north or south—and with our close inspection, the opportunities offered in this respect have been brought to a minimum. But our system necessitates quite a large clerical force in the accounting department for checking and auditing, but the information furnished and the results obtained are such that our people think the money is well spent for such services.

Proceedings of the Accountants' Association.

The report of the Thursday afternoon session of the Accountants' Association appeared in the "Daily Street Railway Review" for Friday, October 29th, page 705. At this session the president's address was presented, as was also the report of the secretary and treasurer and the first eleven questions of the Accountants' Question Box. The remaining questions were taken up at the Friday morning session and following this were the reports of the various committees appointed at the St. Louis convention.

The annual report of the standing committee on Standard Classification of Accounts, of which Mr. C. N. Duffy is chairman, included a very exhaustive compilation of answers received to questions numbered respectively 20 to 28, inclusive, regarding the changing of various accounts. Also nine additional questions, numbered 29 to 37 inclusive were asked through the Question Box, referred to the chairman of this committee and answered by him. Of these questions, No. 37 ("Do not interurban companies find present classification of accounts entirely inadequate?") was perhaps the most important, inasmuch as approximately 45 per cent of the membership of this association consists of interurban companies. The replies received to this question indicated that interurban companies do not find the present classification of accounts entirely inadequate, although a great many companies are in favor of having some changes made in a few accounts, the reasons given for these suggested changes being principally for the purpose of determining the cost of conducting freight and express business. In view of the result of this particular investigation the committee prepared a letter, a copy of which was sent to each of the members of the association on April 4, 1905. The questions propounded in this letter were five in number and are as follows:

"1. Are you in favor of having any change at all made in the present classification of accounts?

"2. If so, what are the specific changes that you recommend?

"3. Do you operate an interurban railway? If so, what recommendations would you make as to changing the present classification, with reference specifically to the accounts of an interurban railway?

"4. Should there be a standard subdivision of the present classification of accounts, construction and equipment, as well as operating, especially a standard subdivision of each one of the operating expense accounts of the present classification, with the idea of providing a uniform basis for comparing same?

"5. Do you use any subdivision of accounts? If so, please forward a copy of same."

There were only 37 replies received by the chairman of the committee; of these 22 answered "No" to question No. 1, and 12 answered "Yes". Of the 12 who replied in the affirmative, a large portion were interurban companies who desired such changes or amplifications as would cover specifically the operation of interurban roads. The reasons given for desiring changes were principally because of the desire to provide for a separation of the costs of conducting passenger, freight and express business. In the judgment of the committee the question of ascertaining the cost of conducting a freight, mail, or express business separate and distinct from a passenger business could be determined independently of any classification of accounts.

To question No. 2, 25 answered in the negative, 9 in the affirmative and 3 were non-committal. After a careful consideration of the replies received to these questions, the committee was unanimously of the opinion that the present classification of accounts should not be changed, the suggestions offered being deemed of insufficient importance to warrant the making of any changes.

On April 28th the committee attended a joint conference with the committee representing the National Association of Railway Commissioners, at which conference were presented the questions and answers just referred to and the position of the Accountants' Association committee as previously stated. The problem was thoroughly discussed and was heartily endorsed and approved of by the committee representing the National Association.

However, with the idea of keeping the standard system of accounting of this association in accord with the development of the art of electric railroading and with respect to formulating of a classification of accounts that will satisfactorily meet the requirements of any electric railway, the committee submitted recommendations as to the application of the present classification of accounts to the operation of interurban railways as follows:

(A). Provide subsidiary accounts for each of the 39 operating expense accounts, designating them respectively passenger, freight, mail, express.

(B). Charge to these subsidiary accounts such proportion of the total charges to the classification accounts, as will be proportionately correct.

The report of the committee on International Form of Report, of which Mr. C. N. Duffy is chairman, shows that the question of this report was taken up early in the year with the secretary of the Austrian association and copies of the accountants' form of report forwarded to him with the request that an endeavor be made to arrive at a form of report that would be international. The committee received in exchange the forms of reports issued by the International Union and accepted at its convention at Vienna last year. The committee thought, however, that owing to the difference in languages and the time lost in correspondence the matter should first be taken up with the associations in Great Britain. To this end a conference was held in New York City, between Mr. James Dalrymple, manager Glasgow Corporation Tramways, who is a chartered accountant and was the accountant and deputy manager of the company before becoming its manager, and this committee. Mr. Dalrymple formulated the suggested Standard Form of Tramway Accounts presented by him to the convention of the Municipal Tramway Association of Great Britain, held in Glasgow in 1903, and stated he had endeavored to adhere as closely as possible to the standard form which had been adopted by the electric railways and steam railroads of America and assured the committee that he would do everything in his power to co-operate in bringing about all that the association hoped to accomplish. The result of the conference was an understanding between Mr. Dalrymple and the committee that he would present the proposition of an international form of report before the convention of the Municipal Tramway Association and take up the question with other tramway associations. At the recent convention of the Municipal Association Mr. Dalrymple was unable to be present but the matter was brought to the attention of the covention by its secretary and by resolution of the convention, referred to its executive committee.

The committee to attend the convention of the National Association of Railway Commissioners held at Birmingham, Ala., Nov. 15, 16, and 17, 1904, reported that there was nothing special before the convention which affected matters concerning the Street Railway Accountants' Association of America other than the report of the committee on the "Classification of Construction and Equipment Expenses and Operating Expenses." The report was as follows:

"In pursuance of a resolution adopted at the ninth annual convention of the National Association of Railroad Commissioners, held in St. Louis, a committee of three, consisting of Hon. William O. Seymour, of Connecticut, Hon. Ashley W. Cole, of New York, and Hon. R. S. Kayler, of Ohio, was appointed to prepare a form of classification of the construction and operating expenses of electric railways.

"This committee had the co-operation of a committee representing the Street Railway Accountants' Association of America, and as a result of their labors a standard system of street railway accounting, covering the classification of operating expense accounts, was adopted at the convention held at Denver, Colo., in 1899. This classification has been adopted in several States, including New York, Illinois, Connecticut, Pennsylvania, Virginia, Vermont and Massachusetts.

"So far as your committee knows, this system has given general satisfaction, and we have no suggestions or changes to offer. [illegible] ing reports [illegible] mend the use of the [illegible] adopted by the [illegible], Me., in July, 1903."

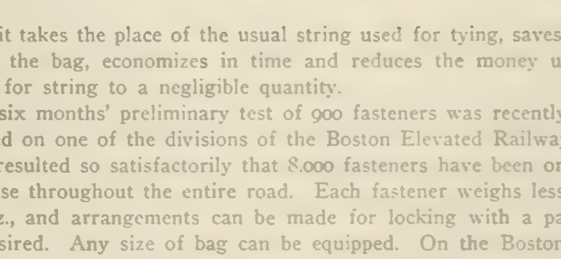
At this convention the accountants' committee reported what had transpired at its St. Louis convention and the National Association of Railway Commissioners authorized its committee to confer with the committee on the Street Railway Accountants' Association. At a conference between the committees representing the National Association of Railway Commissioners, the Association of American Railway Accounting Officers and the Street Railway Accountants' Association held in New York City on April 28, 1905, it was unanimously decided not to make any changes at present but it was deemed advisable that the representative committees of each association keep the proposition before them with the idea of ultimately formulating such changes or additions as would take care of the needs of all interests concerned.

The various papers presented at the meeting of the Street Railway Accountants' Association were read according to the program and will be found on other pages of this issue of the "Review." At this meeting the association decided without a dissenting vote to accept the new constitution of the American Street and Interurban Railway Association looking toward reorganization, the purposes and plans of the new body being outlined by President Ely, of the parent association. A feature of the convention of this association was the exhibit of blanks and forms prepared by Secretary White last year, to which many new blanks and forms of considerable interest and value to the members of the association had been added. In addition to this, four books showing the blanks of the four departments of the Public Service Corporation were shown. These were described in the "Daily Street Railway Review" for September 29th, page 707.

The usual resolutions of thanks were passed, and the election of officers followed.

A New Bag Fastener.

An interesting and effective device for fastening money bags has recently been brought out by Mr. G. A. Danielson of the Treasurer's Department, Boston Elevated Railway Co. The fastener, as illustrated, consists of a light piece of steel slotted to receive the bag and fitted with a pivoted steel key at its outer end. The bag is fed into the slot with the key up and at right angles to the stationary slotted piece, after which the key is pushed in parallel to the slot, locking the bag in position. The device is patented, and is easily put on and taken off. Some advantages claimed for this device are



[illegible]

that it takes the place of the usual string used for tying, saves wear upon the bag, economizes in time and reduces the money usually paid for string to a negligible quantity.

A six months' preliminary test of 900 fasteners was recently concluded on one of the divisions of the Boston Elevated Railway Co., and resulted so satisfactorily that 8,000 fasteners have been ordered for use throughout the entire road. Each fastener weighs less than ¼ oz., and arrangements can be made for locking with a padlock if desired. Any size of bag can be equipped. On the Boston Elevated the cost of string has amounted to several hundred dollars per year by the old method, and a marked saving is anticipated.

Association Officers for 1905-1906.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION.

President, W. Caryl Ely, Buffalo, N. Y.

First Vice-President, John I. Beggs, president, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

Second Vice-President, Calvin G. Goodrich, president, Minneapolis & St. Paul Suburban Railway Co.; vice-president and managing director, Twin City Rapid Transit Co., Minneapolis, Minn.

Third Vice-President, James F. Shaw, president, Boston & Worcester Electric Cos., Boston, Mass.

Secretary, B. V. Swenson, New York City.

Executive Committee: Under the new plan of organization the executive committee is made up of the officers of the American Street & Interurban Railway Association and presidents of the allied associations, which are as follows:

H. H. Adams, president American Railway Mechanical & Electrical Association;

S. L. Rhodes, president American Association Street Railway Claims Agents;

W. B. Brockway, president Street Railway Accountants' Association.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION.

President, W. B. Brockway, general auditor, Nashville Railway & Light Co., Yonkers, N. Y.

First Vice-President, P. S. Young, comptroller, Public Service Corporation of New Jersey, Newark, N. J.

Second Vice-President, Robert N. Wallis, treasurer, Fitchburg & Leominster Street Railway Co., Fitchburg, Mass.

Third Vice-President, H. A. Ferrandau, auditor and treasurer, New Orleans Railway & Light Co., New Orleans, La.

Secretary-Treasurer, Elmer M. White, assistant treasurer, Birmingham Railway & Light Co., Birmingham, Ala.

Executive Committee: W. G. Ross, managing director, Montreal Street Railway Co.; C. L. S. Tingley, 2nd vice-president, American Railways Co.; F. Dabney, assistant treasurer, Seattle Electric Co.; J. H. Pardee, general manager, Rochester & Eastern Rapid Ry.

MECHANICAL AND ELECTRICAL ASSOCIATION.

President, H. H. Adams, superintendent of shops, United Railways & Electric Co., Baltimore, Md.

First Vice-President, F. G. Simmons, superintendent of construction and maintenance of way, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.

Second Vice-President, J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Co., New York City.

Third Vice-President, Paul Winsor, Chief engineer motive power and rolling stock, Boston Elevated Ry., Boston.

Secretary-Treasurer, S. W. Mower, superintendent Rapid Railway Division, Detroit United Ry., Detroit, Mich.

Executive Committee: The Officers and W. S. Twining, chief engineer, Philadelphia Rapid Transit Co.; F. N. Bushnell, chief engineer, Rhode Island Co.; W. Boardman Reed, engineer maintenance of way and buildings, New York City Railway Co.; A. D. Campbell, master mechanic, Seattle Electric Co.

AMERICAN ASSOCIATION OF STREET RAILWAY CLAIM AGENTS.

President, S. L. Rhodes, claim agent Philadelphia Rapid Transit Co., Philadelphia, Pa.

First Vice-President, E. M. O'Connor, claim adjuster, Savannah Electric Co., Savannah, Ga.

Second Vice-President, Henry C. Bradley, claim agent, Chicago Union Traction Co., Chicago, Ill.

Third Vice-President, Andrew J. Farrel, claim agent, International Railway Co., Buffalo, N. Y.

Secretary-Treasurer, B. B. Davis, claim adjuster, Columbus Railway & Light Co., Columbus, Ohio.

Executive Committee: The Officers and W. H. Renand, jr., claim agent, New Orleans Railway & Light Co.; H. V. Drown, claim agent, the Rhode Island Co.; James R. Pratt, claim agent, United Railways & Electric Co.

MANUFACTURERS' ASSOCIATION.

Chairman Executive Committee, E. H. Baker, Galena Signal Oil Co., pro tem.

Secretary, George Keegan, assistant to the general manager, Interborough Rapid Transit Co., New York.

Executive Committee: John A. Brill, J. G. Brill Co.; Charles Knickerbocker, Griffin Wheel Co.; Fred S. Kenfield, Kenfield Publishing Co.; Charles K. King, Ohio Brass Co.; George J. Kobusch, St. Louis Car Co.; Charles C. Peirce, General Electric Co.; Howard F. Martin, Pennsylvania Steel Co.; James H. McGraw, McGraw Publishing Co.; John W. Nute, St. Louis Car Wheel Co.; Frank C. Randall, Allis-Chalmers Co.; Newcomb Carlton, Westinghouse Electric & Manufacturing Co.; William Wharton, Jr., Wm. Wharton, Jr., & Co.; W. H. Whiteside, Allis-Chalmers Co.; E. M. Williams, Sherwin-Williams Co.. J. R. Ellicott, Westinghouse Traction Brake Co.

Manufacturers' Vaudeville Entertainment.

The entertainments on Tuesday, Wednesday and Thursday of the convention week were mentioned in the columns of the "Daily Street Railway Review", published at that time. The entertainment on Friday consisted of a complimentary trolley ride through Fairmount Park by the delegates and attendants at the convention, as guests of the Fairmount Park Transportation Co. On Friday evening the vaudeville entertainment of the Manufacturers' Association was given at the Bellevue-Stratford hotel, talent for which was secured from the ranks of the members of the Manufacturers' Association. The program included music by the Electric Glee Club; French-Canadian dialect stories, by J. H. Stedman, of transfer fame; Col. Carteret, V. C., a dramatic sketch in one act produced by Jacob Wendell, Jr., Evert Jansen Wendell, George K. Denny and John T. Canover; character stories by Dwight B. Dean, given through the courtesy of the J. G. Brill Co.; comic songs by E. J. Wendell; lightning change sketch by Karl Andren, by courtesy of the Galena Signal Oil Co.; buck and wing dancing by R. H. Campbell, by courtesy of the Ohio Brass Co.; and a sketch by the Three Keatons of the Kieth's Theater. Following the vaudeville performance, the floor was cleared and dancing was enjoyed for the rest of the evening.

Membership A. R. M. & E. A.

In addition to the list of new members of the American Railway Mechanical & Electrical Association who have joined since the Philadelphia convention, published in the "Daily Street Railway Review" for September 29th, the following new members are reported:

George Keegan, assistant to the general manager, Interborough Rapid Transit Co., New York City.

Charles Hewitt, superintendent of motive power, Philadelphia Rapid Transit Co., Philadelphia, Pa.

C. B. Voynow, assistant engineer, Philadelphia Rapid Transit Co., Philadelphia, Pa.

J. B. Klumpp, engineer, The Rhode Island Co., Providence, R. I.

Seeing Seattle.

The Seattle Electric Railway Co., which has inaugurated an observation car service, has issued a handsome folder describing the various points of interest in and about the city, reached by its observation cars. One side of the folder is devoted to a bird's eye view of the city, upon which the lines of the company are drawn, from which it is seen that the city and its suburbs are well covered by the company's observation cars. The trip on these cars occupies about three hours, and each car is accompanied by a competent guide to point out and explain all points of interest, among which may be mentioned the business section of the city, the Great Northern docks, government canal between Ballard and Freemont, Green Lake, Capital Hill and Madrona Heights, from which a magnificent view of Lake Washington, Mount Ranier, and the Cascade range may be had.

Discussion in Abstract of Papers by Messrs. Charles F. Scott and W. B. Potter.

The papers presented by Messrs. Scott and Potter before the American Street Railway Association were published in the "Daily Street Railway Review," Sept. 20, 1905. At the conclusion of the reading of his paper Mr. Scott said:

The development of this system has not been undertaken merely for the purpose of supplying the street railway manager with a new device, but it has been a development to meet the needs of railway service. The direct current has reached its limitations. Its cost of installation is very high in certain cases, and it is because there is a growing demand for this class of new apparatus, that its development has been taken up, and I am sure that I voice the views of the engineers with whom I am associated when I say, as engineers, that we feel that this single-phase system should stand on its own feet; that it has a field. If you find that the direct current meets your requirements as well or better, you have no particular reason for adopting the single-phase system simply because it is novel. We believe, however, that on its own merits it will be found of very great value in the development of the railway work which you men have carried on at such a rapid rate. In other words, the engineers of the manufacturing company are not foisting a fad upon you, but have worked out a system to meet your own needs. We have reached that point where we feel that with our knowledge of the apparatus and with the experience which has been secured, it can now be presented to the operating street railway man as a perfectly feasible and practicable system.

Prof. W. E. Goldsborough.—As regards the scientific characteristics of the apparatus under discussion, I have for a long time felt that the alternating-current system was coming to the front, and that ultimately the single-phase sysem would take a place over all other systems. I believe I once had the pleasure of defending the single-phase motor at a discussion in Chicago of the single-phase system used for lighting at St. Louis, at a time when there were only two of us in the room who would say a good word for the single-phase motor. I do not believe any designer of electrical machinery today is satisfied in his own heart with the single-phase alternating current motor which he has to use. I say this in spite of the fact I do not know all the good things which the designers of this apparatus have in store for us. The fact that we can use a 220-volt motor with a larger commutator than that in direct-current machines is an indication in itself that we have better things to hope for, and I am confident in my own mind that in time, through insistent and persistent work on this problem, we will get a single-phase motor which will be more nearly analogous to the multi-phase motor and which will not have a commutator. A great many gentlemen in this room will say that I am wrong, and that the problem has been given up, but I still feel that, as there is a demand for it, necessity being the mother of invention, will produce the article we are all looking for. When it comes to the question of maintenance of equipment,, I feel that we should step aside and look the ground over carefully before we throw out direct-current equipment for alternating-current equipment. When you have a very large number of equipments operated on a rather restricted mileage, then you are confronted with a condition wherein maintenance is an important factor, and there is no question but that at this time it is much cheaper to maintain a direct-current system (I mean maintain the motive power equipment) than to maintain the alternating-current motive power equipment. On the other hand, if you are confronted with a great deal of mileage, and relatively small number of units running over the mileage, then maintenance is a matter of secondary consideration, and you can take long chances in the matter of maintenance for the reason that you are saving so much investment in copper and sub-stations and other things. I believe each of these problems is going to be met by the engineer and solved by the engineer, not for the sake of having a new thing—and we must grant that the American engineer and American people generally are enthusiastic for new things—but for the practical utility of these things.

C. O. Mailloux.—The principal lesson conveyed to me by some of the papers, and especially by this one of Mr. Scott's, is that we shall not go too hastily, and it teaches also the importance of good engineering, not only from the standpoint of the manufacturer, but more particularly from the standpoint of the operating company. It [illegible] true, that there is too little engineering done by the operating companies. The [illegible] the manufacturer, and to this is largely due the great number of [illegible] and should not, blame the engineers of the manufacturing companies if in doing their duty to their employers they sometimes consider the interests of the manufacturer too closely and those of the purchaser too remotely or indifferently. The practical application of the statement which I have made is this: that the present paper on single-phase alternating-current traction will, if nothing more, act as a wholesome check on the rather reckless or unwarranted introduction of the so-called alternating-current sub-station system of distribution which has been used for interurban work in many cases. While I have much faith in the single-phase system, I do not believe that the direct-current motor and the direct-current system is to be put on the shelf forthwith. The paper read shows the possibilities of a system inherently far better adapted to many cases that we know of in the west than the previous systems. This paper is opportune, because those who are assembled here might otherwise be tempted to make equally ridiculous mistakes as have been already made. They will be deterred from making such errors, and will either wait until the single-phase alternating-current system has been perfected sufficiently to warrant their full confidence, or if in doubt, will accept it in preference to the other in cases where the other has not proved a success.

G. D. Nicoll.—As stated in the paper, we began operating on the first day of January of this year. On the first of April we ran within four miles of Indianapolis, all of the operation being on alternating current. We were handicapped in getting into the city of Indianapolis on account of two overhead bridges which were so low that our cars could not pass under them. These were raised, and on the first of July we began operating into Indianapolis. The line then was 41 miles in length, 37 of which was on alternating-current, and the remaining four miles on direct-current in the city of Indianapolis. Up to the time we began operating into the city we had no trouble with the motor insulation. The worst trouble was the question of the transformer ventilation. This was overcome, but on operating the motors in the city of Indianapolis defects developed in the motor windings. These were also overcome, and we are having no further trouble. We are operating the highest schedule that is maintained in the State of Indiana, collecting our current by means of a bow trolley as outlined. We have experienced no trouble whatever with the bow trolley. I am not able to give any data as to the car mileage of the life of the shoe of the trolley, which is composed of wood, plated with aluminum, but it will suffice to say that the cost of operation and of renewing the shoe is not more than, and I consider it less than, would be the case with the ordinary trolley. In general terms I can say that we are well pleased with the operation of the equipment. Some minor changes have been made in the apparatus, but on the whole it is very satisfactory.

W. B. Potter.—The comparative expenditure for equipping a given project with single-phase alternating or direct-current aparatus can be accurately determined, but this comparison of first cost does not represent the net result of operation. The comparative maintenance cost of both systems should also be taken into account. The elimination of the rotary converter and the possibility of operating without sub-station attendants who have no other duties, is a credit in favor of the alternating-current equipment. The maintenance of the car equipment itself will, however, in all probability be more expensive for the alternating-current than for the direct-current equipment. There are several inherent features in the single-phase alternating-current motor which influence the question of maintenance, and to which I will briefly refer. The magnetism of the motor, like the current by which it is produced, is alternating in character and develops differences of potential in the windings of such a degree and character as to be more liable to prove injurious to the windings than in the case of the direct-current motor. For instance, should a single turn of the field winding in a direct-current motor become short circuited on itself, the effect would be simply to eliminate one turn of the field coil; while in the alternating-current motor a similar short circuit would cause that turn to act as a [illegible] current would be [illegible] which would

soon burn out the coil. The alternating magnetism also produces within the armature coils an e. m. f. which injuriously affects commutation and necessitates special provision being made to secure results comparable with direct-current practice. A feature essential to the communtation of the alternating-current motor is an additional field winding, known as the compensating winding, which is wound through the face of the pole pieces midway between the ordinary field coils, and serves to neutralize the armature reaction. In addition to this compensating winding in the fields the motor armature is sometimes provided with what are called high-resistance leads between the armature coils and the commutator. The effect of these leads is to diminish the local current in the armature, caused by short circuiting adjacent commutator segments by the brush. The location of the compensating winding in the pole faces renders it liable to injury in case the armature core should strike the pole pieces, and the presence of high resistance leads may, under some circumstances, result in severe local heating and burning out of the armature. The magnetism of the motor, owing to its alternating character, is of less average density than in a direct-current with the result that for a motor of given dimensions and output the armature speed is considerably higher. To keep the armature speed within the limits that direct current experience has shown to be advisable as affecting the performance of the bearings and a proper contact of the brushes with the commutator, it is necessary to make the alternating-current motor of larger size for the same output. The characteristics of an alternating-current motor, particularly the power factor, are affected by the air gap between the armature and pole pieces; better results being secured with a smaller gap. The alternating-current motors, as ordinarily designed, have an air gap of about one-half that commonly used in direct-current motors of the smaller sizes, and even a less percentage of air gap in the larger motors. We have, therefore, a tendency toward higher armature speeds and a smaller air gap, coupled with a field winding wound in the pole faces, conditions which necessitate a more frequent and careful inspection of the motors or else more frequent and expensive injuries to repair. It is probable that the maintenance of the control and other appliances will not differ materially from that of a direct-current equipment. The maintenance of the car equipment is, however, not a controlling factor in the cost of operation, and if it should be doubled, or even trebled, the alternating-motor maintenance may be far more than offset by the reduction in fixed charges resulting from a lower first cost of the proposition considered as a whole. The conditions which demand more frequent inspection, particularly of the motors, may presumably be a cause of more frequent interruptions in service; hence the importance of giving the alternating equipment more attention than is customary with direct-current motors must not be overlooked.

John I. Beggs.—I desire to ask a question on this subject of Mr. Potter, to see whether the answer will be as pronounced as was Mr. Scott's, when he expressed his views concerning the single-phase motor as to its present state of development and as to the advisability of adopting it on operating roads. Mr. Scott's paper has been of great interest to me. In one of the large street railway properties which I administer, we control everything in the state. We have interurban lines radiating almost like the spokes of a wheel at diagonal points. We bring our interurban cars, which is a large part of the business, into the center of the city. We must enter the city over 6 or 7 miles of track, operated by direct current. I have sent representatives during the past twelve months to investigate these various lines operated with alternating current, and we have had very conflicting reports concerning them. One of our most recent reports was to the effect that the system was so unsatisfactory that it was to be abandoned. We were contemplating trying the apparatus, but it has been very difficult until to-day to obtain data that the manufacturers were willing to stand behind. One of our representatives came back from one of the tours of investigation with the statement that after you got onto direct current the capacity of the motor was greatly reduced; that taking a 75-h. p. motor, which seems to be about the maximum size that it is practicable to get under the ordinary car which is used for both urban and interurban service, the capacity of the motor was cut down very greatly when brought onto the direct-current system. I now understand that is not the case, and that it has practically the same power at 600 volts that it has on the higher voltages on the alternating-current section of the city road. As we have present representatives of the engineering departments of both the large electrical manufacturing companies, I want to get some information from both. There seems to be some difference of opinion between the engineering and manufacturing side and the commercial side.

Mr. Potter.—I would say in reply to Mr. Beggs' question that there is no doubt that the alternating-current motors can perform any service now done by direct-current apparatus. I believe that fully; there is no question in my mind on that point. The proposition is simply a question of judgment and selection as to whether you should or should not use the alternating current.

Mr. Beggs.—That is the point. That is what perplexes me, as the man who takes the responsibility for an expenditure of money running into hundreds of thousands of dollars. It is a question which I have up now, whether I shall build at points, say, 35 miles distant from our main center of generating power, new power stations or depend upon this alternating-current single-phase motor, knowing that the heavy amount of the service in our case must be after the cars reach the 7 or 8 miles area where we have the direct current and where the trains are heavier.

Mr. Potter.—In replying to Mr. Beggs I would add that the question of judgment and selection as to whether alternating-current motors should or should not be used is mainly to the financial question, and not strictly an engineering proposition. Both these factors are, however, closely related, and while it is the latter which determines the former, it is the former, giving due consideration to all incident advantages, which should govern. The alternating-current motor when running on direct current will do even more work that it will on alternating current. A good alternating-current motor in a general sense is a most excellent direct-current motor, with respect to acceleration and heating.

Mr. Beggs.—The statement, as I gather from Mr. Scott's paper, as a matter of expenditure, it would cost less money to put in the composite system than to limit yourself to the direct current, in order to fit yourself with sub-stations and power plants at different points.

Mr. Potter.—It depends largely upon the relative cost of the car equipments, sub-stations and trolley conductors for any particular proposition. On a road of, say, 50 miles in length, employing few cars, the saving secured by the use of a high potential trolley would be so much greater than the additional cost of the alternating car equipments that there would be little question but that alternating-current apparatus would be more suitable for such a proposition. On a road of a few miles in length and having a number of cars per mile the relative cost of the alternating car equipment would be a much larger proportion of the total cost, and whatever saving could be made in the trolley conducting system would be relatively small.

Mr. Mailloux.—I think both of the gentlemen are right, though they do not express themselves in exactly the same terms. Let us define these terms, and the whole situation becomes clearer. Mr. Potter is correct when he says it is a question of finance, or it is a question of the financial analysis and estimation of many factors which bear upon and affect the operation of the road, but it is, unfortunately, one of those financial questions involving considerations, both technical and financial, which can only be properly handled by a competent engineer. That is what it means. If Mr. Potter had said it was a question of financial engineering, or of engineering finance, he would have made the statement a little more clear. To put it somewhat differently, we may say that the question, whether the equipment shall be alternating single-phase or whether it shall be a direct current, fed by sub-station systems, depends in general terms largely on the number of car miles run per mile of track. If we have a long track mileage and a small number of trains, that is to say, a very long headway—suppose, for instance, we have a line 35 miles long and expect to run only three round-trips a day—there is no question but that the single-phase system, even in the crudest form, would be the only thing to use. Those who have undertaken to solve the problem in such a case by the use of sub-stations are sorry now, or soon will be, for it. Again, to go to the other extreme, suppose we have a line of considerable length in miles, but with heavy traffic, with trains running on 10 minutes' headway, especially with double or four-track equipment, it is manifest that there is no question but that the three-phase alternating-

current transmission with direct current sub-stations would be the better plan. Evidently, between the two extreme cases just assumed, there is somewhere a particular case where the merits and demerits of the two systems nearly or quite fully compensate each other. In such cases the question which system should be adopted is one which cannot be answered offhand or by one person alone.

Mr. Hall.—In connection with this subject I will say that I rode on a single phase railway a few months ago—I think this may have some bearing upon Mr. Beggs' questions—and it took some 4 hours to make a trip which would, with the direct-current motor, not have taken more than about 2 hours. That was due to the speed of the car in ordinary running and also due to a lack of acceleration. The time it took to start was a great deal longer than to start on direct current. That is one of the difficulties which has been experienced and has possibly been overcome. My experience occurred a few months ago on a single-phase road, and I understand that the road is now in perfect operation and supposed to be satisfactory. In connection with Mr. Potter's paper I refer to one paragraph, in which he says: "To meet the requirements of the higher voltage now more commonly used, and to further insure the stability of the motor as regards flashing, it is now the practice to provide a greater number of commutator segments; that is, the voltage difference per commutator bar has been reduced to a lower figure." That paragraph in itself seems to my mind somewhat misleading. It seems to say that increasing the number of commutator bars in a given machine will reduce the liability to flashing. I beg to take some exception to that paragraph if I interpret it correctly, because a given motor with the one-turn winding, having 150 bars, would probably be a much poorer motor if it had 200 bars. Its motor power would be increased before its armature increased. Consequently, I should put this paragraph in just the opposite sense, and say if you reduce the number of commutator bars in a given machine that you improve the commutator because you reduce the reaction and increase the time of commutation. The bars I should leave out. That may have some bearing, but at the same time the motor could be improved by having the bars reduced.

Mr. Potter.—In reply, by way of explanation, I would say that my paper, in a sense, has briefly stated the fact without any idea of giving any particular explanations to the reason why. The time of commutation takes place when one section passes over the brush, and that depends more on the speed of the motor than on the width of the commutator segments. Incidentally, as to reducing the number of segments two results are secured—you have a lower speed armature, giving a lower speed commutation, and you have less difference potential between adjacent segments. The advantage of a decreased armature is more apparent in preventing the flashing at high speed, which results from the interruption of the current than it is in connection with the commutation at overloads.

Mr. Hall.—I take it your remarks apply to a motor of a given rating and given speed. Of course, if the speed is reduced at the same time the motor is different.

Mr. Beggs.—I ask whether, when the alternating-current motor runs as a direct-current motor, the acceleration of the alternating-current motor is as good as the direct-current motor?

Mr. Scott.—The rate of acceleration in the motor depends upon the rate of application of higher voltage to the motor; in other words, at the rate at which the controller is thrown on. The rate of acceleration on the alternating-current motor in some cases has been slow, because the controller was thrown on slowly. For example, on the Indianapolis road, if the controller handle, which is adapted to both direct and alternating current, should be turned at the same rate, it happens to give a much lower rate of acceleration on alternating current than on direct current. In order to get the same acceleration in the case of alternating current the controller should be moved faster. Some of the earlier motormen, who were accustomed to operate on direct current, operated in the same way with the alternating current, and got a slower acceleration for that reason. When the rate of the acceleration of the controller was increased the rate of acceleration of the car was increased also. Regarding the point brought up in which a visit to some road somewhere was made and conditions were found which were not equal to those in roads operated by direct current, I presume that the Indianapolis road was referred to in that case. I visited that road a number of months ago, and found that the schedule was as about stated, it took four hours to make the round trip [illegible] but I did not care to go any faster than we were running. The road had been laid in the winter time, and the original contour of the ground was somewhat rolling and the car rolled also. This had one very good effect, which was in the bow-trolley. The bow-trolley had some three feet of length of contact, and the car rolling back and forth made contact sometimes at one point and sometimes at another, and had an oscillation of some two feet or three feet. That was all right until the car tipped so far over the one side that the trolley left the trolley wire, and then there was apt to be trouble. That has been straightened out and things are running smoothly now at 60 miles per hour.

Mr. Mailloux.—I want to refer to a point not mentioned in the discussion, namely, the reference to artificial ventilation mentioned by Mr. Potter. I am glad to have that point mentioned by Mr. Potter, as I consider it very important, perhaps one of the points of greatest importance to street railway men at the present time. All street railway men are familiar with overheated motors, especially when they find themselves compelled to add another trailer to an overloaded motor that is already hauling one or two trailers. They find that the motors are overworked to the point where the poor things give up the ghost. In many cases, while the practice of adding trailers, which is always reprehensible, since it is often unavoidable, palliative measures are sought through the means of artificial ventilation, and if no extensive use of this means has yet been practically made, it is because it has not yet been developed sufficiently. I took up the matter with my associate, Mr. Gotshall, some years ago, out of necessity. We found ourselves compelled to resort to artificial motor ventilation, because we feared that we could not obtain the desired schedules on the New York & Port Chester railroad without it, since the largest motors then on the market were not of sufficiently large size. Since that time larger motors have been made, and it may not be necessary to resort to artificial ventilation when we get running, but the attention we gave the subject at that time showed conclusively that the same methods which we had in view could be successfully applied in many cases. I have been surprised in talking with street railway men to find the great necessity which actually exists for artificial motor ventilation. I am glad, therefore, to have the manufacturers who have good facilities for developing such methods as that take hold of it and see what can be done. I fear ventilation cannot be accomplished by means of ventilating fans. I think some means of producing a current of air having a greater pressure than is obtained from fans will be necessary. We contemplated using first the exhaust from the air brakes, and, secondly, a direct air stream taken from the auxiliary air brake tanks, which would mean that the air compressor would have to be made of larger capacity in order to afford sufficient air for ventilation, in addition to that required for the air brakes. I hope that even the ventilating fan will succeed, as it possibly will in large units. In the case of small motors under street cars I think it would be useless, but it is interesting to find that efforts are going to be made in that direction.

Hanshin Electric Railway.

In a recent consular report to the Government, U. S. Consul Sharp, of Kobe, Japan, writes:

The opening of the Hanshin Electric railway between Kobe and Osaka marked a great advance in electric traction in Japan, it being the first line constructed in this country to connect two large cities.

This railway is operated by the electric overhead trolley system with 1,600 kilowatts steam power, and covers a little more than 19 miles. There are in use at present 18 cars, which were made by the Nippon Sharyo Seizo Kaisha, of Nagoya, Japan, from a sample car imported from the United States. The cars are well made and have a seating capacity of about 50. The rails were imported from Pittsburg, Pa., and the electric motors were imported from Schenectady, N. Y.

The line is divided into four sections, the fare on each section being 2½ cents, these being subdivided into 1¼-cent journeys. All told there are 30 authorized stopping places between the ter- [illegible] off the cars.

Meeting An Emergency.

Events of great local interest almost invariably create business for the transportation lines serving the area affected and occasionally tax the carrying capacity of electric lines to the limit. Especially is this true if the point of interest is on a side line where the ordinary travel does not demand a great carrying capacity. If the event is in the nature of an accident or catastrophe no time for preparation can be had and the situation calls for quick and decisive work on the part of the operating department.

An occurrence illustrating this recently was experienced by the West Penn Railways Co., of which J. W. Brown is superintendent of transportation.

At nine o'clock on the morning of September 9th, three distinct explosions were felt throughout Fayette, Westmoreland and Greene counties. A moment later the general office of the West Penn Railways Co. at Connellsville was notified by the division superintendent at Uniontown that the Rand powder mills at Fairchance had exploded. The superintendent reported that the windows in his office, seven miles from the scene of the explosion, were blown in, and that circuit-breakers would not stay in at the substation, indicating that the lines were down. A rapid drive with horse and buggy to Fairchance brought into view the scene of the disaster as shown in the illustration. Track, poles, trolley, 2200-volt alternating, telephone and signal wires were all hopelessly tangled; the right of way was strewn with debris of every nature, while here and there pieces of clothing and shoes with remnants of human flesh still clinging to them bore mute evidence of the awful loss of life; 18 persons having been instantly killed and many wounded.

TRACK WRECKED BY POWDER MILL EXPLOSION.

The trolley wire was cut loose as soon as possible and in an hour and fifty-five minutes from time of the explosion electric cars were running to the scene of the catastrophe. Car after car was filled in a twinkling by those who had friends and relatives near the scene of the explosion. Cars were stopped a quarter of a mile from the scene, as 600 kegs of powder and a car load of dynamite were still in the fire zone. Superintendents, dispatchers, engineers, line and track foremen with their gangs were soon on the ground and 100 men were put to work rebuilding the line. On the following day, Sunday, the registers on the Fairchance line showed a total of over 25,000 fares, the ordinary schedule on this line being one single truck car every 40 minutes. This illustrates how greatly the service had to be augmented to meet the demands of the curious public who were anxious to see devastation wrought by the explosion of 16,000 kegs of powder.

The St. Joseph Valley Traction Co. began regular passenger service on its line between LaGrange and Middlebury, Ia., September 20th.

Fakirs, Malingerers and Ambulance Chasers.*

BY JAMES R. PRATT, CLAIM AGENT, UNITED RAILWAYS & ELECTRIC CO.

Sometime ago I received a notice from the secretary of your association, requesting me to come to Philadelphia prepared to make a few remarks upon the subject of fakirs, malingerers and ambulance chasers. That all of these people exist is well known to every one who has had any experience in the adjustment of damage cases. The methods pursued by them to secure money by dishonorable means is so well known to every claim agent that I deem it hardly necessary to occupy your time by describing the various channels through which they must work before securing either a settlement or a verdict. I will, therefore, mainly confine myself to some suggestions which may be of value in eliminating this class of people.

Fakirs and Malingerers.

Fakirs may be divided into two classes: the criminal fakir, who starts out with the intention of deliberately getting injured for the purpose of securing money, and the malingerer, or injury fakir. In most cases those who fake accidents work in twos or threes, and conspire to defraud railway companies, public service corporations and quasi-public service corporations. They properly belong to the lower class of criminals and, like murderers, will almost invariably leave some loop-hole whereby, with persistent effort, they are eventually brought to justice. A system of photographing suspicious claimants, who may be classed as floaters, or persons who have no permanent place of abode, would probably aid much in eliminating accident fakirs.

The injury fakir or malingerer is by far the most dangerous of any class of crooks with which defendants in damage cases have to contend. Morally, these people ought to be looked down upon and despised with more contempt than a common thief because they have it in their power, when trained by legal and medical minds, to perpetrate fathomless frauds. It frequently happens that a person, honest in the ordinary walks of life, is very slightly injured in an accident. At first he pays little attention to the injury but upon reaching home and conversing with friends, many of them newly discovered among the legal fraternity since his misfortune, he is advised to take some action against the person or company through whose agency the accident occurred. The injured party at first thinks he has no case because he does not feel that there is any responsibility on the part of the person or corporation connected with the accident, and makes a statement as to how the accident occurred which would tend to relieve the person or corporation from any liability whatever. His friends talk to him and advise him that he should take some action, to which advice he listens, and, in the language of the street, sees a chance to make "easy money." If his mind is once made up to this, he at once lends himself to the unscrupulous, and I must say, dishonest lawyer, medical man and ambulance chaser, and he is willing then to testify to anything that is necessary to make out a case of negligence; his medical man is willing to testify to all kinds of serious and permanent injuries, such as shock to the nervous system, spinal trouble, floating kidneys, pains in various parts of the body, loss of sleep, and if the injured party be a child, one of the favorite pieces of testimony produced by the parents and medical man is absentmindedness. The testimony sometimes shows that the child is sent to a grocery store to get a pitcher of milk and asks for a pitcher of water; again it is sent for bread and asks for butter; all of which I have heard parents and medical men testify to in court. It is really very pathetic to see how easily some plaintiff's consciences fade away at the trial of a damage case.

Then there are the people who meet with an accident and who are only slightly injured but, aided through a process of mental suggestion by those who traffic in injuries, finally honestly believe that the injuries are serious and brood over the accident until they suffer from melancholia or perhaps become hysterical. These people are often difficult to deal with, and much depends upon the character and ability of the attending physician. They may be

*Read before the American Association of Street Railway Claim Agents, Philadelphia, Sept. 26, 1905.

attended by a physician who is perfectly honest, but who belongs to that class of medical men known as "alarmists," and who is afraid that the injury is going to prove permanent and serious. On the other hand, frequent cases have come before us where the physician was an "alarmist" for a consideration too. If the physician is honest and is only alarmed at the seriousness of the case, it usually follows that he is a man with a limited practice and has not had much, if any, hospital experience. In this connection I might add that the medical men who are the most competent to treat accident cases are those who have had a large hospital experience. They see accident cases in every form daily. Medical experts advise us that the best way to deal with people who are alarmed about their condition is to engage them in some occupation which will not leave their minds free to dwell upon their ailments, real or imaginary. Statistics show that a passenger who is injured by the negligence of a carrier does not recover from his injuries as speedily as an employe who is injured by the negligence of a fellow servant and has no legal right of recovery, which indicates to what extent mind is controlled by matter. A man who has no right to recover in damages recovers in health almost twice as rapidly as his more or less fortunate brother.

Ambulance Chasers.

The ambulance chaser is one of the most aggressive and progressive individuals with which society of the present day has to deal. He is very eager for business, his nerve and audacity are unlimited, and his persistence is worthy of a better cause. To my mind, there is no reason why such a person should exist today, but the main question in many states is how to eliminate him.

The ambulance chaser or shyster lawyer as soon as he hears of an accident either through the press, reports at police stations, or by any one of the various channels through which his information comes, goes at once to the home of the injured party, if taken home, or to the hospital if he be taken there. The injured party is advised of the gross negligence on the part of the person or corporation connected with the accident, and is told what an excellent chance he has to recover damages. The rivalry between ambulance chasers is such that the methods pursued by them are very unique, to say the least.. In Baltimore, one of the most persistent ambulance chasers that ever existed usually goes to see the injured party, representing that a client or friend of his has witnesses to the accident and that he, the ambulance chaser, has secured the names of several witnesses and could prove a strong case of negligence, but unless the case were given to him, the witnesses would not be forthcoming. The injured party naturally feels that he should give his case to the one who is in the best position to prove it. The ambulance chaser, of course, has no witnesses, but uses this pretense in order to get the case. Owing to the various attacks made on the shyster lawyer he is beginning to recognize the danger of continuing to solicit cases himself or of even employing a regularly paid runner and he is therefore beginning to devise new methods of getting business. One of the favorite methods which the ambulance chaser pursues in order to influence the minds of injured parties is to carry with him newspaper clippings containing accounts of the verdicts which his shyster lawyer has recovered, and then presents a contract which reads as follows:

"I, Peter Plaintiff, hereby employ John Smith, attorney-in-fact, who agrees to employ John Brown, attorney-at-law, to prosecute my case against Daniel Defendant for injuries received by me, blank date, blank time, blank place, and I further agree to pay said John Smith, attorney-in-fact, 50 per cent of such sum of money as I may recover either by way of verdict or compromise; and I further certify that I sent for the said John Smith, attorney-in-fact, and requested him to take my case and that he did not come to my house before I sent for him.

(Signed) Peter Plaintiff."

When this is done the question of how the accident occurred is discussed. The description of the accident given by the injured party may be such as would prevent his recovery. The ambulance chaser then says: "On your own statement you have not much of a case, but if the accident had happened in this way, etc., (describing a case of negligence), you would have no trouble in recovering." The injured party begins to study over it, and finally [illegible] what the lawyer [illegible] to say in his [illegible] while boarding or alighting [illegible] that he [illegible] when the car was suddenly started and he was precipitated to the ground and [illegible] ignorant people. Frequently when we hear in court descriptions of an accident, the wording of which is identical with the language used in our appellate court decisions where the plaintiffs were permitted to recover. But often in cases against the railway company we hear the plaintiffs testify that they stopped, looked and listened--those watch words which the courts have written over the doors to the steam railroad companies' treasuries—those words throw open the doors and they step in and recover damages. From this it may be seen that the ambulance chaser is not only guilty of common law barratry, but of the more serious crime of subordination of perjury. These people are the most difficult class to eliminate, and for myself, I would rather deal with a criminal fakir than with an ambulance chaser and an unscrupulous lawyer.

One of the favorite methods pursued now by shyster lawyers is to have a number of steerers located in different parts of the city; the steerer is usually a person engaged in some occupation, and as soon as he hears of an accident he proceeds to the nearest telephone and informs the shyster lawyer, giving him the name and address of the injured party. The shyster upon receipt of this message goes at once to the home of the injured party and states that he was sent for; when pinned down to it he does not know by whom, but presumes it was the injured man himself or one of his relatives or friends. He immediately starts the usual line of talk in order to get a 50 per cent contract. When an effort is made to get at the shyster lawyer for this kind of practice he invariably states that he was sent for, sometimes claiming the injured party sent for him, oftener he cannot remember just who it was. This also applies to physicians who make a practice of testifying for plaintiffs. Frequently, when one of these physicians in on the witness stand, under oath, an effort is made by the defendant's counsel to show the connection which exists between the plaintiff's counsel and the expert medical witness, but the medical man never has any recollection of who called him to attend the plaintiff other than that the message came by 'phone. From this it is very evident to any fair mind that this kind of a medical witness has no regard for the sanctity of an oath.

Nor has this practice even the redeeming feature of being a blessing in disguise to those whom the shysters approach. It is true, perhaps, that in some genuine cases of injury where the people would be entitled to recover they are too ignorant to make claim for redress, but in these days of damage suit enlightenment the ignorance of a man injured by a railroad or railway company who does not understand that he may bring a suit, is indeed, the acme of ignorance, and the enlightenment of the Russian peasant will shine brightly beside the darkness of the ignorance of such a man.

Of course, some people are benefitted pecuniarily by the shyster lawyer who persuades them to bring suit; but these are the people who know they have no right of action and can be benefitted only by their own fraud. The party who has honestly suffered an injury can get a "square deal" and a larger return by dealing directly with the companies themselves, or if they refuse them, through an honest, reputable lawyer than by the best of the shyster lawyers, who not only under contract take 50 per cent of the amount recovered, but by the most dishonorable methods generally manages to absorb the lion's share of the claim or verdict. I think it can hardly be questioned that it would be much to the benefit of the honest claimant to have the shyster lawyer and ambulance chaser behind the bars.

It has not been so many decades ago that the legal profession was a liberal profession and solicitation of cases was a criminal offense at common law. It may still be so in many of the states. It was made a criminal offense, not because of any gentleness toward the profession or toward those who have committed an injury, but for the protection of the community. Nothing was deemed to be more injurious to the community than constant litigation which broke into the peace of the community, stirred up conflicts among

the people, and found its way into the sacredness of home life. The lawyer, therefore, in those days who dared to approach an individual unsolicited with a suggestion of litigation was not only debarred by his professional brethren from further practice, but found his way into the common jail. It may or may not be a criminal offense at common law today, but the principle of the protection of the community of the days of common law which made it a criminal offense, is still an abiding principle in our larger and more complex life of today.

But the question, however, which most concerns us now is not so much the methods pursued by fakirs, maligners and ambulance chasers to obtain money dishonestly or how to meet them, as how to eliminate them. Under the conditions which exist in politics today, it is doubtful if the shyster and ambulance chaser can be entirely eliminated, but with constant effort and united action it seems to me there could be some method devised by which they could at least be kept in check. The reputable lawyer and physician with a fearless and absolutely fair-minded jury can do much to relieve the existing conditions. It should be the duty of an attending physician as soon as he finds that a claimant is faking an injury to advise him at once that he will have nothing further to do with the case unless the claimant makes up his mind to act fairly and honestly.

When it comes to actual fight at the trial there are a number of little practices that constant study will produce and which often give good results. In cases where it is suspected that the plaintiff and his witnesses will testify to such facts as might be necessary to prove their case, it is very desirable that the witnesses be excluded from the court room. I have seen this worked successfully; in fact I recall one case—a wagon collision—in which no two of the witnesses could tell the same story, some of them had the wagon going in so many different directions and the car going in two directions, that the jury just laughed at them.

Under the decisions of our own courts and of the United States Supreme Court, the court cannot compel the plaintiff in a damage suit to submit to a physical examination, but our courts have held that if the application is made and the plaintiff refuses to submit to an examination, his refusal is a matter that can be argued before the jury. It has been found desirable when a case is first called in open court to make an offer in the presence of the jury to have the plaintiff examined by any physician whom the court might name. If the plaintiff refuses, it should be an indication to the jury that the injuries are not genuine. Satisfactory results have been obtained by this method.

Reputable lawyers, by united and concerted action can accomplish much toward breaking up the practice which prevails in most parts of the country in damage cases, many of which practically amount to blackmail, to which end I would offer the following suggestions:

1. That an organization composed of a committee of young, active and aggressive lawyers, to be known as a "vigilance committee," be formed in every large city. This committee should gather all information possible in relation to the practices pursued by shyster lawyers, unscrupulous physicians and ambulance chasers, and should keep a record of the testimony given by unscrupulous physicians who make a practice of testifying in cases as to serious and permanent hidden injuries; also keep a card index of all professional and suspicious witnesses, whether medical or otherwise, and report this, with any other information bearing on the subject which they may be able to gather, to the supreme bench of their respective cities. This committee should be composed of men who are absolutely honest and absolutely fearless and who would not be afraid of a little criticism from the under element of the Bar.

2. The passage of a law by the legislatures of the various states, which would not only disbar and punish the shyster lawyers who persistently gun cases, but also punish the common ambulance chaser, who, under existing conditions, is practically absolved from any criminal action whatever. He is not a member of the bar, but is one of the greatest curses with which the community has to deal. Such a bill should meet with the approval of the better element of the bar in all states and can only be opposed by the shyster lawyer and his followers.

3. In the event of the failure of the previous suggestions, the passage of a law by the legislatures of the various states which would require plaintiffs in all cases before instituting suit to deposit with the clerk of the court in which the suit is brought, an amount of money estimated to be sufficient to cover the costs of the suit, or to give security for like amount, said security to be approved by the clerk of the court in which the suit is filed. This in some cases might work a hardship, because it is undoubtedly true that there are honest people who receive bona fide injuries and who have a right of action who are not financially able to deposit the amount of costs, or to give security for same. This objection might be overcome by the adoption by the various states of an act of congress which authorizes the bringing of a suit In Forma Pauperis. A still better method probably would be a law making the attorneys who bring the suits personally responsible for the costs. This, to my mind, would be the most effectual means of driving the shyster lawyer from the court house or "temple of justice," as he chooses to call it.

The ambulance chaser and the shyster lawyer are a menace to society, an obstruction to business and a curse to the legal profession; they prowl around like hungry wolves seeking whose property they may devour. The question may well be asked, "Is a man, even in the humbler walks of life, who by industry and thrift has saved enough to procure a home for himself and family, secure?" The ambulance chaser and shyster lawyer first leveled their guns at steam railroads and street railways, as this class of defendants comes in contact with a greater number of people than any other public corporation. The work of the ambulance chaser was gradually extended until it embraced private corporations, manufacturing establishments, large mercantile houses which are compelled to employ a great many persons, and the retail dealer who may employ only a few clerks and drivers.

Today the shyster lawyer finds his way into the home and drags into court the ugly petty quarrels of the family, that would have otherwise been quietly and easily settled but for his bestial presence.

As the object of this association is to overcome this evil, I would respectfully suggest and most earnestly urge that no effort be spared for the elimination of the fakir, the injury fakir or malingerer, the shyster lawyer, the ambulance chaser and the unscrupulous doctor. When these factors are eliminated there willl be a very noticeable decrease in the number of claims filed and suits instituted. The three most able factors in combatting this modern evil are the honest lawyer, the honest physician and the public press.

Interstate Tunnel Railway Co.

Articles of incorporation were filed simultaneously at Albany and Trenton, September 20th, of the Interstate Tunnel Railway Co., of New York, and the Interstate Tunnel Railway Co., of New Jersey. The incorporators are Thomas N. McCarter, Charles A. Sterling, Albert B. Carlton, Mark T. Cox, John B. McDonald, Herbert H. Vreeland, John D. Crimmins, Robert A. C. Smith and Henry D. MacDona. The companies will be operated as a single traction concern for the mutual benefit of the New York City Railway Co., formerly the Metropolitan, and the Public Service Corporation of New Jersey.

These companies have been organized for the purpose of constructing a tunnel under the North River from the terminus in Jersey City, at Erie and Twelfth Sts., to a terminus under Chambers St., between Broadway and the Brooklyn Bridge terminal, in the Borough of Manhattan, and to provide thereby better means of communication between the business portions of the city of New York and the territory served by the Public Service Corporation, which operates all the surface lines in the counties of Hudson, Essex, Passaic, Union, and Middlesex, in New Jersey. The Public Service Corporation proposes to supplement its existing facilities in New Jersey by a new direct high-speed line from Newark, with communication, without changes, to the proposed tunnel in Jersey City, thus affording direct transportation from its terminus in Newark to the city hall in New York in 20 minutes. Arrangements have also been made for a joint passenger station at Jersey City, which will enable the Erie Railroad Co. to transfer its suburban passengers to the proposed tunnel line. The location of the proposed tunnel at the Manhattan end has been made with a view to furnishing the best possible facilities for the distribution of the traffic not only by means of the 520 miles of the metropolitan surface lines, but also by the proposed new rapid transit subways recently laid out by the Board of Rapid Transit Commissioners.

Question Box of the Mechanical and Electrical Association.

COMPILED BY [illegible] WALTER MOWER, [illegible]

As an indication of the interest taken by our members in making this feature of the convention a success, 47 questions were received prior to June 15th, the greater number of which are here answered.

In some cases there is a decided difference of opinion—some do, some do not—certain things are costing one more than another, etc. In most instances the reasons have been carefully stated, and before the convention, there will be time for those who do not to investigate the reasonableness of the statements of those who do, and be prepared at that time to ask more questions, or to more positively defend their position.

For this is the primary object of the Question Box: to stimulate healthy discussion on miscellaneous subjects.

Therefore, while in its present condition it is partially complete and contains many valuable ideas, it will not have accomplished its full purpose until it has been discussed at the convention, and further replies in writing have been added.

As the time allowed for the consideration of the Question Box will undoubtedly be limited, it will be necessary to dispense with the reading of the printed answers, and I would respectfully suggest that members prepare themselves to open, or enter into the discussion of the various questions by reading them carefully before coming to the meetings.

The figure after each answer indicates the name of the writer, corresponding with the figure opposite his name in the list following.

Very respectfully,

S. W. MOWER, Secretary.

No. 1. C. F. Baker, superintendent of motive power and machinery, Boston Elevated Railway Co., Boston, Mass.
No. 2. F. F. Bodler, master mechanic, United Railroads of San Francisco, San Francisco, Cal.
No. 3. D. W. Dozier, chief engineer, Twin City Rapid Transit Co., Minneapolis, Minn.
No. 4. T. M. DuBois, master mechanic, Syracuse Rapid Transit Co., Syracuse, N. Y.
No. 5. E. E. Franklin, master mechanic, Portland Consolidated Railway Co., Portland, Ore.
No. 6. J. M. King, master mechanic, Danville Railway & Electric Co., Danville, Va.
No. 7. W. H. McAloney, superintendent of rolling stock, Denver City Tramway Co., Denver, Col.
No. 8. Wm. Pestell, chief engineer, San Juan Light & Transit Co., New York, N. Y.
No. 9. W. Boardman Reed, engineer maintenance of way and buildings, New York City Railway Co., New York.
No. 10. P. J. Mitten, superintendent of overhead construction, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
No. 11. G. J. Smith, master mechanic, Metropolitan Street Railway Co., Kansas City, Mo.
No. 12. J. L. Sullivan, master mechanic, St. Francois County Railway Co., Farmington, Mo.
No. 13. W. Wallerstedt, engineer of car equipment, Interborough Rapid Transit Co., New York, N. Y.
No. 14. E. T. Munger, master mechanic, Metropolitan West Side Elevated Ry. Co., Chicago, Ill.

1. What is the best composition to use in setting an engine bed on its foundation?

The best method of setting an engine bed on its foundation is to grout it onto the foundation with portland cement. The cement should be mixed one-half cement and one-half sand, and poured through a high gate in order to give it pressure to fill up thoroughly under the bed plate. The engine should be staked up, and leveled to the proper height and lined before pouring the cement. For the same purpose, rust joints made from cast iron borings and driven or calked under, after the engine has been leveled and lined up, are often used. No. 3.

2. What are the arguments for and against a solid spider in large generators?

1. The spider divided into two or more parts has the advantage of being less liable to shrinkage strain than it would be if cast in one piece. It is also more easily handled and transported, and requires less apparatus to place it on the shaft.

The advantage of the [illegible] and also in the fact that the [illegible] without interfering with the [illegible] no value with a large [illegible], the spider which has been assembled in parts, can be made as strong and rigid as the solid [illegible]. No. 1.

2. Some of the arguments in favor of solid spiders in large alternating current generators are:

1st. Greater [illegible]

2nd. The fly-wheel and rotating portion of the generator are combined into one piece, making a simpler design.

3rd. When the fly-wheel and rotating element of the generator are combined, it does not require as long a shaft and concentrates the load at one point, thus allowing a shorter distance between bearings. The reduction in length of shaft allows of greater strength and cheaper shaft construction.

Some of the points against the use of a solid spider are:

1st. Greater weight is required to obtain sufficient fly-wheel effect on account of the metal being nearer the shaft. If the same weight is concentrated in the rim, the rotating moment is, of course, greatly increased. Owing to the design of a solid spider, it is usually necessary to make it of materials which can be built up instead of casting it in two or more sections.

2nd. The use of a solid spider in the ordinary alternating current generator usually requires an abnormal diameter or an excessive weight of rotating element in order to obtain the required fly-wheel effect.

If this question refers to solid spiders as against split hub and spider, then some of the arguments for and against solid spiders are:

1st. Solid spiders give greater rigidity, and, if no internal strains exist, due to shrinkage in cooling, they are much stronger than split spiders of the same weight.

Some disadvantages of the solid spider are:

1st. That it requires a press to place it on the shaft when being erected.

2nd. A single large casting is more difficult to produce, and heavier to handle.

3rd. If a solid cast spider is not free from internal strains, it is quite probable that the split spider will be the stronger of the two. No. 8.

3. The principal objections to a solid spider in a generator are: In large generators the excessive weight causes great trouble in transportation. The great weight also makes the solid spider (for large units) expensive and difficult to erect at the power station, as it must be pulled over the engine shaft by special devices and put into place by the help of hydraulic rams of 400 or 500 tons capacity for the largest generators. In the case of the split spider, it can be bolted together around the shaft, and is, of course, much easier and less expensive to handle, both in transportation and erection. The split spider, however, costs considerably more to make than the solid spider. For small units the solid spider is undoubtedly preferable to the split spider, while in large sizes the split spider is probably the more satisfactory and economical. No. 3.

3. What is the best kind and grade of carbon brush for a 550-volt direct current generator, and what has been the experience with the various grades?

The grade of carbon brush to be used on a generator can best be determined by trial. A brush which works satisfactorily on one generator may not be at all suitable for another. A low grade carbon brush can be used with good results on but few 500-volt generators where overloads are carried.

The brush from which we have obtained the best service is a high grade brush which contains a small percentage of graphite. The condition of load and inherent characteristics of the generator determine which brush is best. No. 1.

4. Which is the better form of brush holder for a generator: one in which the carbon is free to move up and down, necessitating the current passing the entire length of the brush and being taken from the tip; or a holder which firmly grips the brush, and is de-

signed with elasticity enough to allow of the brush following the commutator?

1. We have a large number of generators using various kinds of brush holders. From my observation I am of the opinion that a brush which is firmly gripped by a holder which has spring enough to hold the brush on the commutator with the proper pressure, gives up and down i.. a holder which only serves as a guide.

Almost any holder is satisfactory during light loads, but it requires a good holder and brush to give satisfactory service during times of overload and abnormal conditions. A brush which is held in a holder that merely serves as a guide is very apt to give trouble, due to area of contact between brush and pigtail not being great enough, which causes the pigtail to burn off.

Again, if the brush has a soldered cap on the end, it is not unusual for this cap to become unsoldered owing to the brush heating up. If a holder is used which firmly grips the brush, troubles similar to the above do not occur. No. 1.

2. I think a brush holder that firmly grips the brush the best form of holder if designed so as to make quick changes when necessary to change brushes. No. 6.

---

5. Does a storage battery working in conjunction with a power house with moderately fluctuating loads, show an ultimate economy?

The advantages of a storage battery working in conjunction with a power station with moderately fluctuating loads depends to a great extent upon the total capacity of the station. If the plant is small and has but a few generating units, a battery is sometimes very useful for carrying the peak and light loads, and can also be used as a standby in case of accident to any of the generating apparatus.

If the station is a large one, the principal use of a storage battery is to take the momentary fluctuations, but when these fluctuations are small as compared with the size of a generating unit, the first cost and maintenance of a battery having sufficient capacity to carry the peak load or to be of use as a standby is usually too great to warrant its installation. When greater capacity is needed in a large station having a moderately fluctuating load, it is usually found advisable to install additional generating apparatus instead of storage batteries.

Frequently the battery is useful as an insurance against interruption to service, due to its ability to supply sudden demands in case of breakdown to generating units or cables, and the value of this as an insurance may entirely outweigh the question of first cost and economy. No. 8.

---

6. What is a good cleaner for slate switchboards, where burned around the circuit breakers?

First clean off with sand-paper; then give one coat of any good filler that will not carry current. When dry, putty up all uneven surfaces, using good, hard drying putty. Rub down with rock pumice stone, clean off and give one or two coats of color, give two coats of japan, varnish, after thoroughly dry, polish in the usual way. A good polish can be made from butter of antimony and raw oil. No. 14.

---

7. What economies are shown by buying coal on specification of high calorific value contracts?

The buying on coal on specification of high calorific value contracts is done to protect the purchaser by keeping the coal up to the contract standard, with a penalty of a rebate for every B. t. u. below the number of units stipulated in the contract. Otherwise there would be practically no way to prevent the seller from supplying coal of a very much inferior grade than that considered when the contract was made. In a number of power stations, when coal is bought as above, every cargo or car of coal is tested for its calorific value at the station when received. No. 3.

---

8. Does the advantage obtained from the use of "Phono-Electric" trolley wire outweigh the disadvantage experienced on account of its reduced conductivity?

The advantages obtained from the use of "Phono-Electric" trolley wire depend primarily upon the amount of traffic over and the curvature of the line. Its use is desirable on curves in practically all cases, as the length of wire in use for such purposes does not materially affect the resistance of the whole line, and with the ordinary sizes of trolley wire it has sufficient conductivity for all practical purposes. Wherever the conductivity may not be sufficient, it is advisable to erect feed wire in connection with it. The "Phono-Electric" wire has sufficiently increased wearing qualities to warrant further investment for feed wire, as the interest and maintenance charge will be much less with this arrangement than with the common trolley wire used alone.

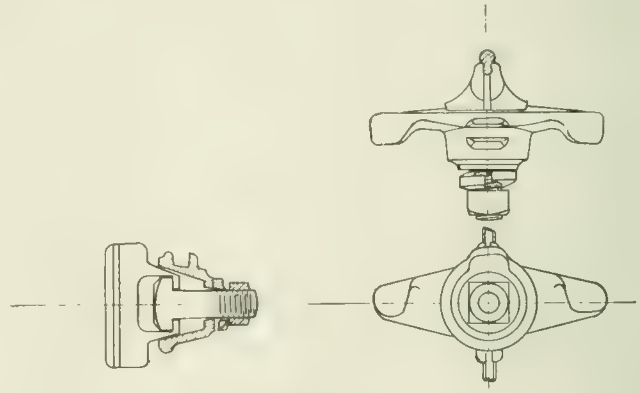
Its use on straight lines is only advisable where cars are running on very short headway, in which case sufficient feed wire may be erected to take care of the difference in resistance between the "Phono-Electric" and hard drawn trolley wire, the increased interest being easily taken care of by the difference in maintenance as above No. 8.

---

9. What style of trolley ear do you recommend? What are the points of advantage of the "Clinch," "Semi-clinch," soldered ear, etc.?

The best, for all purposes, is the mechanical clamp ear, being easily attached to the wire during construction and permitting of ready adjustment when overhauling and tightening trolley wire.

By using the combination of ear and hanger, as shown (thus bringing the span wire in close proximity with the trolley wire), a very short ear may be employed, and the possibility of kinking trolley wires at hangers is then obviated. The employment of a flexible suspension, permitting the hanger to move readily in a



MILWAUKEE TROLLEY HANGER.

vertical direction, and slightly horizontally, will overcome the difficulty arising from fraction due to crystallization of trolley wire at the point of the ear.

A soldered ear should never be used. The heat necessary to attach softens the wire at its most vital point. No. 10.

---

10. What is the most common cause of flash-overs on small four-pole motors?

There are several causes for this: Weak fields, due to insulation rotting from the wires, causing them to come together, and shortening the field; brush holders not spaced to cover the exact number of bars on the commutator or placed to one side. They should point exactly to the center of the armature shaft; otherwise, as the commutator wears down they will throw out of line, covering the wrong bars on the commutator.

Proper care should be taken in winding armatures to get the commutator bars perfectly lined with the slot in the armature core, and the proper lead from the coil to the proper bar in the commutator; otherwise with the coil lead one bar either way it will give the same effect as with the brush holders a little to one side, causing the brush holders to flash over. No. 4.

---

11. What is the best method of inspecting motors for low bearings?

1. By going over the motor shell carefully immediately after coming in from service and feeling of it on all sides, should one side be warmer than the other it would denote that the armature is crowding that side and touching slightly. By careful inspection, it may be discovered in this way before doing any injury to the armature. No. 4.

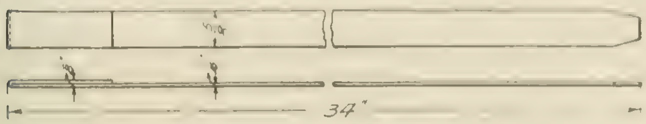
2. Most motors are now designed with a removable cover on the bottom shell at the commutator end, whereby free access is obtained to gage the air gap between the armature and bottom field pole.

A simple gage for this purpose, consisting of a piece of spring brass about 1/32-in. thick with a width of ¾-in and long enough to

reach the full length of the pole, has been used to advantage. By riveting a small piece of brass on each end, the gage can be used in inspecting the standard as well as the minimum air gap allowed. No. 13.

3. Cars should be run over the pit at least twice a month, and the clearance between armature and pole piece inspected, by removing clearance cover from lower half of motor casing. All bolts and the condition of grease boxes should be examined at the same time. On an interurban road motors should be inspected as often as is possible, but must not be allowed to run over one week without inspection. No. 12.

4. G. E. 58 motors can oftentimes be satisfactorily inspected by taking a "candle look" through the hand holes. If in doubt, however, the clearance may be ascertained by taking a narrow strip



GAGE TO LOCATE LOW ARMATURE BEARING.

of fibre and moving it between the pole piece and armature. By keeping the shells tight in the boxes, better results are obtained than if they are put in loose, as I have seen some do. The shaft should be kept true to get the longest wear from the bearings. No. 5.

5. We use a piece of iron for a gage, as per sketch, to locate low bearings. This is shoved in between the armature and lower pole piece. An armature in first-class condition should take the large end of the gage; if it will not take the large end and the small end enters freely, the car is left in service and a record made that the armature is working down. The car is then carefully watched until the small end of the gage just enters, when the car is sent to the shop for repairs. No. 14.

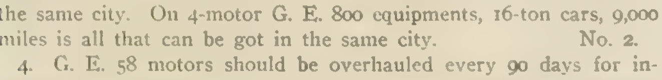
12. How often should motors be overhauled; if on a mileage basis, how many miles?

1. This should be left to the judgment of the man in charge, as it depends greatly on the design of the motors and on the conditions under which they are operated.

Our cars are ordered in for general overhauling about every fourteenth month, the maximum mileage of the motors during this period being 65,000, the average 52,100 and the minimum 43,500 miles. No. 13.

2. Motors should be overhauled according to inspection, as the mileage basis will not apply equally to city and interurban service. No. 4.

3. This depends upon the condition of armature and field coils, pinion, commutator, and bearings. Usually only the last two conditions are taken into consideration when the word "overhauling" is



GAGE TO LOCATE LOW ARMATURE BEARING.

used. The style of motor, methods of lubrication, quality of babbitt in bearings, quality of copper in commutators, kind of brushes used, and service conditions vary widely. On 2-motor G. E. 1,000 equipments, 10-ton single truck cars, an average of 10,000 miles is considered right in one western city. On 4-motor G. E. 1,000 equipments, 20-ton double truck cars, 14,000 miles is considered right in the same city. On 4-motor G. E. 800 equipments, 16-ton cars, 9,000 miles is all that can be got in the same city. No. 2.

4. G. E. 58 motors should be overhauled every 90 days for inspection and cleaning; W. P. or the 800 class should be overhauled every 30 days. No. 5.

5. Different types of motors need different attention; a motor run in grease should be overhauled every 90 or 100 days, one run in oil every six months; this is general overhauling. No. 12.

13. What should be the composition of babbitt metal for motor bearings?

1. The following babbitt metal composition makes a long-lived and tough metal, that will not pound out nor be too severe on the armature shaft: 100 lb. tin, 10 lb. copper, 10 lb. antimony. No. 4.

2. We are using the [illegible] 3 lb. tin, [illegible]

Our motor bearings [illegible] age of 2,100, with an oil [illegible] miles, the cars being equipped with two 125-h. p. motors. No. 1[illegible]

3. A good composition [illegible] lb. copper, [illegible] lead.

Phosphor bronze is composed of [illegible] and phosphorus, 0.8 per cent. No. 3.

4. 10 parts tin to 1 part antimony. No. 7.

14. Do you use felt wicking or waste packing with oil in your car journal boxes?

1. Wool waste packing with oil is used on the Subway and Manhattan Divisions of the Interborough Rapid Transit Co., New York City. No. [illegible]

2. Elastic wool waste is far superior to felt wicking for journal boxes, from the standpoint of economy and efficiency. No. 2.

3. Wool waste well saturated with oil and packed under the axle so as to give a pressure on the under side of the axle, filling the top with a heavy cup grease, gives satisfactory results. No. 4.

4. We use wool waste with good results. No. 5.

5. Wool waste packed with oil. No. 7.

6. Felt wicking. No. 6.

7. Wool waste packing I have found to be all right when waste and oil are properly mixed. No. 12.

8. We use waste packing with oil in our car journal boxes. No. 14.

15. What should be the chemical composition of a good car oil?

1. This company is using a composition of crude oil, whale oil and red lead. No. 13.

2. Analysis of a car and motor oil that we consider very good: Specific gravity 25°, flash test 425° Fahr., fire test 495° Fahr., cold test 15 to 20° Fahr. below 0, viscosity 25.5 at 68° Fahr., or the viscosity, as compared with that of water at that temperature. No. 7.

16. What is an economical figure for lubrication (per mile) of a 20-ton car equipped with four 40-h. p. motors?

1. A figure showing good economy would be 19½ to 20 cents per 1,000 miles. No. 13.

2. This is a hard matter to determine. Very few roads are able or will give any data as to the cost of lubrication. From data of our own at hand, we would judge that 18 cents per 1,000 miles, with oil at 20 cents per gallon, should be the maximum with cars equipped with four 40-h. p. motors, designed for oil lubrication and air brakes with independent motor compressors. This figure should cover all the oil used about the car.

There is no doubt in our minds that this figure could be reduced to 12 cents or less with close attention.

We have found that the latest type of motors only require oiling every 10 or 15 days, and the cost of our oil on this type of equipment is not above 11 cents. We have not the exact data, as we operate cars equipped with the syphon lubricator on the same division, and the cost per 1,000 miles is figured as a whole. No. 11.

3. About 28 cents per 1,000 car-miles. No. 7.

4. Eight cents per 1,000 car-miles for all oil and grease used. No. [illegible]

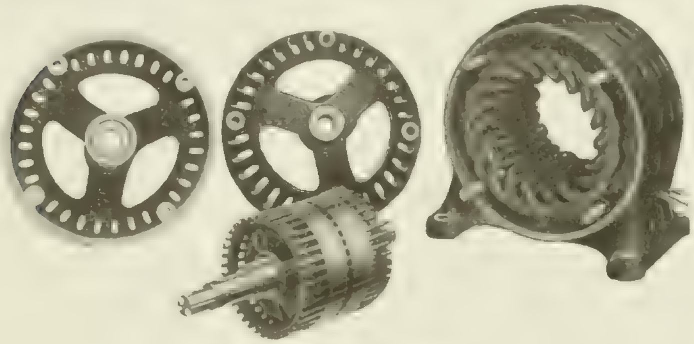
(To be continued.)

Consul-General Hanna, of Monterey, writes that the street car properties of Monterey have changed hands, and that they have been very much improved. It is the purpose of the new owners to rebuild the entire system and establish a modern up-to-date service for the city; which it is believed will be installed in less than a year.

The receipts of the Manchester Corporation Tramways for 12 months ended March 31st, amounted to £631,955. The working expenses were £411,597, so that a gross profit of £220,358 was shown. This, after making provision for interest, redemption of debt, and income tax, enabled the corporation to apportion £46,000 in aid of rates, £4,043 in street improvements, and £70,007 to renewals and depreciation. The £46,000 in aid of rates was still further increased by the addition of £5,000 transferred from a reserve fund acumulated in former years.

The National Electric Co's. New Induction Motors.

The accompanying illustrations show the [illegible] a new type of induction motor which has just been put upon the market by the National Electric Co., of Milwaukee. These machines are of extremely heavy and substantial construction, and may be operated either from the floor, side wall or ceiling, by changing the brackets which carry the bearings. Owing to the high speeds at which these motors run, and the small space between the stator and rotor, a very heavy shaft is used, while the bearings are of large [illegible] so as to eliminate as far as possible [illegible] variations in the air gap.



INDUCTION MOTOR PARTS.

The frame is of cast iron into which the laminations are assembled. All the windings are form-wound, and between each coil air space is provided to take care of the heating. Ventilation has also been carefully provided for, there being numerous openings in the frame, and ventilating spaces between the laminations. The rotor is of the squirrel-cage type, and the bearings are self oiling and have wearing surfaces of large proportions. An auto starter is furnished with the squirrel-cage type, consisting of transformers connected across the line with voltage taps suitable for starting the motor under different conditions of load. A switch is provided for throwing the motor from one voltage to another. All of this apparatus is immersed in a tank of oil, which makes it sufficiently reliable to operate at high voltages and which takes care of any heating due to starting under heavy torque.

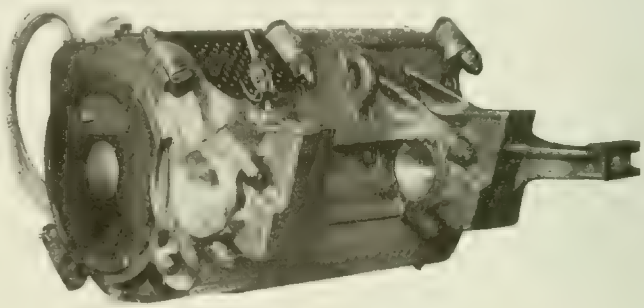
RECENT TYPE OF INDUCTION MOTOR.

The Educational Committee of the Brooklyn Rapid Transit Employes Benefit Association has arranged to conduct a series of interesting free lectures and demonstrations during the coming winter. A class has also been organized for physical culture and a bowling league established among the employes of the different departments

New Westinghouse Railway Motor.

The progress in electric railway work has constantly called for a heavier rolling stock and faster schedules, and these in turn have necessitated increase in size of the motors. This increase in size has necessarily been marked by mechanical changes, many of which are included in the design of the new No. 113 motor illustrated herewith, and lately placed upon the market by the Westinghouse Electric & Manufacturing Co. The smallest motor of this type is 75 h. p., and the largest 200 h. p., with several sizes between these figures.

One of the characteristic features of this type is the diagonally divided field frame which makes every part of the motor accessible. Other special points are the gear case, supported entirely at the ends so as to avoid side strains; housings for armature bearings clamped between two halves of the frame; large size bearings with a new and effective system of lubrication; armature and commutator assembled on a single spider; bar wound armature with split coils. All of the motors of this type have cast steel frames split at an angle of 45 degrees with the horizontal. The axle bearings are carried with the lower half of the split frame, and are divided at an angle of 45 degrees with the perpendicular, so that the weight of the motor is supported almost entirely by the part of the frame extending over the axle, rather than by the axle cap bolts. By lifting off the upper half of the field castings,



WESTINGHOUSE 200-H.P. MOTOR.

the armature may be removed without dismounting the motor; or the motor may be removed from the truck by merely taking off the gear case and axle caps.

The armature bearings are of solid phosphor bronze, and oil and waste lubrication is provided. The pole pieces and armature core are built up of steel punchings, and the armature coils, which are made in two parts, are arranged so that the top coils which are most liable to injury, may be removed without disturbing the rest of the winding. The motors are supported by nose suspension, with safety lugs. All of the details of this type of motor have been carefully and thoroughly worked out.

New York City Railway Earnings.

The quarterly report of the New York City Railway Co., including the Third Avenue line, for the quarter ended June 30, 1905, is as follows:

	1905	1904	Increase.
Gross	$4,417,081	$4,479,812	*$62,731
Expenses	2,420,230	2,512,543	*92,313
Net	$1,996,851	$1,967,269	$29,582
Other income	325,738	133,525	192,213
Total income	$2,322,589	$2,100,794	$221,795
Fixed charges	2,793,539	2,513,420	280,119
Deficit	$470,950	$412,626	$58,324

The consolidated income account for the year ended June 30, 1905, compares as follows:

	1905	1904	Increase.
Gross	$17,907,390	$17,757,650	$149,740
Expenses	10,031,120	9,530,360	500,760
Net	$7,876,270	$8,227,290	*$351,020
Other income	1,225,818	1,086,209	139,609
Total income	$9,102,088	$9,313,499	*$211,411
Fixed charges	11,497,415	10,368,283	1,129,132
Deficit	$2,395,327	$1,054,784	$1,340,543

*Decrease.

Personal.

MR. J. F. NEIL has been appointed assistant secretary of the Equitable Trust Co., Chicago, vice Mr. C. Huntoon, assistant secretary and treasurer, resigned.

MR. F. B. HUNTINGTON, secretary of the Eastern Wisconsin Railway & Light Co., was recently elected vice president of the same company, to fill the vacancy caused by the resignation of the vice-president and general manager, T. F. Grover.

MR. JAMES HEYWOOD, who since 1893 has been in the employ of the Philadelphia Rapid Transit Co., and for the last few years assistant superintendent of lines and cables, has succeeded Mr. F. H. Lincoln as superintendent of lines and cables, Mr. Lincoln having been appointed assistant general manager of the company.

MR. JAMES C. HAIN, engineer of masonry construction for the Chicago, Milwaukee & St. Paul railroad, has resigned that position to become associated with J. G. White & Co. in the same capacity. Mr. Hain graduated in 1893 from the University of Wisconsin, and has been connected with the Chicago, Milwaukee & St. Paul railroad for ten years and was appointed engineer of masonry construction in 1901.

MR. EDWARD G. CONNETTE, whose resignation last July as vice-president and general manager of the Syracuse Rapid Transit Co. was not accepted by the board of directors, has since obtained his release and has accepted the position of general manager of the Worcester Consolidated Street Railway Co., of Worcester, Mass. Mr. John J. Stanley, general manager of the Cleveland Electric Railway Co., has been appointed vice-president of the company, and Mr. John E. Duffy, superintendent of the Syracuse Rapid Transit Co., will retain that position, having practical charge of the operation of the system. Mr. Stanley will retain his position as general manager of the Cleveland Electric Railway Co., it being his intention to spend only a few days each month in Syracuse.

PROF. BERNARD V. SWENSON, the recently elected secretary and treasurer of the American Street & Interurban Railway Association, was born in Chicago, May 3, 1872. He received his early education in the public schools in this city and at the Chicago Manual Training School, from which latter institution he graduated in 1889. Professor Swenson then entered the University of Illinois, graduating in 1893 and completing both the courses in mechanical and electrical engineering and receiving the degree of bachelor of science in each course. From 1893 to 1898 he was an instructor in the university and during the last three years was assistant professor of electrical engineering. In 1898 Professor Swenson was appointed assistant professor of electrical engineering at the University of Wisconsin, which position he retained up to his present appointment. In 1901 he received the master's degree in mechanical engineering from the University of Illinois and the master's degree in electrical engineering from the University of Wisconsin. During the past year he has been on leave of absence on account of this work with the Electric Railway Test Commission. Professor Swenson was a member of the International Jury of Awards at the Louisiana Purchase Exposition, an author of electrical engineering publications, joint editor of the report of Electrical Railway Test Commission, and has also been a frequent contributor to the technical press. He is a member of the American Institution of Electrical Engineers and of the American Society of Mechanical Engineers and is an associate member of National Electric Light Association. Professor Swenson has also acted as consulting engineer in the design, construction and testing of electric light and power plants and electric railways and his intimate acquaintance with and experience in electrical and mechanical engineering render him well fitted for the office of secretary of the new association.

Obituary.

MR. FRANK B. HOSKINS, president of the Eastern Wisconsin Railway & Light Co., and ex-mayor of Fond du Lac, died Monday, Sept. 18th, of acute appendicitis. Mr. Hoskins was one of Fond du Lac's foremost citizens, and had been closely identified with the history of the city for 25 years. He was elected register of deeds of Fond du Lac County in 1878, and for several years thereafter served as a member of the board of education, and as a member of the common council. In 1898 he was elected mayor of Fond du Lac, and was re-elected in 1899. He was also president of the [illegible] board of [illegible] [illegible] public offices [illegible] [illegible] interests. Mr. H[illegible] [illegible] prominent member of the [illegible]

Spokane & Inland Railway Co.

A contract has [illegible] Railway Co by the Westinghouse Electric & Manufacturing Co. of Pittsburg, Pa., for the equipment of an electric road, the present terminals of which will be Spokane, Wash., and Moscow, Idaho, 146 miles apart. An article describing the route and preliminary plans of this road appeared in the "Street Railway Review," Aug. [illegible] soon as possible. The road is a home enterprise the stock being held entirely by men living in the district through which the line passes,—business men, professional men and farmers. The directors of the company are J. P. Graves, president, F. A. Blackwell, vice-president, F. Lewis Clark, John Twohy and Alfred Coolidge.

The single-phase alternating-current system of operation will be used. Besides the passenger traffic the company is preparing to do a heavy freight business and also to carry mail and express. Power for the operation of the road will be purchased from the Washington Water Power Co. which will supply 3-phase current at 4,000 volts pressure, 60 cycle, to a frequency changing station approximately 1 1-2 miles from the generating station. Seven 750-kw. oil-insulated water-cooled transformers will step down the voltage from 4,000 to 2,000 volts, the potential for which the induction motors of the frequency changing sets are wound. There will be four of these motor-generators or frequency changers of 1,000-kw. capacity each at normal rating. Each consists of a 1,000-h.p., 3-phase, 2,000-volt, 60-cycle induction motor, a 1,000-kw. single-phase, 2,200-volt, 25-cycle revolving field alternator, and a 750-h.p., 550-volt direct current generator which is to float on the storage battery acting alternately as a motor and generator. The three machines will be mounted on a single bed plate with seven bearings. Exciting current for the alternators will be supplied by three sets, each consisting of a 75-h.p., 3-phase, 2,000-volt induction motor and a 50-kw. d. c. generator.

Nine 675-kw. oil-insulated water-cooled transformers will step up the voltage from 2,200 to 45,000 volts, at which pressure it will be transmitted to the fifteen static transformer sub-stations, each containing two 375-kw., 45,000-6,600 volt oil-insulated self-cooling transformers. A 23-panel switchboard, electrically operated automatic oil circuit-breakers, and protective apparatus complete the equipment of the frequency changing station. Low equivalent lightning arresters and choke coils are provided for both primary and secondary circuits in all sub-stations.

The transmission lines will consist of two No. 2 copper wires and the trolley will be of the standard catenary construction, using a No. 000 wire and carrying current at 6,600 volts.

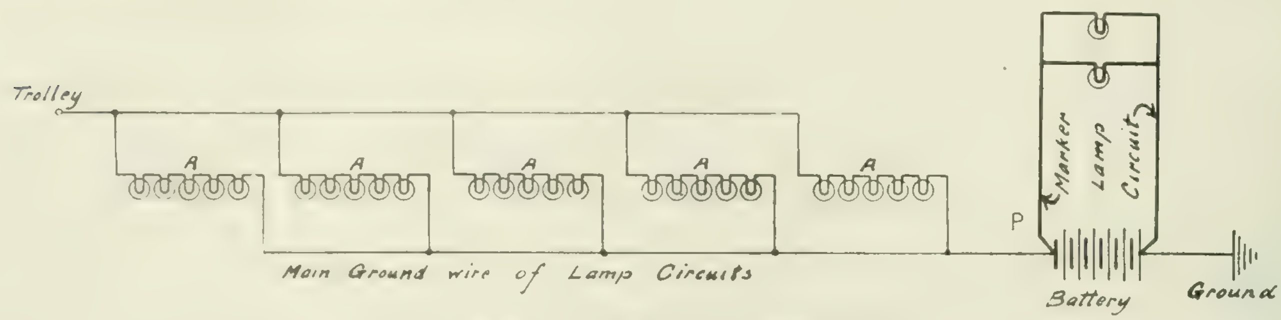
Each passenger car will be equipped with four 100-h.p. motors, capable of maintaining a schedule speed of 35 to 40 miles an hour. In the freight service four 150-h.p. motors will be used on each car. For the heavy freight service double locomotives weighing approximately 70 to 80 tons will be used, each consisting of two parts and each part a complete 35 to 40-ton locomotive. Two or more of these locomotives may be coupled together and operated from the front cab as a single unit. The motor cars and locomotives will all be operated by the Westinghouse multiple unit control system. The motors will operate under three different conditions,—6,600 volts alternating current in the interurban districts, 700 volts alternating current in the smaller towns, and 575 direct current in the city of Spokane.

The Lake Shore & Michigan Southern R. R. has announced a reduction of 50 per cent in passenger rates between Toledo, O. and Bryan, O., and Toledo and Adrain, Mich., to meet the competition of the Toledo & Indiana and the Toledo & Western interurban lines.

Arrangements for the use of interchangeable coupon ticket books have now been made by 20 interurban electric railways in Ohio, Indiana and Michigan, representing a total mileage of about 1,700 miles.

Electric Marker Lamps.

The Lintern Car Signal Co., 312 Electric Building, Cleveland, O., has recently placed on the market an electric marker or tail-light, after a long and exhaustive test. The value of a marker that does not require any daily attention and that will remain in operation when the trolley is off, is readily apparent to the operating manager. More than one light can be used if desired, this being accomplished by introducing a 6-volt battery in the lighting circuit of the car, as shown in the sketch herewith, and running a low-voltage circuit from the battery for the marker lamps. When the trolley is on the wire there is no current drawn from the battery, the marker lamps operating from the lighting circuits, while the current not needed for the lamps charges the battery. The battery is capable of discharging one ampere for 30 hours, or two amperes for 15 hours, and weighs 45 lbs. As the discharging from the battery normally is only momentarily and as the lamp circuits in the car are in operation considerably more than the marker lamps, the battery is in the nature of an emergency feature; consequently the demands on it are comparatively rare, insuring a life of several years for the battery.



WIRING DIAGRAM OF LINTERN ELECTRIC MARKER LAMPS.

The capacity of the lamp in candle-power seems low when compared to the ordinary incandescent lamp, but when compared with the oil lights, it gives a brighter light and is distinguishable at a greater distance than an oil lamp when in the best possible condition, and as the oil lamp's efficiency is dependent on its being well trimmed, having good wicks with good adjustment, sufficient and good oil, the average efficiency of the electric lamp is far greater than that of the oil. The lamps are eight volts, one ampere, but are working on a six-volt circuit, which increases life of lamp 50 per cent. The fact that two lamps or more can be used almost as cheaply as one, is of great importance in practical railroading, and the greater reliability and efficiency of the electric marker, together with its minimum cost of maintenance and operation recommend it to the use of electric railways.

The Egry Despatching System.

The Egry despatching system for train orders offers a complete departure from the old method and has for its advantages security, protection and simplicity. Written orders are required for all car movements, except, of course, when cars meet according to schedule, and special registers are used, as shown in the accompanying illustration. The method of placing these registers is generally at the discretion of the road, some companies having cars equipped with portable telephones, others having telephones in pole boxes, and in other instances orders are only given at way stations. In any instance a register is placed at the despatcher's office and one at each of the receiving points.


EGRY NO. 00 MANIFOLDER.

The despatcher writes the orders given, producing triplicate copies at one writing, places one copy on file for his reference and sends one to the general office with despatch sheet. The third record is concealed in the locked receptacle of the register. It may be extracted when desired and all orders carefully compared and checked.

The conductor in receiving an order over the telephone, after writing the order, by the turning of the crank, withdraws two of the copies of the order and the third copy remains in the register. Access to these registers cannot be had by anyone save the authorized official of the road, who has the key. The conductor reads the order back to the despatcher for his "complete" and delivers one copy to the motorman. Thus, it is an easy matter to determine any leaks or loopholes, causing waste of time, carelessness, causes of accidents, as well as other deficiencies.

This system is the product of the Egry Autographic Register Co., Dayton, Ohio, which also has devised a system of railway billing, the principles of which are similar to its registers, bills of lading, waybill and auditor's slip being made at one writing. Among the electric railway companies using either the Egry despatching or billing system are the Indianapolis & Martinsville Rapid Transit Co.; the Interurban Railway Co., Des Moines, Ia.; Columbus, London & Springfield Railway Co.; the electric branches of the Boston & Maine R. R.; the Evansville & Princeton Traction Co., and the interurban lines at Dayton, O.

Cars and Trucks.

The J. G. Brill Co., Philadelphia, Pa., is distributing a very complete publication descriptive of modern types of city and interurban cars and trucks. The cars and trucks shown in the publication are characteristic of the regular output of its plants and represent standard types established in general practice, rather than those types possessing features intended to meet peculiar local conditions. The publication includes illustrations and complete descriptions of the various cars built by this company for interurban service and city service, including the Brill semi-convertible type, the Stephenson semi-convertible type, the Brill convertible type and the combined convertible and semi-convertible types of cars. Also the Brill "Narragansett" type of open car, standard single and double truck, open and closed cars, the "California" type of car, combination open and closed cars, top seat cars and drawing room cars. Baggage, express and portable sub-station cars, snow plows and sweepers, sprinkler cars and a complete line of Brill trucks are also shown and described in detail, as well as the many supplies and car specialties manufactured by this company. The publication is an excellent example of what is best in the printers' art, as well as a complete directory to modern practices in car and truck building. This well executed catalog is one that will be much used for reference.

The Chicago & Alton R. R. has discontinued the interurban service it established last summer in competition with the electric railways of Central Illinois.

The Brooklyn Rapid Transit Co. will equip its cars during the coming winter with a new type of vestibule, the first shipment of which has already been received from the John Stephenson Co.

Convertible Cars for Shreveport, La.

The Shreveport (La.) Traction Co. has put on its lines within the last month several handsome cars of the convertible type of the American Car Co. under the Brill patents. The company operates about 12 miles of line in Shreveport and West Shreveport. This type of convertible car is in considerable use in the gulf states where the climate is semi-tropical and the abundant rainfall and moist atmosphere during a large part of the year require a character of construction more than ordinarily good to be absolutely impervious to water.

Attention is directed to the sill step, which is a modification of the Narragansett type. This step is wider than appears in the

INTERIOR SHREVEPORT CAR.

photograph and gives ample room for secure foothold. The cover plates for the openings over these steps when the panels are drawn down may be plainly seen in their folded position. When the car is closed these plates are raised flush with the floor and present an even surface; the value of this extra step will be at once recognized when it is noticed that double trucks having equal sized wheels are used under the cars. With such trucks the car floor is too high to be easily and safely reached by a single step. The running board is the same height from the track as the platform step and from sill step to car floor is same height as from platform to car floor. These heights are respectively 18, 14½ and 7½ in. In the illustration of the exterior of the car two pairs of windows are shown raised at different heights and a pair of sashes and windows are raised entirely into the pockets in the side roofs. The operation of raising

NEW TYPE OF CAR FOR SHREVEPORT TRACTION CO.

and lowering the sashes is sufficiently easy and simple for persons of moderate strength and ordinary intelligence. Therefore, passengers may accomplish it and thus assist the motorman in closing the car in case of a sudden storm, and conversion in such cases being practically instantaneous. The interiors are finished in golden oak with three-ply birch veneer ceilings tinted a light green. The seat backs are provided with brackets between the backs and posts which enclose the space and also provide hand grips for the use of passengers in entering and leaving by the side openings. The platform at front end of car is intended for [illegible] only, while that at rear is [illegible] of the "[illegible]" type [illegible] with a handrail.

The general dimensions of the car are: Length over body, 30 ft. 8 in.; over crown pieces, 41 ft. 4½ in.; over panel from crown piece, 4 ft. 6 in. at front end, and 6 ft. 2½ in. at rear end; width over sills, 8 ft. 1 in.; width over posts at belt, 8 ft. 5 in.; sweep of posts, 1½ in.; center to center of posts, 2 ft. 7 in.; side sills, 2½ x 7¾ in.; Z iron sills, 6⅛ x 8 ; 16 x 15 16 in.; [illegible] posts, [illegible] in. and of side posts, 3⅜ in. The seats are 36 in. long and the aisle 23 in. wide. Among the other patented specialties with which the car is equipped are the builders' folding gates, Brill sand boxes, angle iron bumpers, platform gongs, brake handles, and step-over back seats, signal bells and drawbars. The cars are mounted on Brill No. 27-GE1 trucks having solid forged side frames and 4-ft. wheel base and 33-in. wheels. Each car has four 40-h. p. motors.

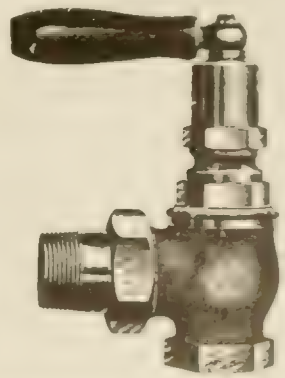
Northwestern Elevated Annual Report.

The annual report of the Northwestern Elevated Railroad Co. for the year ending June 30th, 1905, has just been published. It shows the total earnings, including the loop net earnings to be $1,786,414, operating expenses $616,628, net earnings, $1,169,786, fixed charges and taxes $952,627, surplus for year $217,159. In the operating expenses is included an item of $39,500, which was set aside in monthly installments for betterment and maintenance of structure. The taxes include the conpensation to the city on account of the loop. The total number of passengers carried during the fiscal year was 26,812,825, being a daily average of 73,460, or an increase of 5.45 per cent over the previous year. The ratio of operating expenses, maintenance reserve, loop account and taxes to the earnings was 62.04 per cent.

Crane Quick-Opening Self-Packing Radiator Valve.

The Crane Co., Chicago, has recently designed and is now placing on the market a new quick-opening, self-packing steam radiator valve, which is illustrated herewith. By a special device, placed in the stuffing boxes of these valves, the packing is automatically kept tight and precludes the possibility of leaking. This device consists of a vulcanized washer, located in the top of the stuffing box and kept in position by spring compression. The valves open and close by turning a lever handle one-half turn, a quick and easy operation which will be readily appreciated.

The construction of these valves [illegible]



CRANE Q[illegible]

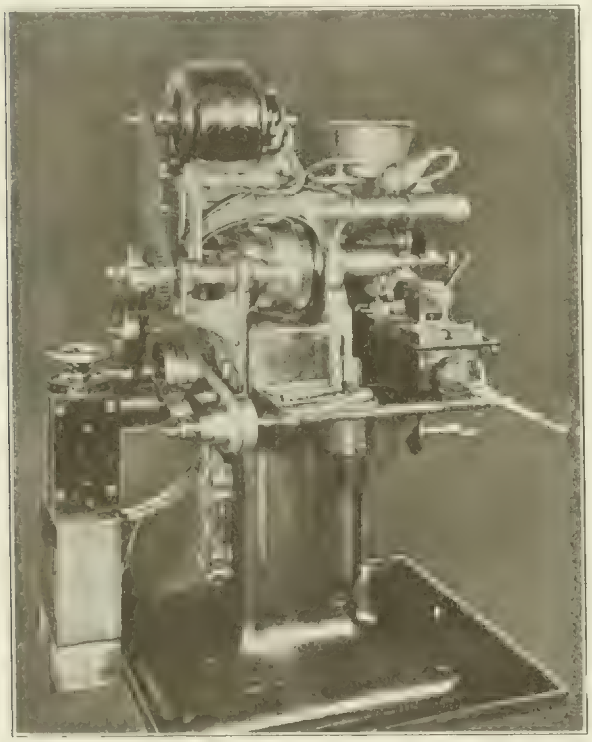
discs bear on the seats very tightly [illegible] until released. The bonnets of these valves are interchangeable with the bonnets of Crane regular radiator valves and the user may equip his old valves with these new and important improvements.

These valves have artistically designed proportions and add much to the appearance of a nicely furnished apartment. by their symmetrical proportions and general rich appearance. The level handles are made from cherry wood, painted a rich black color, which contrasts very nicely with the nickel plated trimmings of the valves.

Motor-Driven Tools in the Plant of the John Simmons Co.

The John Simmons Co., 110 Center St., New York City, built an addition to its plant about a year ago to be occupied, mainly, by tools for work on large pipe, steel and iron fittings. A feature in the installation of these new tools was the substitution of individual motor drive for shaft drive, which not only made the machines capable of being run at more efficient speeds but made it possible to install a generating plant of smaller capacity than was formerly required. The power equipment, which is used for furnishing light and power for the entire building, consists of a 150-h. p. direct-connected set which supplies current at 240 volts and has a capacity of 100 kw. The current is distributed over a 4-wire multiple voltage system from which six voltages are available, from 40 volts to the total voltage of the line.

The largest machine in the shop is a 2-spindle, 48 and 26-in. lathe, power for which is obtained from a 13-h. p. semi-enclosed motor running at 1,100 r. p. m. It drives through an intermediate gear to a gear on the largest step of the cone pulley, and the controller is placed on the floor near the tail end of the lathe, being manipulated through a shaft on the carriage apron so that



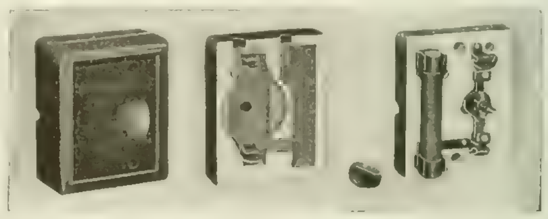
MOTOR-DRIVEN MILLING MACHINE.

the operator may control the motor without moving from his position. Other machines installed which are motor-driven, include a 24-in. planer drive shaper, a 22-in. drill, a 24-in. crank shaper, three small lathes for brass work, three lathes of slightly heavier construction used for iron work and a No. 3 universal milling machine, which latter tool is illustrated. The mounting of the motor and the connection to the drive are shown in the illustration. This machine is driven by a 1-h. p. motor running at 1,200 r. p. m. and supported on a bracket mounted on top of the machine. Another bracket supports an intermediate shaft to which the motor connects by a Renolds "silent" chain. A pinion engaging gear teeth on the middle step of the cone pulley is mounted on the chain sprocket. Other than these there are no changes from the original arrangement of the driving mechanism, back gears between the cone pulley and the spindle being used if a slower speed than the direct drive is desired. In this way the 12 speeds possible through the motor are doubled so that the tool has a capacity for 24 different speeds. The controller is of the drum type and is mounted on the switch box which is supported on blocks directly upon the floor.

It has been the object in this installation of motor drives not to destroy the original state of the tools so that they may at any time be easily reconverted to belt driven form. The cone pulleys were in most cases retained and the gears which were placed on the steps of the pulleys are in the form of rings slipped on and secured by set screws. The same care was exercised in mounting the motors so that it would be possible to restore the belt-driven apparatus. These equipments were installed under the supervision of Mr. George T. Hanchett, consulting electrical engineer and Mr. George N. Noble, superintendent of the machine shop and power plant of the John Simmons Co.

Combined Switch and Enclosed Fuse Cut-Out for Car Lighting.

Large cars are constantly coming into more general use in both city and suburban railway service, and heavier duty is being imposed upon the lighting switches and cut-outs on account of the use of several lighting circuits in multiple. The switch and cut-



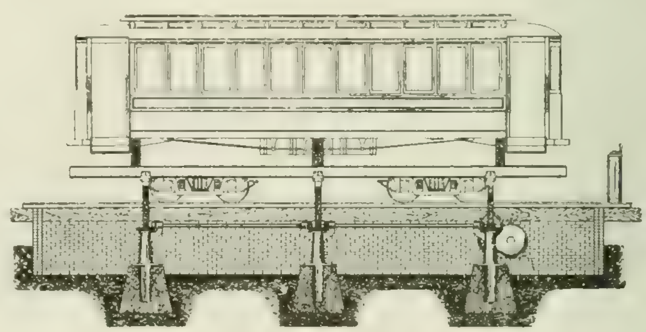
COMBINED SWITCH AND ENCLOSED FUSE CUT-OUT.

out illustrated herewith has been designed by the General Electric Co. with a view to these conditions, and also to convenience in installation and operation. The switch movement is positive and rapid, and will invariably break its rated load. The fuse is of the enclosed type and will open a dead short circuit on any line with a voltage up to 650. It is held in position by spring clips, no binding screws being used, and can thus be quickly snapped into place. The cover is also held by substantial clips and does not carry any part of the circuit. The contracts and binding screws for wiring, mounted on the surface of the flat base, are all easily accessible, and the back of the base is recessed so that the device may be used in connection with either cleat or concealed wiring.

Motor-Driven Car Hoist.

The accompanying engraving shows a new motor-driven car hoist manufactured by the Pittsburg Machine Tool Co., at Allegheny, Pa.

The machine is so designed that the columns are placed on a foundation in the pit in the car barn, and when the screws are down in the columns the I-beams come nearly flush with the car rails, which are laid between the I-beams. The lower shaft at the head of



MOTOR-DRIVEN CAR HOIST.

the machine is made of a size that is suitable for attaching a standard street car motor with gear. Timbers are then thrown across the I-beams underneath the body of the car, the motor is started and the body of the car is raised up in a very short time to the proper height for removing the trucks. The screws are of large diameter. The large bevel gears are furnished with friction washers underneath, and the machine is well made throughout. The attaching clamps between the screws and the I-beams are malleable iron. The machine is made in two sizes, 22 ft. and 36 ft., for short and long cars, but can be furnished any size to suit the cars.

The Works of the J. G. Brill Co., Philadelphia.

The J. G. Brill Co. commenced the building of street cars in a small shop at 31st and Chestnut Sts., in 1868, the firm at that time consisting of John George Brill and his son G. Martin Brill under the style of J. G. Brill & Son. John A. Brill was then with them although not a member of the firm. Car supplies was an important part of the business and still continues to be so. The good judgment and conscientious workmanship shown in the production of the company were soon recognized and the business grew rapidly. Pride in the quality of work has been characteristic of the productions of the concern from the very beginning and the highest standards have been consistently maintained. In 1872, James Rawle joined the firm, which then became J. G. Brill & Co. It was in this year that a large order of cars for Mexico was obtained. This was the first foreign order, after which orders from abroad increased rapidly and have continued to amount to a large percentage of the business. In 1876, the firm was given, at the Centennial Exposition at Philadelphia, the highest award for street cars. The car exhibited made a very favorable impression on the street railway men who saw it, for not only was the workmanship perfect and the type the most advanced up to that time, but a number of new features were included which afterwards were adopted in general practice. Again, in 1883, the firm obtained the gold medal, which was the highest award, for the best street car at the World's Railway Exposition held at Chicago. Since then the highest awards have been obtained at the expositions of Vienna, Barcelona, Philadelphia, Paris, Buffalo, Charleston, Osaka and elsewhere.

As the business grew, shops were added until the ground was completely covered, and in 1877 an additional plot was obtained and soon covered with buildings. Still the accommodations were too limited and in 1884 the remaining portion of the available adjacent land was secured and additional erecting shops built. At that time it became apparent that a change to another location where more land could be obtained and a larger plant erected, was imperative, and a tract of eighteen and one-half acres was purchased at 52nd St. and Woodland Ave. where in 1889 the construction of the present plant was commenced. Two years previous to this time the company was [illegible] J. G. Brill Co. The following year, [illegible] Brill occurred, and G. Martin Brill became president. The officers were G. Martin Brill, president; John A. Brill, vice-president, and James Rawle, secretary and treasurer. These gentlemen have continued in these capacities to the present.

In 1890, when the [illegible] was well equipped to [illegible] brought about by the introduction of electricity as the motive power of street railroads. It was only the year before that the first large system, that of the city of Boston, was equipped for electrical operation. Systems of other cities rapidly followed in equipping their lines for electricity and although horse and cable car bodies were mounted on electric trucks and largely used at first, the demand for new cars [illegible] the capacity of the [illegible] year after year important additions were required.

PLANT OF THE J. G. BRILL CO., LOOKING TOWARD THE GATE FROM TOP OF 175 FT. CHIMNEY.

The type and construction of trucks for electric motors was of first importance at this time, and the inventions of members of the firm were planned and carried out with rare judgment and energy. It was Mr. John A. Brill, the vice-president, who first saw the necessity for an independent truck frame for carrying the motor, and the first electric car to be satisfactorily operated was mounted upon a truck of his design. The single-truck which was evolved from this type is well known to street railway men and includes frames made of solid forgings. It was also due to his foresight and persistence that the maximum-traction truck, which he invented, became a practical success. He saw that to carry the long cars satisfactorily which were rapidly coming into use in city service, a double truck of a radically different design from those in use was necessary and disregarding the condemnation which was heaped upon him from all quarters for endeavoring to build a "mechanical monstrosity," brought to completion a truck which to the present day conforms to requirements more complex than are associated with any other type. The success of the "Eureka" maximum-traction truck has been phenomenal; it is the standard type on some of the largest systems of the world and the builder states that over 20,000 are in operation.

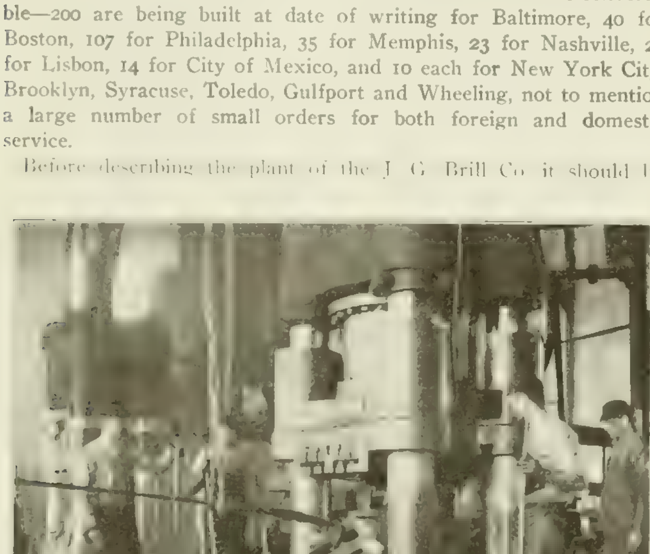
The system of equalization, which has given the Brill short-base

double truck — the high speed truck their reputations for ease and safe riding, was also originated by Mr. John A. Brill. Space does not permit of enumerating the valuable inventions which are the result of his genius for conceiving and discriminating, and his indefatigable zeal in bringing these inventions to the highest point of excellence. This article, however, would be far from complete if we omitted to mention the three patented types of cars which he has brought to such a completeness in meeting the conditions

GROUND FLOOR OF THE MACHINE SHOP.

found in the different fields for which they are intended—the convertible, semi-convertible and "Narragansett" types. These cars are too well known to need description; they are used abroad as well as in all parts of this country and it is significant of their immense importance to the business that of one of them—the semi-convertible—200 are being built at date of writing for Baltimore, 40 for Boston, 107 for Philadelphia, 35 for Memphis, 23 for Nashville, 20 for Lisbon, 14 for City of Mexico, and 10 each for New York City, Brooklyn, Syracuse, Toledo, Gulfport and Wheeling, not to mention a large number of small orders for both foreign and domestic service.

Before describing the plant of the J. G. Brill Co. it should be



2,000-TON HYDRAULIC PRESSES IN FORGING SHOP.

stated that the design of the buildings, and their location and equipment, were planned in detail chiefly by the president, Mr. G. Martin Brill, and Mr. James Rawle, the secretary and treasurer. The latter's practical knowledge of engineering has proved invaluable on all occasions. The organization of the various departments was effected under the direction of the president, whose wise foresight is everywhere evident, and the co-relation of every part has been worked out to a completeness which shows plainly the well-ordered scheme and able guidance of an executive whose broad knowledge and liberal policy has co-ordinated the whole.

Entering the gate of the Brill works, the visitor sees at the right a large two-story finishing shop with a frontage of 200 ft., and nearly as deep, which contains three-quarters of a mile of trackage and has a specially designed combination transfer table and elevator, electrically operated along the front of the building, and by means of which the largest cars are quickly placed on any track of either floor. After crossing many tracks filled with cars and trucks ready to be shipped, one approaches the office building at the end of a line of buildings 680 ft. long. The rear doors of the offices open almost at the center of the works, a convenient arrangement for the frequent trips of the officials through the shops. Starting from this point and passing between two buildings where castings and supplies are stored, the blacksmith shop is entered on the left. At this end one sees small furnaces with many men wielding hammers and is confused by the deafening roar of a multitude of machines. Continuing through the shop for about 200 ft. one comes to a large department filled with steam hammers of 1,000, 2,000 and 3,000 lb. weight, and heavy "bulldozers." Here some of the side frames of the trucks are forged, and large pieces of ironwork for cars, such as bolsters, bumpers and trusses are made. Leaving this building, the visitor makes his way among great piles of iron and steel billets to another forge shop, 75 by 150 ft., equipped with heavy steam hammers and 2,000-ton hydraulic presses, where it is stated, the most intricate large forgings in the world are made—a process of manufacturing side frames for trucks peculiar to this firm. The operation of these enormous presses, and the rapid and carefully trained movements of the gangs of men who handle the bulky pieces of white-hot metal with specially devised derricks, is one of the most interesting sights in this great plant. In the shop adjoining, a building of equal size, are a great variety of the latest types of spring making machines, which turn out every form of spring, from the diminutive box-lid coil to the heaviest steam locomotive driving spring. Oil burning furnaces are used exclusively.

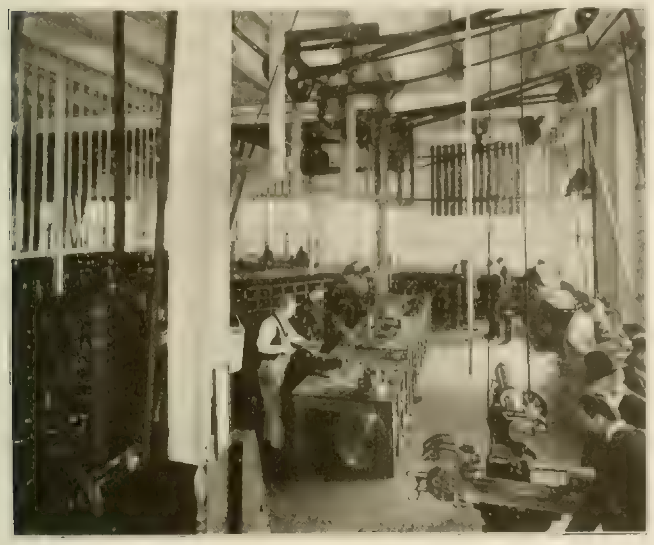
The machine shop is a three-story building, 100 by 125 ft., erected two years ago, and enclosing at the rear a chimney stack 175 ft high, with opening at the top 8 ft. in diameter. The shop is filled with multiple drills, planers, lathes, milling machines, boring mills, turret lathes, and many specially devised automatic machines. The material from the forge shops is bored and finished here; castings are also bored and finished, sheet metal stamped, and dies for the hydraulic presses cut, all material being handled by pneumatic hoists. A part of the first floor is occupied by the engine and pump rooms. A 1,000-h. p. corliss engine furnishes the power to the machinery in the wood mill and machine shops, and drives two belted generators furnishing light and power; a direct-connected 200-kw. unit is held in reserve for use when the belted units are stopped; a Ball engine drives a high-voltage generator which furnishes current for the trolley system of the plant; an arc-light generating unit furnishes 5,000 volts for 100 lights. Besides these there are several other engines and generators which supply current to the motors of machinery in all the shops for nearly all the machines are equipped to be driven interchangeably by steam and electricity. A new boiler house at the rear of the machine shop contains a main battery of four return-tubular boilers of 150-h. p. capacity each, and two boilers of 400-h. p. each. The forge shops have five upright waste-heat boilers of 150-h. p. each, and two direct-fired of 175-h. p. each. Connected with the machine shop by a bridge and a transfer table is the truck-assembling shop where the heavy parts are handled by pneumatic hoists. This is a three-story building, 160 by 60 ft., and includes an axle and wheel-grinding department. An engine room adjoins which furnishes air for the pneumatic hoists and tools.

The wood mill, a three-story building, 80 by 180 ft., is connected with the lumber sheds, kilns and drying rooms by bridges and a number of trolley lines. Here, as elsewhere, the most improved types of machines are used. The uninitiated pauses with wonder before machines which bore square holes through timber—the hollow-square chisels with their revolving drills inside going through the wood as a knife goes through cheese. A 75-h. p. high-speed engine operates blowers which draw the sawdust and shavings from the machines through a system of piping to two large separators over the boiler room. Crossing a bridge, the second floor of a building 100 by 140 ft. is reached; the first floor of which is used for boxing cars and large pieces of material. On the second floor,

and the floor above, the car roofs are made and covered with canvas, bulkheads of open cars set up, and other sections of cars that may be assembled in single pieces are put together and carried to the car erecting shops.

The bending house is a two-story building, 120 ft. long. The wood is steamed in tanks of various sizes, after which the pieces are clamped to forms and placed in drying rooms.

Returning between the wood mill and packing shop where is operated a traveling crane which extends the entire length of these buildings, one crosses the tracks of a transfer table which runs for 340 ft. between the machine shop, woodmill, and packing shops, and a long section of erecting shops. In the first erecting shop car sills are being put together with crossings and tie-rods, and covered with flooring. This comprises the bottom framing, which as soon as completed, is mounted on shop trucks and commences its peregrinations until the completed car rests on its own trucks in the finishing shop. In the next shops the side posts are set up, the ends built in, and the roofs put in place. Those who know little of car building can have but a faint conception of the wonderful skeleton that is between the panels and sheathing and the finished woodwork. As lightness is essential in an electric car body, and as it is not uncommon for the body to carry a load of twice its own weight, every piece of wood and metal is placed in such a manner as to



A CORNER OF THE TOOL ROOM.

give the greatest possible strength, trusses and tie rods playing an important part. Leaving this section of the erecting shops, which cover 200 by 320 ft., the visitor crosses another transfer table electrically operated over a pit 360 ft. in length with another section of erecting shops extending the full length of the table, and sees cars in a more advanced stage of building; platforms, vestibules, head-linings, windows, and interior woodwork being installed here and the first coats of paint applied. Following a track which leads from the end of the transfer table around the rear of these buildings, leads to the finishing shop first seen on entering the gate. In this shop, the painting, lettering, decorating and varnishing is done; the seats, heaters, and the rest of the equipment are put in place, and the cars mounted on their trucks. It is interesting to note the large variety of types of cars all of which have their special fitness for the conditions found in the cities whose names are seen on the letter boards: Double-deckers for England, Europe and Mexico; combination open and closed cars for the mild climates of the Pacific Coast, South America, South Africa, and elsewhere; convertible cars whose windows and panels slide up into pockets in the side roofs; semi-convertible cars with large windows which are also stored in roof pockets when not in use; the "Narragansett" type of long open car with its convenient pair of steps at each side, and many others, including sumptuously furnished private cars, powerful electric locomotives, sprinkling cars and sweepers. One is impressed with the large number of cars approximating in size and appearance the finest coaches used in steam railway service and showing the advanced development of interurban electric railroading.

Before leaving, the visitor should know about a few departments

and other things. He has missed the seat department occupying a floor space 100 by 125 ft., the extensive varnishing rooms, the glazing, upholstering, drafting, and electrical-equipment departments, the shipping platforms and wheel sheds, the equipment for fire protection, including an elevated 50,000-gallon reserve tank, and two "Underwriters'" fire pumps, each with a capacity of 1,000 gallons per minute. Tracks from the Pennsylvania and the Baltimore & Ohio lines enter the yards and pass through the principal buildings, and a complete trolley system connects all of the buildings—about 6½ miles of trackage in all.

An Available Water-Power.

In its investigation of the natural resources along the Chicago & North-Western line that the Industrial Department of that company has had its attention called to a situation at a northern Nebraska point that in a way indicates what the future of this western country may provide to the industrial world. The point referred to is a city having a population of about 1,200 people located on one of the great rivers of the state. This river affords at this location a very desirable water power site with capacity estimated at 4,000 h. p. This power could be used in many ways to great advantage. It would be valuable for the generation of electric power.

Recording Clocks.

An interesting innovation has recently been introduced by the tramway authorities at Newcastle, England, in the shape of recording clocks. These have already been fitted up near the three termini and are very simple in operation. It is the conductor's duty to insert a key which he carries into an opening in the clock, thus automatically registering the number of his car and also the time. The recording tapes are daily removed from the mechanism and taken to the head office, thus giving a complete time of every car on the route.

Combined Wheel and Rail Brake.

The U. S. Metal & Manufacturing Co., of New York City, has recently secured the patents covering and is now manufacturing a combined wheel and rail brake, which was invented some years ago by James Grady, of Brooklyn, N. Y. The brake was originally designed for use on the Montague St. cable line of the Brooklyn Rapid Transit Co. and has since been adapted for use on electric cars. The improved brake is shown in the accompanying illustration as applied to a maximum traction truck.

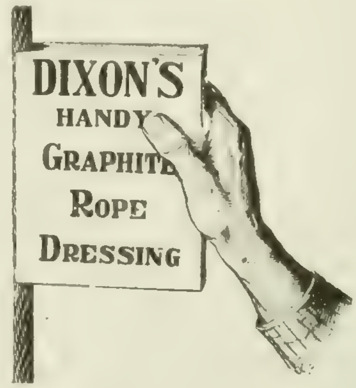
The brake shoe differs from the regular shape only in that it is provided at its base with a track shoe to engage the rails, its face fitting the periphery of the wheel and flange. The shoe, which may be of cast iron with chilled faces or any sort of detachable shoe with malleable iron or other frame, is spring-supported from the outside cross-bar of the truck by hangers whose upper ends have a vertical movement. The shoe is pressed against the wheels by cams, which are operated by a rocker arm and which engage against the rear of the brake-shoe frames. The operation of a hand lever revolves the rocker arm and presses the cams against the shoe frames, which with an ordinary stop simply press against the periphery of the wheel. In an emergency stop the leverage is increased and this presses the shoes still tighter against the wheels and carries the shoe down with the rotation of the wheel until the track shoe at its base engages the rail.

The completion of the line of the Ft. Wayne & Wabash Valley Co. from LaFayette to Battle Ground, Ind., a distance of seven miles, will be celebrated with a big barbecue, October 18th.

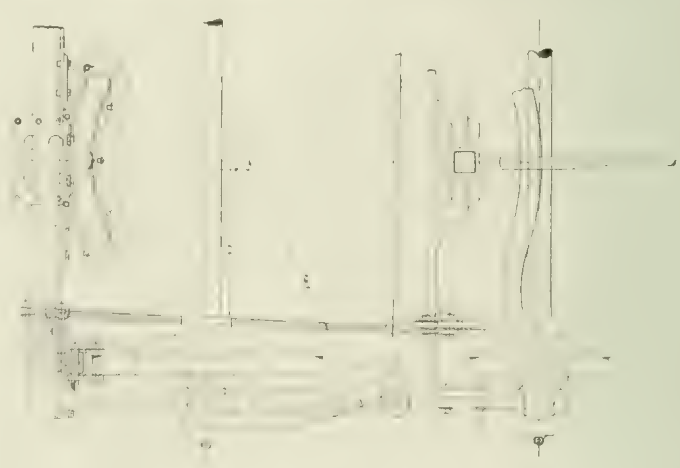
Wire Rope Lubrication.

Elevator and other cables used for hoisting purposes, are subject to both internal and external wear; the former is caused by the rubbing of the wires and strands upon one another under pressure in bending over the sheaves, the latter by rubbing and wedging in the grooves of the pulleys. Unless the cables are kept well lubricated they wear and deteriorate rapidly.

As a lubricant for wire rope Dixon's Ticonderoga flake graphite has the endorsement of the leading manufacturers as well as the approval of those experienced in its use, because of the well recognized fact that flake graphite prevents the abrasion and wear of



all parts coated with it. For this purpose graphite must be combined with suitable greases to make it adhere, but there has always been considerable danger and difficulty in applying grease to moving cables. Dixon's "Handy" graphite rope dressing supplies the ideal qualities of Dixon's flake graphite as a wire rope lubricant in such a form as to make it thoroughly acceptable to practical men who have used it. The package is of about the size and shape of an ordinary book and contains nearly 3 lb. of graphite lubricant. It is easily applied by holding the open edge of the package against the cable while in motion. There is no trouble and no danger to the workman, no waste nor dripping off of lubricant. The economy and efficiency of this dressing, in prolonging the life of wire rope and saving the expense of frequent renewals of worn cables, should commend it to the careful attention of every firm operating hoists or elevators. For further particulars address the maker, the Joseph Dixon Crucible Co., Jersey City, N. J.



PLAN AND ELEVATION OF COMBINED WHEEL AND RAIL BRAKE.

STREET RAILWAY REVIEW

Vol. XV | NOVEMBER 15, 1905 | No. 11

Topeka Railway Company.

Being a Description of the Roadbed, Shops, Equipment, Generating Station and Park.

The Topeka City Railway began operation as a horse car line in 1880. Seven years later the Topeka Rapid Transit Ry. started as a steam dummy road, and after 18 months operation by steam power was electrically equipped. Later the Rapid Transit Co. absorbed the Topeka City Ry., and in 1892 the Topeka Railway Co. was organized to take over the holdings of both companies. A steam operated line between Topeka and Vinewood Park was absorbed in 1903 so that now the Topeka Railway Co. controls the entire street and interurban mileage at Topeka, all of which is operated by overhead trolley.

DAM AND LAGOON, VINEWOOD PARK

VIEW IN VINEWOOD PARK, TOPEKA RAILWAY CO

There are in all 36 miles of track, consisting of 8 miles of suburban track and 28 miles of city track. Seventeen miles of the city track is built in paving, the remaining portion being in macadamized or dirt streets. The city lines extend as double-track routes throughout the central portion of the city, and in the outlying districts are continued as single-track lines with turning loops or "Y's" at the ends. The entire built-up portion of the city is now served by the city lines and frequent service is furnished between the business center of Topeka and a neighboring town of Oakland by a suburban line. A similar line connects the transfer points of the city lines with Vinewood Park, [illegible] miles distant [illegible] Topeka.

Track Construction.

The track built in the paved streets conforms to the standards shown in the illustration. In this type of construction the roadbed consists of a 6-in. foundation of concrete, on which are 6 x 8-in. x 8-ft. white oak ties spaced 2 ft. center to center. Both 75 and 80-lb. 8-in. Shanghai rails are used with the concrete foundation brought up to the middle of the web. On top of this a sand cushion, carrying vitrified paving brick is laid, as shown in the illustration. This arrangement, with cut-away gage brick and ordinary paving brick laid lengthwise against the back of the head of the rail, has proven to be particularly satisfactory. The brick after being placed are thoroughly cement grouted, which materially adds to the life of the pavement near the rails. The high rails in this construction are tied at intervals of 10 ft. by standard tie rods, and the rails of both tracks cross-bonded every 500 ft., at which point the two tracks are connected with an auxiliary negative return cable.

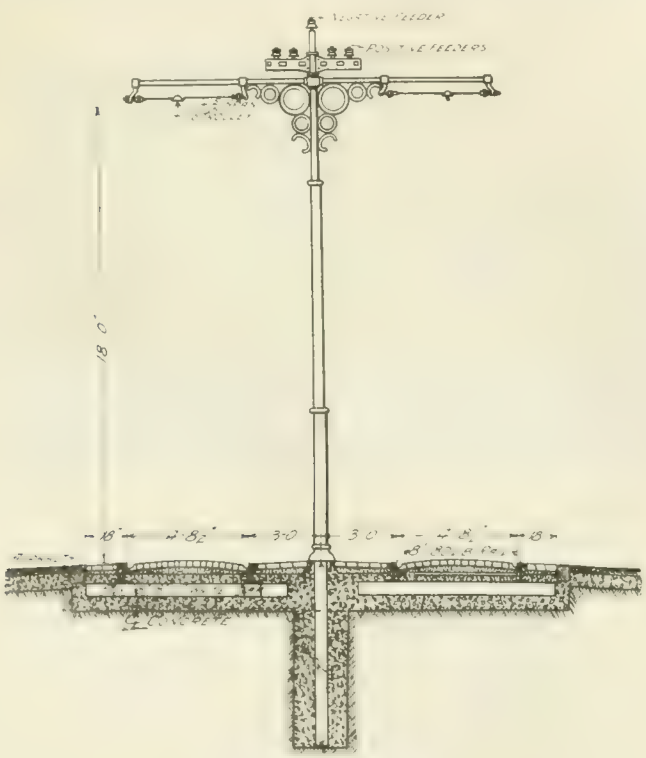
The streets in Topeka are wide and much iron center pole construction is used. The poles are set in concrete to a depth of 7 ft.

CAST WELDING OUTFIT.

below the tops of the rails. Flexible suspension is used with the pole top arranged as illustrated.

In unpaved streets the track is carried on a bed of broken stone 6 in. deep below the bottom of the ties. Standard white oak ties are used and the rails are of standard A. S. C. E. section weighing 75 lb. per yard. On all double-track lines a center-to-center distance of 10 ft. 8½ in. is maintained. The suburban track, a cross section and illustration of which are shown, is of steam railroad construction with T-rails and oak ties carried on a 12-in. bed of broken stone.

The trunk lines are double-bonded with American Steel & Wire Co's. and General Electric Co's. standard types of No. 0000 concealed bonds. Outlying lines are single bonded with the same makes of bonds. As new track is laid in the paved streets, and as portions of the present track are repaired, the joints are cast welded with the welding outfit shown in one of the illustrations. This outfit and the special work furnished through the L. E. Myers Co., of Chicago, were manufactured by the Falk Co., of Milwaukee, Wis. Of the several layouts furnished, the cut herewith shows a large double-track through three-part "Y" at Sixth St. and Kansas Ave. This work is made of 7-in. rail with bolted guards. The frogs are provided with wheel blocks and riser fillers, planed to fit with the rail, so as to give as integral a piece as possible. The square crossings

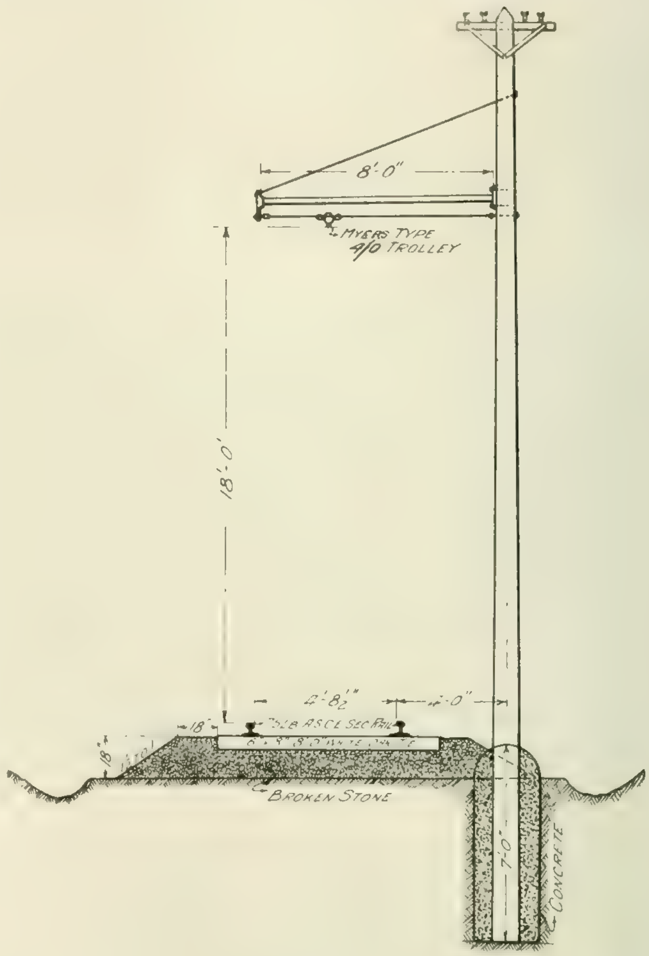


CROSS-SECTION CITY TRACK.

shown in the foreground, are of the Falk Co's. "steel bound type," each frog being thoroughly welded by a heavy mass of steel, so designed as to give guards at all frog intersections for at least 12 in. from the point.

Feeders.

In order to furnish a more perfect return system three negative feeders run to the station from taps along the more important trunk lines. From Vinewood Park a 500,000-c. m. feeder extends along the suburban line, six miles to the intersection of Seventh St. and Kansas Ave., and from this intersection a 1,000,000-c. m. negative feeder is carried to the power house. From the street intersection mentioned a 500,000-c. m. negative feeder extends north along the Kansas Ave. line and serves to help carry the return current from the cross-town lines intersecting Kansas Ave. West of the power



CROSS-SECTION INTERURBAN TRACK.

house is a similar arrangement of negative feeders using 300,000-c. m. cable carried on the trolley poles. Wherever there are return cables, the track is tied to them, at intervals of 500 ft., with No. 0000 copper wire, and the return current system is made complete by a No. 0000 supplementary negative carried through all special track work.

The direct-current feeders are carried in the usual way and consist of seven separate lines controlled from panels of the power station switchboard. Three of these feeders are 350,000 c. m., three are 500,000 c. m. and one for the Vinewood Park Division is 1,000,000 c. m. The trolley is tapped to these feeders at points 1,000 ft. apart.

Bridges.

On the Vinewood division is a single-track steel span 100 ft. long over the right of way of two steam roads. The eastern approach to this span is a fill 35 ft. high and 1,500 ft. long.

Where the main street of Topeka, Kansas Ave., crosses the Kaw River the city has built a concrete-arch bridge of seven spans. Close to this bridge and on the down stream side is the new double-track bridge recently built by the Topeka Railway Co., for the accommodation of its Kansas Ave. lines. This bridge has seven through, pin-connected truss spans set on steel tubes carried down to bed

rock and filled with concrete. The piers of these spans are placed opposite and on the down stream side of the concrete piers of the city bridge. The tubes are 6 ft. in diameter, and in order to place them on bed rock it was found necessary to sink them to a depth of about 27 ft. below the river bed. The clearance of the bridge below low water is 27 ft. The steel work for the bridge was manufactured by the American Bridge Co. As the double-track line on Kansas Ave. is in the center of the street, the railway company purchased a private right of way at either end of the bridge, so that the approaches are of easy grade and curvature.

BIG FILL AND BRIDGE OVER STEAM RAILROADS.

KANSAS [illegible]

Equipment

On the city lines the company operates single-truck cars, and for the excursion and suburban traffic double-truck cars. All the passenger cars of this road are of the single-end type. There are 30 single-truck, semi-convertible cars, manufactured by the American Car Co. and in the railway company's own shops. These cars have large rear platforms of the "Detroit" type fitted with division railings in front of the door, which is located near the step. The front vestibule is carried on an extension of the main sills of the car and is entirely closed. The cars are heated with Peter Smith hot-water heaters, the heater and coal box being placed in the front vestibule. Automatic gates operated by a crank in the motorman's vestibule are used on the rear step. The single-truck cars are equipped with "Eclipse" fenders and side destination signs of the modified "Detroit" type set in angle-iron frames. The smaller front and rear signs are made of wire glass, so held in an angle-iron frame that they are illuminated from the interior of the car. These single-truck cars are mounted on Brill 21-E trucks with 7-ft. 6-in. wheel base and are equipped with two G. E. 54 motors and K10 controllers.

VIEW ON INTERURBAN LINE.

There are five double-truck Jewett cars with the same fittings as the single-truck cars, but having a front vestibule 8 ft. long arranged with side seats for a smoker and baggage compartment. These cars are mounted on [illegible] M. C. B. trucks and equipped with four G. E. [illegible] brake and Consolidated [illegible] Each car has a wooden pilot of the locomotive type.

There are five double-truck open trailers 50 ft. long equipped with National Electric Co's. air brake and hose connections for operating in trains. There are [illegible] open single-truck motor cars and 6 closed single-truck trailers. Accompanying illustrations clearly show the appearance of both the single and double-truck standard types of cars.

At the terminus of the Vinewood Division is a large stone quarry, the output of which is handled entirely by the freight equipment of the Topeka Railway Co. There has also been built up a carload-lot freight transfer business, serving all portions of the city. Side tracks have been built and connections to the steam roads made so that the electric freight locomotive of the company can handle cars between the steam railroad yards and the factories and industries located on the street railway lines. This business amounts to an average of about 15 cars handled per day, 10 of which are cut or crushed stone from the Vinewood quarry. The freight equipment includes an electric locomotive equipped with four G. E. 67 motors with maximum gear reduction. This locomotive is of the platform type 30 x 8 ft. 6 in. in size with the cab at one end. It is mounted on American Car Co. M. C. B. trucks and has National Electric Co. air brake equipment. The freight rolling stock includes 12 flat cars, each of 50,000-lb. capacity mounted on regular M. C. B. freight trucks. An accompanying illustration shows the freight locomotive and its train as operated over the Topeka Railway Co's. system.

SPECIAL WORK [illegible]

The miscellaneous equipment includes two McGuire snow sweepers, five snow plows and a Trenton trolley wagon. This wagon with its team is kept in the emergency station shown in the front view of the offices and barns. Whenever emergency calls are made, the wagon is manned by employes of the shops who are also experienced linemen.

The regular schedules require the operation of 25 cars over nine separate routes. With this equipment the outlying lines are given schedules with headways varying from 7 to 15 minutes. On Kansas Ave., the main thoroughfare, the headway is two minutes. There are 90 trainmen and 30 other railway employes.

At the intersection of Eighth St. and Kansas Ave. is a trolley waiting and transfer station built in the parking between the sidewalk and curb. All the cars of the system with the exception of one division, pass this point, and as a large percentage of transfers are made here, the building serves a useful purpose.

SINGLE END CITY CAR WITH GATES.

The company transports United States mail between the main post office and all of the sub-stations located in the city or suburbs. It also carries mail between Topeka and Oakland, a small city reached by one of the suburban lines. The mail is carried on the regular passenger cars and is checked through by the several conductors handling it, by means of a pouch tag. Each conductor handling a pouch, punches on the tag the point where the mail was picked up and the point where it was delivered, together with the time of each transaction. This system has been found very satisfactory and has greatly facilitated handling mail on passenger cars.

Power Station.

Power for the operation of the entire system and also for commercial lighting for the city is generated at the power house of the Topeka Edison Co., which is controlled by the same interests that own the street railway. The site of the power house is four squares from the business center of the city, which is also the approximate center of distribution for the street railway.

This plant began operation in December, 1885, as the Edison

FREIGHT TRAIN ON CITY TRACKS.

Electric Illuminating Co. At that time the equipment consisted of three return flue boilers, 72 in. x 16 ft., the product of a local manufacturer. There were three 15 x 15-in. Armington & Simms simple engines each driving through belts two Edison bi-polar, 120-volt, 45-kw., direct-current generators. These machines were used to feed the Edison 3-wire lighting circuits, and it is interesting to note that they are still in successful use after having generated current for practically 20 years. Twenty-four-hour service has always been furnished.

Four years ago a new power house was erected which contains an up-to-date equipment of boilers, engines, generators, storage battery, etc.

The present boiler equipment consists of four 365-h. p. and four 300-h. p. Babcock & Wilcox boilers set in pairs. This equipment is housed in a building 75 x 80 ft. in horizontal dimensions. Adjacent to the boiler house are two rooms each covering a ground area 30 x 50 ft. In one of these is a water treating plant. In the other, which is adjacent to both the boiler house and the engine room, is a machine shop for general repairs.

The water treating plant consists of two tanks of 60,000-gal. capacity, each so connected by piping with the boiler feed system

INTERURBAN MOTOR CAR WITH TRAILER.

that the contents of one tank can be used to feed the boilers while water in the other tank is being chemically treated. The capacity of either of the tanks has been found sufficient to run the plant under ordinary conditions for a period of 18 hours.

The coal supply is brought to the outside of the boiler house by the street railway company, and is handled by means of a Mead coal and ash handling system. The conveyor of this system elevates the coal from the level of the street and deposits it in steel hopper-bottom bunkers extending under the roof between the boilers. From the bottoms of these bunkers the coal is led by means of steel pipes to the Babcock & Wilcox stokers on the boiler fronts. The con-

WAITING AND TRANSFER STATION.

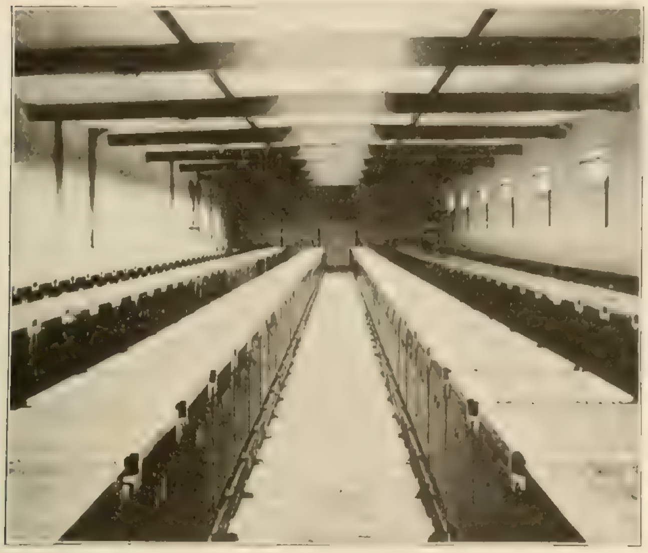
veyor chain with its buckets, after having deposited the coal, passes down the end of the boiler room and on its return trip removes the ashes from under the fronts of the boilers.

An equipment of Green fuel economizers is interposed between the battery of boilers and the single stack serving them. This stack is of the steel self-supporting type 8 ft. in diameter and 187 ft. high.

The engine house is of pressed brick and steel construction with a corrugated iron roof, similar to that on the boiler house. Extending along the entire length of the roof is a skylight of ample size to thoroughly ventilate and light the interior of the engine house.

The entire machine floor is served by a 20-ton crane of 45 ft. span manufactured by the Whiting Foundry Equipment Co.

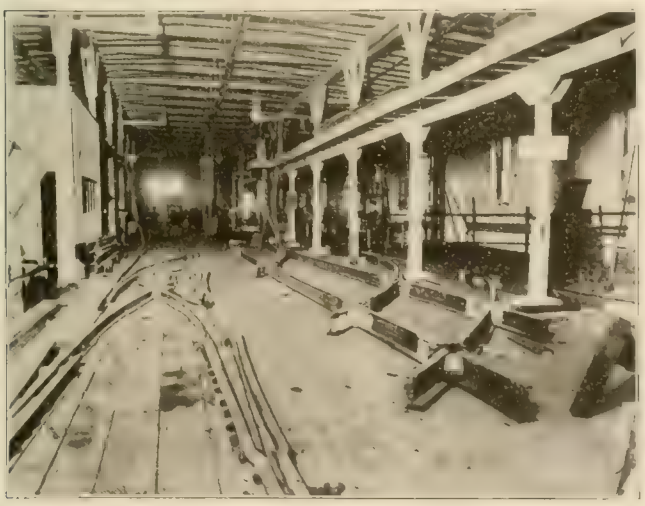
There are three vertical Buckeye cross-compound engines, two of which have cylinders 23 and 42 x 30 in. These two engines each drive two 500-kw., 600-volt direct-current generators. There is now being installed a third vertical Buckeye engine with cylinders 30 and 54 x 33 in. This engine will also drive two generators, direct



INTERIOR STORAGE BATTERY HOUSE.

connected. One of these will be a 500-kw., 600-volt direct-current machine, and the other a 400-kw., 240-volt direct-current machine. The engine and shaft are so designed that if desired each cylinder can work as a simple engine driving its generator, or the two can run as a cross-compound engine. These 600-volt direct-current generators all furnish current for commercial circuits and for the operation of the street railway. Alternating current is used for lighting and power service in the outlying districts. The generators are all of the General Electric Co's. make.

Exhaust steam from the engines is distributed throughout the

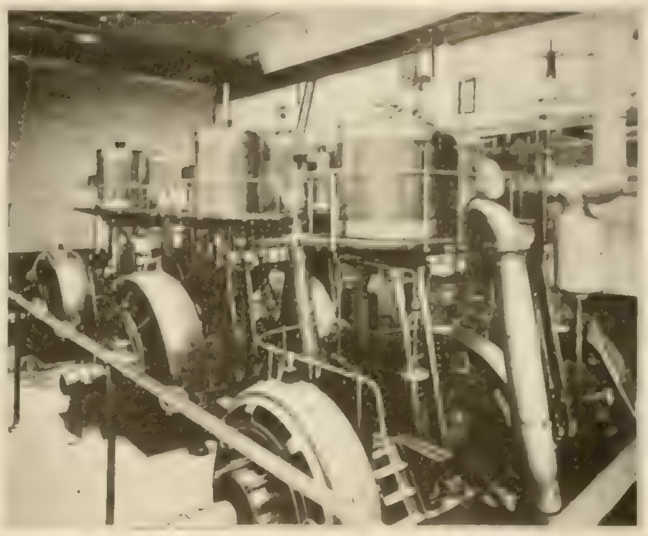


SPECIAL WORK AND MACHINE SHOP

central portion of Topeka and sold for heating purposes. The steam distribution system was installed under the patents of the American District Steam Co.

Adjacent to the engine room is a single-story brick building 90 x 32 ft. in floor area. An exterior view of this building may be seen in one of the illustrations. Inside the building is a storage battery manufactured by the Gould Storage Battery Co. This battery equipment consists of 280 elements, type S-617, each having a capacity of 640 amperes for one hour and a booster set which controls the operation of the battery. The lead lined tanks are of sufficient size so that the battery [illegible] by installing additional plates. The booster is of the Gould "Counter E. M. F." type. The storage battery installation was designed to absorb load fluctuations, thus regulating the load upon the engines within the limits of 2½ per cent above and below normal load. It is stated that this regulation has been maintained even under the most severe operating conditions.

A double-decked switchboard controls the circuits inside the



NORTH HALF OF [illegible]

power plant and the outgoing feeders. The lower panels of this board stand upon the engine room floor and handle all the machine and storage battery circuits. The panels of the upper board, which is supported on the steel framework, are all outgoing feeder panels for railway lighting and power circuits.

Shops.

The car barn, shop and office buildings, a front view of which is shown, are located near the center of the system a short distance from the power house. These buildings, with the exception of the machine shop, are built of solid concrete blocks 12 x 12 x 24 in. in size, made of a mixture of one part Portland cement and three parts Kaw River sand. The blocks are laid in cement mortar of 1 to 2 mixture. The arrangement of the buildings is such that their outer walls form a large rectangle which, between the ends of the buildings, is made complete by a high wall built of similar concrete blocks. The enclosed yard is paved with vitrified brick laid

POWER HOUSE AND [illegible]

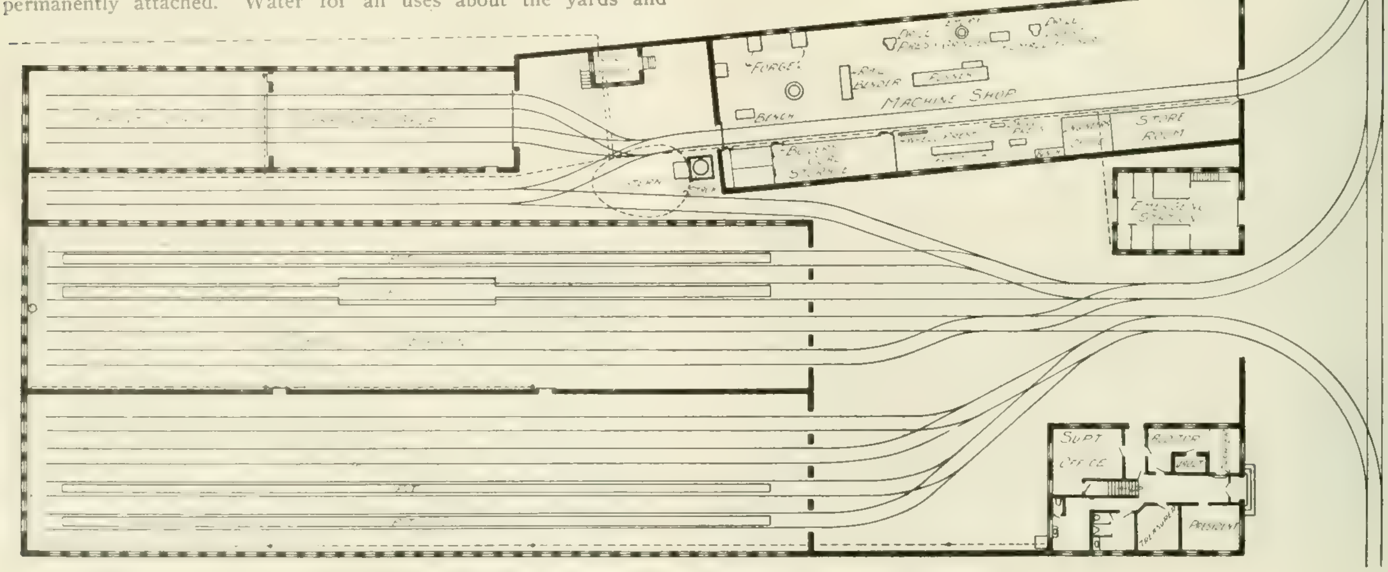
on a 6-in. sub-base of concrete. The spaces between the bricks are grouted with Portland cement.

The largest building is a car barn 242 ft. long by 103 ft. wide. This building has a fire wall extending throughout its entire length dividing the barn into two bays with four tracks in each. The roof of the building consists of a composition covering laid on one-inch sheeting. The pits in the barn are arranged as shown on the plan drawing of the yard. The paint and carpenter departments are housed in a building of the same type of construction. This building is 32 ft. wide by 152 ft. long, having two tracks throughout its

length. A rolling steel door separates the paint and carpenter department. Between this building and the car barns is a space 15 ft. wide and the length of the buildings, which is provided with a track and used as a storage yard.

In the yard between the carpenter shop and machine shop is the oil storage house and pumping station for the group of buildings. The design of the oil house and pumping station is clearly illustrated by the accompanying vertical section. Oil is unloaded from wagons by means of a block and tackle, the barrel being raised and moved to the interior of the oil house on a traveler which serves to place the barrel in a support for holding it until the oil has been drawn off by means of a pipe to the filling table below. In the basement of this building is a 25-h. p. G. E. motor direct geared to a triplex pump of 300-gal. per minute capacity. The operation of this pump is controlled by an automatic rheostat, which maintains water pressure between 30 and 60 lb. for ordinary use and at 125 lb. pressure for fire protection. For regulation and maintenance of pressure, water is pumped against an air cushion in a steel standpipe located in the end of the car barn. This standpipe is 32 ft. high and 3 ft. in diameter, and is connected with nine fire plugs located about the yards. Each fire plug has a 100-ft. coil of 2½-in. hose permanently attached. Water for all uses about the yards and buildings is drained from the different roofs to a 6,000-bbl. cistern built of concrete under the paving in the yard between the carpenter and machine shops.

OFFICE, CAR HOUSE, EMERGENCY HOUSE AND SHOP BUILDINGS—TOPEKA RAILWAY CO.



PLAN OF OFFICES, CAR BARN AND SHOPS, TOPEKA RAILWAY CO.

The machine shop, as shown on the plan, contains a very complete equipment for the repair of trucks and the construction of special track work. With the exception of a few intersections the company has built practically all of its own special work in this machine shop and with the present equipment has provided for economically maintaining its own special work.

In the front of the yard enclosure are the emergency station and the general office building. This latter building is 40 x 60 ft. in size and two stories high. The lower floor serves as the offices for the heads of the railway departments and the upper floor is entirely occupied by the club rooms of the employes' benefit association.

Benefit Association.

The employes' benefit association is chartered under the state laws and has in its membership almost all officers and employes of the Topeka Railway Co. It has the usual quota of officers and is managed by a board of trustees composed of nine men; six employes and three officers of the company. This board of trustees also has control of the affairs of the employes' club rooms.

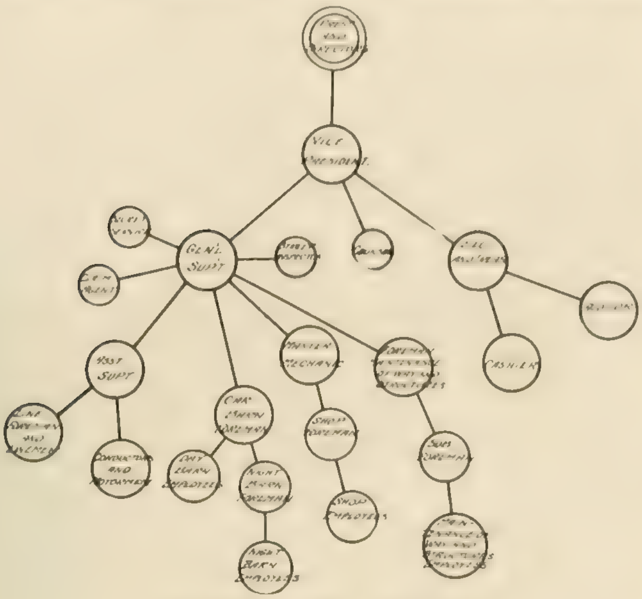
The second story of the office building was built and is equipped especially for the association. Here are provided billiard and pool tables, a well-filled reading table, cigar and tobacco stand, gymnasium, shower bath and lockers. A nominal fee is charged for the use of the billiard and pool tables and bath rooms, the money so collected becoming a part of the general funds of the benefit association. The association pays sick benefits of $7 per week for 15 weeks, $10 per week for 10 weeks and a death benefit of $50. A reserve fund of $200 is kept, and should this fund be decreased by the payment of benefits, each member is assessed 30 cents per month until the fund is again complete. For every dollar paid by the men, the company contributes a like amount, which decreases the number of assessments to five or six a year.

The association rooms are frequently used for social gatherings, to which the families of the members are invited. The accompanying picture was taken at such a gathering held last Christmas.

Vinewood Park.

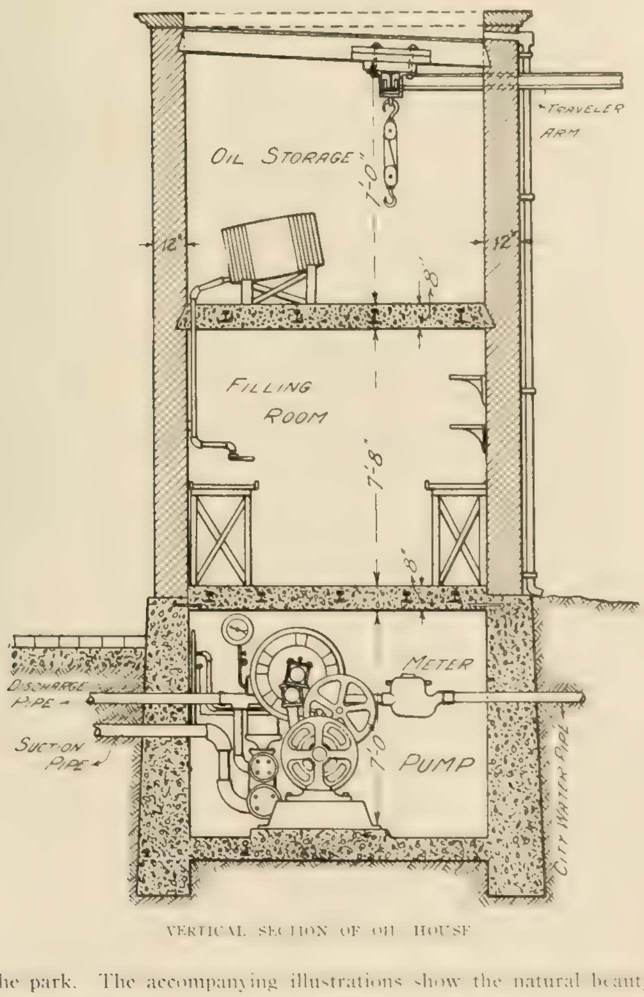
The company owns a pleasure resort known as Vinewood Park. The property comprises 375 acres of woodland, 40 acres of which

has been improved and set apart as a modern amusement park. This park is at the terminus of the Vinewood Division and six miles from the center of Topeka. The amusements in the park include a figure-8 toboggan; carrousal; summer theatre, seating 800 people; cafe; dance hall, artistically built, with a large veranda and two



ORGANIZATION TOPEKA RAILWAY CO.

large stone fireplaces, which permit the use of the building for popular dances given by the management at regular intervals throughout the winter. Band concerts are given, and for this purpose a large sound shell with an enclosure seating 1,500 people has been constructed. There are several rustic pagodas scattered throughout



VERTICAL SECTION OF OIL HOUSE

the park. The accompanying illustrations show the natural beauty of the location and the natural lagoon winding about through the park, the water [illegible] dams.

The grounds are [illegible] current. For lighting [illegible] generated by a [illegible] engine. [illegible] structed near the entrance [illegible]

The officers of the Topeka Railway [illegible] Wilson; vice-president and general manager, L. E. Myers; secretary and treasurer, [illegible]


CHRISTMAS DINNER [illegible]

superintendent, A. M. Patten; assistant superintendent, W. E. Hixon.

The entire road, power plant, buildings, etc., were designed, constructed and equipped by the L. E. Myers Co., Monadnock Building, Chicago.

The Cost of Carrying a Passenger.*

BY C. L. S. TINGLEY, SECOND VICE-[illegible] CO., PHILADELPHIA, PA.

This is a broad subject and is worthy of the most careful study. Conditions vary so widely that the conclusions of one man may not be of much value to another. Adequately treated, it would require months of study and work. Owing to the limitations of time imposed by our worthy secretary, and the demands of the writer's own business, he was unable to give it the careful study of which the subject was worthy, and must plead this in extenuation of any shortcomings which may be discovered in his handling of the question.

At first sight this would seem to be a very simple question, and one which would be readily answerable by any one in the railway business. Any manufacturer who can do business in these days of combinations and fierce competition can give you at once the cost not only of every item of his product, but of every stage of manufacture, and one who is familiar with the standard classification of accounts adopted by this association, and with the recommended form of report would say that it would be an easy matter to compute the cost of carrying a passenger. Apparently, however, this is not true, for no less an authority than Mr. Edward Dana Durand of the National Bureau of Corporations, who, in collaboration with Mr. T. Commerford Martin, prepared the text of the United States Census Report of 1902 on "Street and Electric Railways," writing in the Review of Reviews for February, makes the statement that for the census year the average cost of carrying a passenger has fallen to three cents, but this is coupled with the statement in the latter part of his aricle that "as a matter of fact American street railway companies have almost never made systematic appropriations for depreciation out of their earnings."

This question is further most ably handled by Mr. Howard S. Knowlton in the Review of Reviews for July, and from both of these articles it is apparent that the question of an adequate depreciation account is the crux of the whole question.

*Read before [illegible] Philadelphia, Sept. 29, 1905.

It is contended by Mr. Durand and [illegible] supported by many practical street railway men—that if the physical property is well kept up from time to time as it is worn out or becomes obsolete, and all such replacements charged to operating expenses, that there is little or no need for depreciation charges. But as a matter of actual practice it is well known that this is not done, nor is it sound accounting, as in that case each year fails to bear its proportion of the dissipation of capital caused by the wearing out of the property. Take, for instance, the case of track. Ten years ago the road which laid down an 80-lb. girder rail was well abreast of the times, and the track was subjected to the operation of 20-ft., or in some cases a trifle larger, cars, with two 20-h. p. motors. Now, suppose that this track had been kept in good repair, ties renewed from time to time, joints kept up, and everything done for it that was needed; it is today subjected to the wear of from 40 to 50-ft. cars, with four 40-h. p. motors, and is inadequate and must be replaced with 100 to 120-lb. girder rail laid in concrete, the cost of which must be borne either by a depreciation fund or by new capital. The same thing is true of cars, motors, and power plant.

Mr. Knowlton quotes from Electric Railways and Tramways, published by Mr. Philip Dawson, an eminent English engineer, in which he gives as the results of an extended study of street railway conditions in this country the following table of allowances for depreciation:

Buildings	1-2 per cent.
Turbines	7-9 " "
Boilers	8-10 " "
Engines (slow speed)	4-6 " "
Generating Units (direct coupled)	4-8 " "
Transformers	5-6 " "
Batteries	9-11 " "
Rotary Converters	8-10 " "
Bonding	6-10 " "
Overhead System	3-8 " "
Cars	4-6 " "
Shop Equipment	12-15 " "
Motors	5-8 " "
Track Work	7-13 " "

And deduces therefrom a fair average allowance for depreciation of from 8 to 10 per cent as a minimum. The latter figure coincides with the writer's own judgment in the case.

The special report of the United States census bureau on "Street and Electric Railways" for the year 1902, on page 11, gives the following figures in table six:

Distribution of the Gross Income of Operating Companies to Leading Items of Expenditure.

	Amount.	Percentage.
Gross Income from all Sources	$250,504,627	100.0
Operating Expenses	142,312,597	56.8
Fixed Charges, Total	77,595,053	31.0
Taxes and Licenses	13,078,899	5.2
Rentals	25,518,225	10.2
Interest	38,085,911	15.2
Miscellaneous	912,018	0.4
Dividends	15,882,110	6.3
Surplus	14,714,867	5.9

And on page 39 of the same report the average fare is stated at 4.94 cents per revenue passenger. We now have data for all items which enter into our competition except the much-discussed one of depreciation.

From the foregoing we get the following table of cost as shown by United States Census Report, being the average of all the roads in the United States:

Gross Earnings per passenger		4.94 cents
Operating Expenses per passenger	2.81 cents	
Taxes, Licenses, Rentals, and Interest per passenger	1.53 "	
Total cost per passenger without any allowance for depreciation		4.34 "
Surplus over cost per passenger		.60 "

For the purpose of illustrating this discussion the writer has selected three companies with which he is connected as typical of varying conditions:

First: One which had been originally well constructed, had been well maintained, but had been in operation for over ten years prior to passing to its present ownership and the resultant rehabilitation.

Second: One which had not been so well constructed originally, and which had been in operation less than ten years before passing to its present ownership.

Third: One which had been thoroughly well built and maintained, and had been in operation less than ten years since its reconstruction before passing to its present ownership, but upon which much of the equipment had become obsolete, owing to the advancement of the art and changed conditions of service.

As the census bureau has reduced all its figures to the basis of percentage of gross earnings, the writer has taken the amounts expended in the reconstruction of the above properties and reduced them to the percentage of the gross earnings for the year following the completion of such reconstruction, so that in each case the property might have the advantage of any increased revenue due to better service, etc. The average of the three properties has also been taken. The items considered in arriving at these conclusions are only those relating to the destructible plant. In the first instance the percentage is 21.5 per cent; in the second, 11.7 per cent; in the third, 4.1 per cent, and the average is 12.1 per cent.

If Mr. Knowlton is correct (and the writer believes that he is) that the average life of the destructible plant is ten years, we would have an average yearly charge on the gross earnings of the above properties which should have been taken care of by a depreciation fund of 1.21 per cent of the gross earnings.

From the foregoing we can deduce the following table as an illustration of how a minimum charge for depreciation affects the cost of carrying a passenger:

Gross Earnings per passenger		4.94 cents
Operating Expenses per passenger	2.81 cents	
Taxes, Licenses, Rentals, and Interest per passenger	1.53 "	
Depreciation per passenger	0.06 "	
Total cost per passenger		4.40 "
Surplus Over Charges per passenger		0.54 "

In these figures no consideration has been given to the question of amortization of capital in the case of limited franchises. Many of us are connected with companies which are working under such franchises and know that this is a question which must be met.

The profitable part of a street railway is that which lies in the heart of the city and is of limited extent; it is that upon which you get the short ride. Every progressive street railway—and what street railway is not progressive—must keep extending its lines into the outlying portions of the city where riders are few, the hauls are long, and the dead runs are numerous; where for one or two trips night and morning the cars are full, but the balance of the day are empty, or nearly so. As the city grows, the street railway—that pioneer of civilization—must push further and further out into the wilderness of vacant lots, and the hauls grow longer and longer, but the nickel gets no larger; wages get higher, and the cost of almost everything which we use advances, so that all of the increased travel goes to keep up that portion of the road which must be run at a loss. The central portions of the system—and this is especially true in the larger cities—have, as a rule, become so congested that no more cars can be operated with safety, so that the profitable short ride has about reached the maximum, precluding the possibility of relief from that source.

In conclusion I would repeat that an adequate depreciation fund seems to the writer to be the crux of the whole matter. This is a much mooted question, and one which it is not the province of this paper to discuss, but to those who are interested I would commend a careful study of Mr. Durand's article in the February Review of Reviews, and also of Mr. Knowlton's in the July number, together with the report of the United States Census Bureau for 1902.

The Cincinnati, Georgetown & Portsmouth Traction Co. has recently opened its line from Georgetown to Russellville, Ohio.

Test of the Railway System of the Scioto Valley Traction Co.

BY F. C. CALDWELL, PROFESSOR OF ELECTRICAL ENGINEERING, OHIO [illegible]

The principal object of this test was to obtain, as complete as possible, a statement of the distribution of the power consumption and losses throughout the system during a normal day's run, though, naturally, many other points were brought out in the course of the work. The test was made in accord with an established policy that during each year a complete test of some interurban railway be carried out by the students of the Departments of Mechanical and Electrical Engineering at the Ohio State University. This test formed the subject matter of three graduating theses, presented by nine seniors for their degrees, and it was participated in by no less than 70 observers, taken from the upper classes of the two departments. The steam end of the test was directed by Prof. E. A. Hitchcock of the Department of Mechanical Engineering.

It will be remembered that this system, which was described in the "Review" for September, 1904, is one of the comparatively few third rail lines now in operation and that it runs in a southerly direction from Columbus, O., having as the southern termini of its two branches Lancaster and Circleville. The line may be divided into the sections indicated in the following table, the distances between points being as given.

Circleville Division. Town.	Miles.	Lancaster Division. Town.	Miles.
Columbus		Columbus	
Obetz Junction	3.53	Obetz Junction	3.53
Lockbourne	4.69	Canal Winchester	8.50
Ashville	6.91	Hooker	11.13
Circleville	8.15	Lancaster	4.13
	23.28		27.29

The lines branch at Obetz and the power house is at Rees Station, on the Circleville division, 1.08 miles south of the junction. There are four converter sub-stations, one in the power house, two on the Lancaster Division at Canal Winchester (9.5 miles) and Hooker (17.3 miles), and one on the Circleville Division at Ashville (10.4 miles). The transmission is at 27,000 volts, three phase, which is used even in reaching the converters in the power house. The Circleville branch is now being extended to Chillicothe, about 20 miles farther south.

A brief outline of the equipment is as follows:

Apparatus.	Kind.	Make.	Number.	Capacity.
Power Plant.				
Boilers	Water tube	Franklin	4	450 h. p.
Main engines	Hor. Cross Comp. Condens.	Hamilton-Corliss	2	1,500 h. p.
Alternators	25 cycle, 375 v.	Bullock	2	1,000 kw.
Exciter engines	Hor. Non-Condens.	Harrisburg	3	
Exciters	125 volt	Bullock	3	100 kw.
Transformers	375-27,000-volt, oil cooled	Wagner	6	370 kw.
Sub-Stations.				
Transformers	Oil cooled	Wagner	3*	150 kw.
Rotaries	600 volt	Bullock	1*	400 kw.

Roney stokers with coal and ash conveying apparatus are used. The switchboard is General Electric. The high tension line is of aluminum and equivalent in conductivity to copper wire of 66,000 c. m. The third rail is of A. S. C. E. standard section, in 60-ft. lengths and weighs 100 lb. per yd. It is supported at every fifth tie on porcelain insulators. The track is of 70-lb. rails and is well bonded and ballasted.

The test was run for 24 hours or for such part thereof as the apparatus was in use. The first readings were taken on the starting up of the engines at 4 a. m., Apr. 21, 1905. Power measurements throughout the sytem were made until 12:40 a. m., Apr. 22nd. At this hour the system was shut down, with the exception of the exciter which was kept running [illegible] at 4 a. m. on the 22nd.

*In the power house this equipment is duplicated.

In the boiler room the coal was [illegible] ured by calibrated water meters, and its temperature taken; the flue gas was analyzed with Orsat's apparatus; the flue temperatures were taken with three pyrometers and the draft with manometers. Steam pressures were taken and calorimeters were used. Air temperatures were read.

In the engine room four indicators were used upon the main engine and one on each auxiliary, also one on the steam line below the throttle, readings being taken every ten minutes. The engine speed was determined by a revolution counter and a tachometer. Steam gages and thermometers were also read. Due allowance was made for steam leakage and condensation.

In the switch gallery, readings of all instruments were taken at one-minute intervals.

In the sub-stations and on each of the four cars, half-hourly readings on watt-hour meters were taken during the time of operation of the system. Also during a little over three hours in the afternoon, designed to cover one cycle in the movement of the cars, 15-second readings of current and potential were made. It was also necessary to measure the power given to the Central Market system, with which the line connects at the south end of Columbus. Only three of the boilers and one engine were used during the test, one of the boilers supplying the auxiliaries.

A brief resume of the special points brought out by the test will be given first, followed by a general statement covering the disposition of power consumption and loss.

The area of heating surface per boiler is 4,884 sq. ft. and the grate surface 90 sq. ft. The coal used was Hocking Valley nut, pea and slack, giving the following analysis:

Proximate Analysis.	Per cent.	Ultimate Analysis.	Per cent.
Moisture	5.63	Carbon	[illegible]
Ash	17.06	Hydrogen	[illegible]
Volatile matter	30.50	Oxygen	13.65
Fixed carbon	46.79	Nitrogen	[illegible]
		Sulphur	[illegible]
	99.98	Ash	[illegible]
			100.00

The analysis of the refuse gave ash, 82.17 per cent; unburned coal, 17.83 per cent.

The calorific value of the coal by Mahler calorimeter was 11.084 B. t. u. This gave 11,746 B. t. u. per pound of dry coal, or 14.162 B. t. u. per pound of combustible.

DATA FOR BOILER TEST.

Average temperatures in degrees Fahrenheit were: Boiler room, 64; flue, 540; feed water, 150; water entering heater, 44.

Steam pressure (per gage), 141 lb.

Quality of steam, 97.5 per cent.

	Boiler No. 1.	Boilers Nos. 3 and 4.
Coal fired	[illegible]	[illegible]
Feed water	164,000 lb.	287.000 lb.

DATA FOR BOILERS NOS. 3 AND 4 USED ON MAIN ENGINE.

Apparent evaporation per lb. coal as fired	6.66 lb.
Equivalent, from and at 212, as fired	7.25 lb.
Equivalent, from and at 212, per lb. dry coal	7.68 lb.
Equivalent, from and at 212, per lb. combustible	10.08 lb.
Equivalent evaporation per sq. ft. heating surface per hour	1.55 lb.
Boiler h. p.	440
Efficiency of boilers (from combustible)	68.7 per cent.
Efficiency of boilers and furnaces	63.0 per cent.
Coal per boiler h. p. per hour	4.75 lb.
Coal per sq. ft. of grate per hour	11.59 lb.

FLUE GAS ANALYSIS.

	Per cent by Volume.	Per cent by Weight.
Carbon dioxide	6.32	9.40
Oxygen	13.20	14.27
Carbon monoxide	.07	0.07
Nitrogen	80.41	76.31

Air required per lb. of coal, theoretical .... 9.13 lb.
Air used per lb. of coal, actual .... 24.2 lb.
Per cent air excess 165.5

HEAT BALANCE FOR BOILERS NOS. 3 AND 4.

How Used.	Per cent.
Loss due to latent heat	3.9
Loss due to products of combustion	9.5
Loss due to air excess	13.5
Loss due to unburned coal	4.5
Loss due to radiation, etc. (unaccounted for)	6.0
Heat used for water evaporated (useful)	62.6
	100.0

MAIN ENGINE PERFORMANCE.

Average r. p. m. 94.6
Pressures: Steam at throttle from cards .... 138.5 lb.
Av. initial, from cards, high pressure cylinder .... 110.3 lb.
Av. initial, from cards, low pressure cylinder .... 13.9 lb.
Av. back, from cards, high pressure cylinder .... 19.5 lb.
Av. back, from cards, low pressure cylinder .... 2.70 lb.
Vacuum at engine, inches mercury 24.7
Vacuum at engine, lbs. absolute 2.54
Vacuum at condenser, inches mercury 25.4
Vacuum at air pump, inches mercury 27.3
Steam before entering low pressure cylinder (from temp. 254° F.) .... 17.2 lb.

Mean Effective Pressures.

	Head End.	Cylinder End.
High pressure cylinder	25.6	21.9
Low pressure cylinder	10.7	9.5

Average i. h. p developed by engine 780
Dry steam consumed by engine .... 274,400 lb.
Dry steam per i. h. p. per hour .... 17.0 lb.
Coal per i. h. p.-hour .... 2.62 lb.
Coal per kilowatt-hour .... 4.15 lb.
Thermal efficiency of engine, per cent 13.5
Efficiency, piston to switchboard, per cent 86.6
Efficiency, steam to switchboard, per cent 11.7
Efficiency, coal to switchboard (Boilers Nos. 3 and 4 only), per cent 7.4

PERFORMANCE OF AUXILIARIES.

Total weight of steam for engines and pumps, lb 159,500
Water per i. h. p. for auxiliaries, lb 49.7
Coal per i. h. p. for auxiliaries, lb 7.85

POWER PLANT PERFORMANCE.

Total coal per i. h. p.-hour (main engine), lb 4.22
Total coal per kilowatt-hour, lb 6.69
Net efficiency of plant from coal to switchboard, per cent 4.7

The current generated by the exciter was used partly for lighting and for running a traveling crane, a grab bucket for coal conveying, a coal crusher, a filter motor, and the boiler feed pumps, as well as for exciting the alternator field. These various demands were divided approximately as follows:

	Kw. h.
Lights (210 incandescent, 12 arc)	381
Crane (very little used)	2
Grab bucket, crusher and filter motor	21
Boiler feed pumps	184
Alternator fields	373
	961

The total power delivered to the switchboard was 10,580 kilowatt-hours. The load curve shows that the average load increased rapidly from about 150 kw. at the start to about 525, at which it remained nearly constant, though with considerable fluctuation, till about 1 p. m. It then increased slightly, to about 620 kw., between 8 and 9, after which it fell off rapidly and fairly uniformly, till midnight, the last readings being about the same as the first. The maximum average for any half hour was 780 kw. between 8 and 8:30 in the evening.

The average field current for the main generator was 369 amperes. The average for the feed pump was 70.6 amperes. The main current (373-volt) curve varies greatly in character from hour to hour during the day, at times being quite uniform and at times very jagged. During most of the time it varied within the limit of 500 and 1,500 amperes, averaging 907 for the day; 2,000 amperes was the maximum current noted and this was reached several times. Twice during the day the current fell nearly to zero.

The average potential at the switchboard was 27,050 volts with a maximum variation from about 25,400 to 28,400. For the most part the variation was between the limits of 26,500 and 27,700. The current curves for the different feeders showed, of course, much greater proportional variations.

TEST OF TRANSMISSION SYSTEM.

This part of the test was of unusual interest, on account of the use of the third rail, and especial attention was given to its characteristics. Although the good voltage regulation obtained on the car was quite striking, it soon became evident that the resistance of the third rail conducting system was much higher than it should be, and further investigation showed that the trouble lay in the bonds between the rail and the copper cables, running under crossings, etc. Four of these taken at random and compared by means of a milli-voltmeter with variable rail lengths, gave 100, 140, 155 and 40 ft. of rail as having equal resistances.

The bonds between the rails, both of the third rail and of the track, seemed to be in good condition, giving on test equivalent rail lengths equal to only one or two times the lengths of the bonds.

Measurements of the resistances of the third rail system, the track and the 27,000-volt system were made when the plant was shut down at night. In measuring the track and third rail resistances, the lines of the high tension system were used as potential wires. During these measurements, which were made on two nights, the temperature was from 25° to 26° F. One of the 125-volt exciters was used as a source of current and a short circuit was made at the end of the system between the third rail and the track. One high tension line being connected to the third rail and one to the track at the power house, the resistance of any section of track or third rail could be determined by connecting voltmeters between these potential wires and the tracks or third rail at any sub-station. The current and potential at the power house would give the resistance of the whole system. On account of leakage, which will be discussed later, these resistances will be a little too low. Results were obtained with four different currents. Owing to the special interest attached to this matter, the complete set of values will be given.

SUMMARY OF RESISTANCES.

Section of System.	Ohms.	Miles.	Ohms per mile.
Third rail and track from P. H. to trolley, west track, Parsons Ave.	.194	4.49	.0432
Third rail and track from P. H. to trolley, east track, Parsons Ave.	.210	4.49	.0468
Third rail and track from Obetz to trolley, east track, Parsons Ave.	.135	3.41	.0396
Trolley and track, west track, Parsons Ave.	.029	.16	.181
Third rail and track from P. H. to trolley, Circleville, including trolley	.835	18.63	.0448
Trolley and track at Circleville	.166	1.42	.117
Third rail and track from P. H. to trolley at Circleville	.669	17.25	.0388
Third rail from P. H. to Ashville	.318	10.52	.0302
Track from P. H. to Ashville	.081	10.52	.0077
Third rail and track from P. H. to trolley at Lancaster	.749	23.89	.0314
Third rail from P. H. to Hookers	.587	19.03	.0308
Track from P. H. to Hookers	.093	19.03	.0049
Third rail from P. H. to Canal Winchester	.277	9.58	.029
Track from P. H. to Canal Winchester	.058	9.58	.0061
Track and third rail from P. H. to Obetz	.064	1.03	.0621

Track and third rail from Hookers to Lane trolley ...	110	4.86	.0226
Track and third rail from Ashville to Circleville, incl. trolley	415	8.15	.0509
Track and third rail from Ashville to Circleville (to trolley)	[illegible]	6.73	[illegible]
High tension from P. H. to Hookers, per phase ...	31.56	19.00	1.68
High tension from P. H. to Ashville, per phase ...	16.28	10.52	[illegible]

It will be noted that the resistance of the third rail conductors is from four to six times greater than that of the track, whereas on account of its larger area (ratio 10 to 7), and its higher conductivity, it should have a resistance little, if any larger than that of the two track rails in parallel.

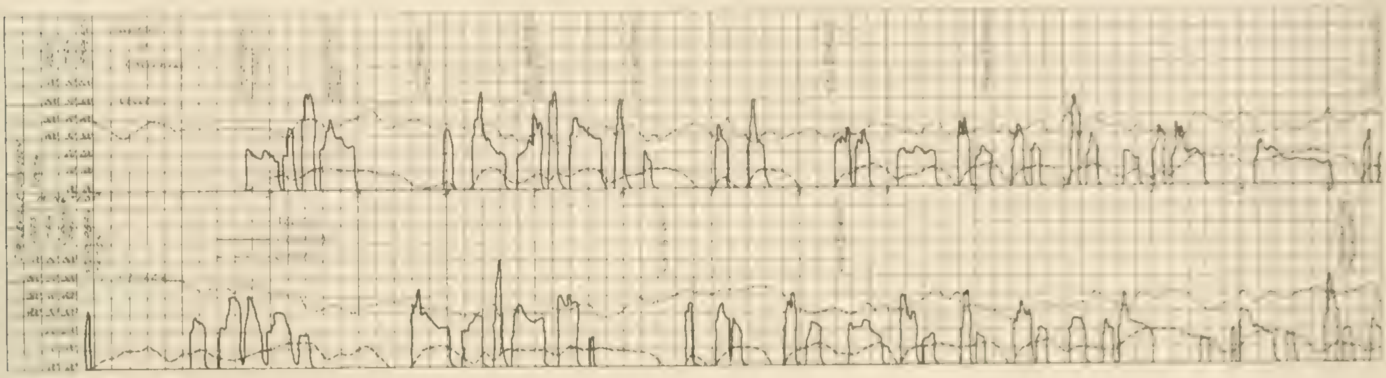
The question of the leakage from the third rail to the earth is one which is always of interest in connection with third rail systems. Such leakage may occur over the supporting insulators of the rail, especially when these are wet, or it may take place in the underground cables.

Tests for leakage were made on two occasions, first at night following a heavy rain throughout the day. With all current-using circuits open, an ammeter was placed in the third rail feeder at the power house supplying the Circleville division (23.3 miles), and the 600-volt current thrown on. At first 170 amperes passed, but this fell in about eight minutes to 40 amperes. The circuit having been opened, the third rail beyond Ashville (8.15 miles) was cut out. On next closing the circuit, a current of 40 amperes flowed, which fell to 13. These results, together with those obtained on the Lancaster division, and later during dry weather on the Circleville division, are given in the following table:

Weather.	Track.	Length, miles.	Amperes on closing circuit.	Steady current.	Amperes per mile.
Wet.	Columbus to Circleville....	23.28	170	40	1.72
Wet.	Columbus to Ashville.....	15.13	40	13	.85
Wet.	Obetz to Canal Winchester	8.05	40	19	2.35
Wet	Obetz to Hookers....	10.18	144	120	6.27
Dry.	Ashville to Circleville.....	8.15	*1	*1	.012
Dry.	Rees to Ashville	10.52	22	12	1.83

In the preceding [illegible] read accurately with 100 ampere meter.

The fall in the current after the closing of the switch is probably largely due, during wet weather, to the drying off of the insulators. The switchboard [illegible] steady current is probably largely due to bad cable terminal insulation, especially where this current is large, and also in the case of dry weather. Following the first test a bad cable leak was found between Canal Winchester and Hookers. These tests, while not sufficient to be conclusive, indicate that, barring the unnecessary cable leakage, there should be very little trouble from this source, even during wet weather.

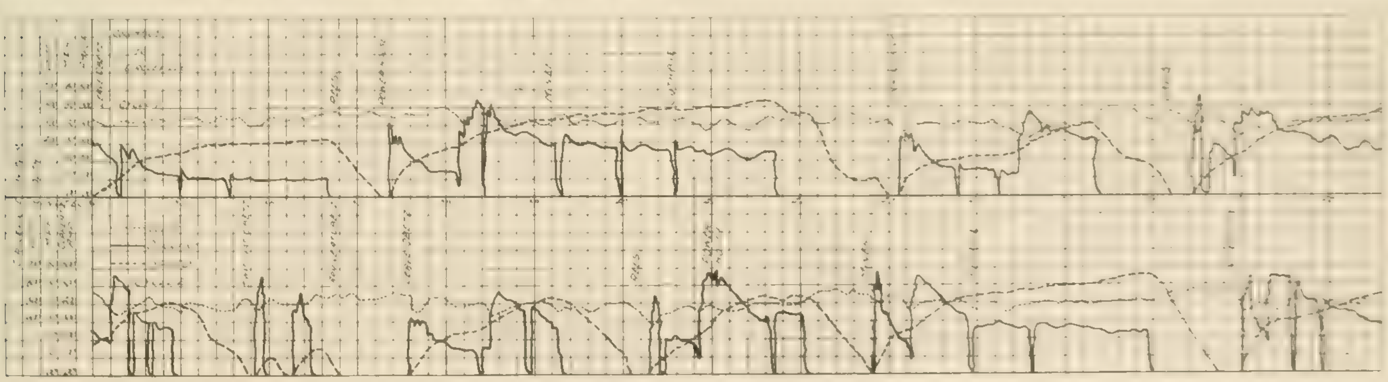


CAR TEST RECORD ON CITY TRACK

In determing the distribution of power consumption it was necessary to compute the energy taken for the car lighting and heating, which was not included in the main circuit wattmeter readings. There are 35 lamps per car, taking approximately 1.93 kw. with 550 volts; the headlight takes 1.38 kw.; the heaters are arranged in four groups; each group is controlled by a switch and takes about 4.6 kw. By observing the times when light and heat were turned on and off, the total energy so used on all cars was calculated as being, for car lights, 28 kw.-h.; for headlights, 17 kw.-h.; for heaters, 182 kw.-h.; total for light and heat, 226 kw.-h.

The obtaining of wattmeter readings on the cars involved the solution of the problem of so suspending the meters as to protect the jewels from damage by the vibration and jarring of the cars. This was done by suspending each meter in a sort of cradle by two coiled springs of stiff steel wire, from the car roof. While this method removed satisfactorily the vibration, the swinging round of the meter was so great as to necessitate someone steadying it continually. It also caused some doubt as to whether the readings might not be affected by the movement of the meter. A calibration made later with the meters suspended similarly and bounced around even more violently by hand, showed that there was no appreciable effect produced by the motion. Calibrations of wattmeters used were made, both before and after the test, which showed no appreciable change in the constants.

The following table gives the wattmeter readings throughout the system for the day of the test, together with the efficiencies obtained.



CAR TEST RECORD ON INTERURBAN TRACK

Energy Delivered.	Corrected results kw.-h.	Per cent of total delivered.	Per cent of total generated.
Total energy generated	10,580		100
Power delivered by sub-stations.—			
Power house rotary No. 2	[illegible]	44	
Power house rotary No. 1	500		
[illegible]	1,220	17	
Canal Winchester	1,000	23	
[illegible]	1,100	16	
Total	7,320	100	69.2
Energy used.—			
Car No. 110, Circleville Division	870		
Car No. 103, Circleville Division	750		
Car No. 102, Lancaster Division	1,152		
Car No. 106, Lancaster Division	903		
Lights and heaters on all cars	226		2.1
Total	3,901		37.0
Energy delivered at Parsons Ave. to Columbus system	2,192		20.7
Energy delivered to street railway at Lancaster	252		2.4
Total used	6,345		60
Lost in transmission system	4,235		40
Lost in transformers, high tension lines and rotaries	3,260		30.8
Lost in track and third rail	975		9.2

All-day efficiency of transmission system................60 per cent

An effort was made to obtain efficiencies at different loads by taking readings of the wattmeters every half hour during the day, but no satisfactory connection between load and efficiency could be deduced. This was probably due to the different locations of the cars, and to different leakage, since, during part of the test, it rained hard.

The large percentage loss in the high tension transmission and transformation system must be chiefly due to the fact that this apparatus is working so much under its rated load, the average loads in the outside sub-stations being only about 15, 21 and 14 per cent, respectively, of the capacity of the apparatus. If the system were working with normal rated load, the loss in transformers and rotaries should not be over 10 per cent, whereas, under the present conditions, it is probably about 27 per cent. With the present rapid development of the system, these conditions will be greatly improved.

The 15-second potential readings taken between 2:00 and 5:00 p. m., and covering one complete cycle in the movement of the cars, showed, as was to be expected, good regulation throughout the system. At the outside sub-stations the variation lay between 620 and 580 volts for the most part, with occasional momentary drops to 550. At the power house sub-station, where the load was greater, the regulation was not quite so good, dropping more frequently to 500 volts and varying for the most part between 620 and 550 to 570. On the cars the voltage seldom fell below 500 momentarily, usually varying between 600 and 540 or over.

The maximum currents recorded were, most of the time, in the vicinity of 300 amperes, though occasional peaks reached 500 or even occasionally 600.

The following table shows the expenditure of energy in the different parts of the system:

	Per cent.
Energy supplied to the plant in the coal	100.00
Used for auxiliaries, lighting, etc., including losses	32.58
Loss due to moisture in the coal (Boilers 3 and 4)	2.44
Loss due to air excess above that required (Boilers 3 and 4)	8.54
Loss due to heat in products of combustion (Boilers 3 and 4)	6.04
Loss due to unburned coal in refuse (ash-pit) (Boilers 3 and 4)	2.83
Loss due to radiation from walls, etc. (Boilers 3 and 4)	3.54
Loss from energy in steam not converted into power	38.00
Loss in engine friction and in generator	.80
Loss in high tension system and rotaries	1.61
Loss in third rail and track	.33
Available for running cars	3.28

This analysis brings out in a striking way the relative importance of the losses occurring in the steam and in the electrical end of the plant. The large loss in the operation of the auxiliaries is particularly noticeable. In this connection it should be stated that with the present load the plant normally operates with but two instead of three boilers. The coal per kilowatt-hour is therefore about 10 per cent higher than it should be, and in the foregoing analysis this difference is mostly charged to the auxiliaries. It is also to be noted that the power used by the auxiliaries, etc., would be very slightly increased if the plant were working at its full present capacity, or six times the load at the time of the test.

CAR TESTS.

In addition to the tests on the cars mentioned, a special test was made upon one car at a later date, which constituted the subject of a separate thesis. In this test a complete set of readings was taken covering four trips of the car, two on the Circleville Division and two on the Lancaster. The same motorman was employed throughout the day. For the current readings a graphic recording ammeter, similar to the one described before the American Institute of Electrical Engineers in 1903 by Mr. A. H. Armstrong, was loaned to the University by the General Electric Co. In this instrument, the magnet of which is separately excited, the needle carries a pen which makes its record on a 4-in. strip of paper driven by clockwork. The time is recorded by another pen, as in a chronograph, every five seconds. The scale as used was 200 amperes per inch; the rate of travel of the paper can be adjusted for from 4 in. to 8 in. per minute. In this time circuit, also, a bell was connected so that five second signals were given for speed and voltage readings.

The speed was obtained by means of a small generator known as an Apple igniter and kindly loaned by the Dayton Electric Co. for this purpose. This was supplied with a rubber tired friction wheel, which pressed upon the car wheel axle and thus set up an e. m. f. proportional to the speed of the car. The fields were separately excited with the same current used for the ammeter field. An approximate calibration was made by running the igniter in the laboratory, but this was later corrected from the speed time curves and actual known distances run over by the car. A difference of about 2 per cent was found in the constants when going forward and backard, due probably to the fact that the instrument had to be set slightly askew on the axle.

A wattmeter was used, suspended as in the former tests, but the readings obtained were not consistent and are not given. A wattmeter was also placed in the pump circuit. The cars weigh 42 tons. They were built by the American Car & Foundry Go., and are mounted on No. 27 Brill trucks, with four G. E. No. 66 B motors of 50 h. p. capacity, geared 64-301, and Sprague type M, form E, multiple control system. The cars are fitted with Westinghouse air brakes, which can be used either directly or automatically when running single cars. The wheels are 35½ in. in diameter.

The brake was used directly and the pump at 600 volts took about 4.5 amperes or 2.7 kw. while operating. The following table gives the power used by the pump on the different trips.

	Time, hrs.-min.	Energy, Watt-hrs.	Av. power for pump, watts.	Watt-hrs. per mile.
Columbus to Circleville	1:13	120	99	4.5
Columbus to Circleville	1:10	135	116	5.0
Circleville to Columbus	1:07	135	124	5.0
Circleville to Obetz	0:42	70	49	4.2
Obetz to Lancaster	0:48	35	44	1.5
Columbus to Lancaster	1:25	147	106	4.8
Lancaster to Columbus	1:23	141	102	4.6
Lancaster to Obetz	0:57	47	485	2.1

In connection with the car test the power readings on the cars made during the first test were worked up more in detail and the table on the following page gives the data as arranged from this test. These tests were computed from the beginning of the Scioto Valley third rail proper at the south end of Columbus.

The somewhat greater values per car-mile on the Lancaster division are due to the greater number of grades and curves on that line. The difference bewteen car No. 103 and No. 110, and again between No. 106 and No. 102, in the amount of energy taken is quite striking. These cars are supposed to be duplicates, so that the difference is probably largely due to the difference in the handling of the motors.

The graphic ammeter records, together with the curves derived from the five-second readings of the voltage and speed, were plotted together on profile paper, the combined curves aggregating over one hundred feet in length. Parts of these curves are reproduced here. A study of them brings out the following facts:

The necessity for turning off the power at all crossings gives the current curve a particularly jagged appearance. On starting the car the current usually rises to between 400 and 500 amperes, then if the motors are thrown in parallel, it falls gradually to about 250 to 300, or if they are kept in series, to about 150 amperes. The average current as determined by planimeter for one of the runs from Lancaster to Obetz was about 150 amperes. The steps of the controller at starting show as a series of saw teeth more or less horizontal in general direction, according to the rapidity with which the controller handle was thrown over. The maximum current recorded was 680 amperes, though it seldom exceeded 550.

The speed curves show that during the actual running outside the city, an average speed of about 35 miles per hour was usually attained. The maximum speeds were usually between 45 and 50. In the city streets about 15 miles was the maximum reached. The highest speed recorded was 58 miles per hour; 50 miles was several times exceeded.

The voltage curves show the voltage varying usually between 550 and 600 volts, dropping [illegible] on starting the car, as low as 450.

The calibration [illegible] liability of station recording wattmeters in this kind of service, the errors found [illegible] in one case as 16 and in another 30 per cent. The ammeters were also very inaccurate.

POWER USED BY CARS

Number of car.	Run.	Number of stops.	Number of passengers.	Kilowatt hrs. supplied to motor.	Distance, miles.	Time, minutes.	Average speed m. p. h.	[illegible]	[illegible]	[illegible]
103	Cols. to Circleville...	11	1[illegible]	[illegible]1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]2
110	" " " ..	15	19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
103	Circleville to Cols...	15.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
110	" " "	15	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
102	Cols. to Lancaster..	15	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
106	" " " ..	15	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
102	Lancaster to Cols...	16	24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
106	" " "	16	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

For the successful carrying out of this test much credit is due to the following members of the graduating class of the Ohio State University, who had charge of the parts indicated:

Power plant: L. G. Robinson, L. C. Hopkins, G. C. Vennum, and C. R. Hepner. Transmission system: O. F. Metz, T. A. Wingard, W. H. Kempton. Car test: L. W. Chubb, H. L. Hope.

Much is also due to the officers of the Scioto Valley Traction Co. for their hearty cooperation in the work of this test, and to the Columbus Railway & Light Co. for the loan of wattmeters, without which the test could not have been nearly so complete.

Traffic Problems Upon Loops and Stub Tracks.

BY HOWARD S. KNOWLTON.

The analysis of traffic is a problem of never-ending importance upon the modern electric railway system. Although the volume of business may average about the same for different days, the distribution of traffic is probably never exactly twice alike. On large systems there is a constant shifting of loads between different lines from month to month, while on small roads the variation in earnings upon different routes are often most striking. There is always an element of uncertainty in the preparation of schedules for the more populous communities, a necessary margin being left at car houses between regular and extra cars to take care of unforeseen variations from the normal run of traffic.

Within the past few years more scientific methods have come into play in the study of street railway operation, and the results have been most gratifying. In the early days there was little time for anything but the exacting work of keeping the cars moving, but with the development of power stations and rolling stock in the direction of larger and more reliable equipment, breakdowns have become less frequent, and the work of maintenance has fallen more into the course of routine duties. An enormous amount of work remains to be done in the determination of maintenance cost in detail upon all classes of electric railways by the co-operation of the auditing and motive power, rolling stock and road departments, but all this is a matter of dealing with data ready at hand or easily obtained. The study of traffic is in many ways a problem of greater perplexity. It is easy enough to find out what a car is earning, but not so easy, and much more expensive, to determine how far the average passenger on even a single trip is carried. Here is a tremendous difference between the steam road, with its definite way bills of freight haulage and its tickets and mileage coupons for passenger service, and the city trolley system, with its elastic journeys and vast transfer privileges. The field of study in connection with street railway traffic is almost limitless, and every factor which bears upon it is worth investigation.

The relation of loops and stub tracks to the expeditious handling of traffic is a much more complicated subject than appears upon first acquaintance. The relative efficiency of the two styles of layout, or better, their comparative traffic capacity, is often misconceived. The choice of a loop or a stub track layout is not a matter to be decided off hand, where large volumes of traffic are to be handled in rather limited periods. Questions of available real estate area, terminal station design as a whole, possibility of separating incoming and outgoing traffic, character of surrounding property, cost of construction and other points bear directly upon such a choice in many cases. At the same time it is well worth while to investigate the possible movement of rolling stock upon both loops and stub track layouts, and it is with the intention of presenting equations which will throw light upon the general cases most commonly encountered in such studies that this article is prepared.

Considering a simple loop of single track with a tangent stretch of platform parallel to the rails, let

D = length of platform in feet.

N = number of cars platform will hold—i. e., number of cars which can stand beside platform simultaneously.

S = average speed of cars in miles per hour when moving along platform, exclusive of stops.

T' = time in seconds, exclusive of stop, for one car to traverse the length of the platform.

T'' = time in seconds of car stop.

M = interval between cars, in seconds.

C = number of cars per hour which can be handled.

If the interval M is known, the number of cars per hour is readily determined by the equation

$C = 3{,}600 \div M$ ....(1)

If the times T' and T'' are known, M can be found by substituting their values, together with the value of N, in

$M = (T' + T'') \div N$ ....(2)

assuming, of course that the platform is kept filled with cars during the time considered.

Eliminating M, we have

$C = 3{,}600\ N \div (T' + T'')$ ....(3)

Now, $T' = D \div (S \times 1.466)$ ....(4)

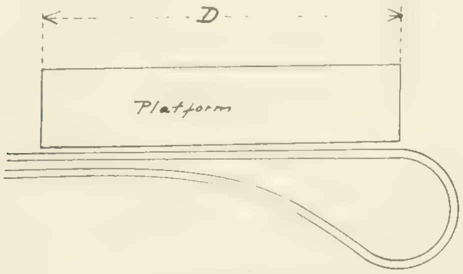
So we have, substituting for T' its value in (4)

$C = (5{,}280\ NS) \div (D + ST'' \times 1.466)$ ......(5)

That is, given the length of a platform served by a single loop track, the maximum number of cars it will hold, the average speed of the cars and the time taken by a stop of average length, (5)

gives the maximum traffic capacity of the loop in cars per hour, barring external obstructions and delays. Thus, we find that 371 cars per hour can be passed over a loop serving a platform 250 ft. long, with 5 car berths, 20-second stops and an average speed of 6 miles per hour along the platform edge.

Fig. 1 illustrates a simple loop with a platform upon which no distinction is made between arriving and departing passengers. In case the platform is divided, so that a double stop is made, the problem must be solved separately for each portion of its platform. The smaller value of C consequently represents the maximum number of cars which can be passed over the loop in an hour, the effect being to change the adjoining platform's conditions as to the



[illegible]

values of N, S or T″. The same facts apply to double platforms in series upon the same track.

It is interesting to vary the quantities appearing in equation (5) and analyze their effect upon the car movement. Fig. 2 shows the traffic capacity in cars per hour of three loops having respectively 75 ft., 150 ft. and 300 ft. of platform length, the stops varying from (1) to 60 seconds, and the speed of cars along the platforms being 6 m. p. h. The curves were platted to include values on each side of the range of practical operation, as well as those encountered under commercial conditions of passenger handling. They were all worked out on a slide rule from equation (5). The first point of interest is the convergence of the curves to a common intersection at 844 cars per hour and 0 length of stop. This means that the maximum number of equal length cars per hour which can be passed over any loop at 6 m. p. h. platform speed and just come to rest is 844, the cars being of such length that 8 can stand on 300 ft. of platform track simultaneously. It will be seen that the length of stop has a much greater influence upon short loop traffic capacity than upon the car movement possible upon long loops. (In this discussion the length of the platform track is referred to when speaking of the length of loops.) Thus, on the 300-ft. loop 740 cars per hour can be handled on a 5-second stop of each, whereas on the 75-ft. loop only 540 cars can be handled. Under the conditions assumed the 15 and 20-second stops are most marked in their relative influence upon the car movement. While common sense tells us that if a large number of cars are to be handled in a given time at a platform where long stops cannot be avoided, the platform must be larger than if shorter stops were possible, it is interesting to see the relations between the factors in the case graphically expressed. Another conclusion which may easily be drawn is that with a given type of car and fixed platform speed, in order to handle a given number of cars per hour the length of platform is directly proportional to the time of stop permissible. Thus, 300 cars per hour can be handled on the 150-ft. loop with 31-second stops, but on the 75-ft. loop the stops must not exceed 15.5 seconds on the average for this traffic.

In the actual handling of traffic 6 miles per hour is often a much higher speed than can be maintained by cars approaching a platform stop within the platform limits. The curves in Fig. 2 were plotted mainly to show what might be called "forced-draft" conditions in car movement, but a simple change of the value of S from 6 to 4, or whatever the speed my be, is all that is necessary to enable one to calculate the traffic capacity of any loop with which he is concerned. Throughout this article the object has been to show a method of studying loop and stub traffic rather than to tabulate results which anyone may easily work out for himself. The variation in length of track, size of cars, speeds and stops in actual practice are so numerous that to work out the curves for a great variety of practical conditions would transcend the available space of this discussion. It remains, however, to determine an equation for the traffic possible on a stub track in which

D = length of platform in feet.

N = number of cars platform will hold.

T′ = time in seconds for one car to run length D.

T″ = time in seconds for one car to make stop.

S = average speed of cars in m. p. h. along platform, excluding stops.

M = interval between cars in seconds.

I = time in seconds for last car of each group N to clear inbound track.

C = maximum number of cars per hour which can be handled on the stub.

Now, C = 3,600 ÷ M, as in the study of loops..(1)

And M = (2 T′ + T″ ÷ N) + I............(2)

Since the stop enters but once, and the groups of N cars must each wait until the preceding group has cleared the inbound track before proceeding. (In the case of the loop, the different groups of N cars can follow each other directly upon the inbound track.)

From (1) and (2) we have

C = 3,600 N ÷ (2T′ + T″ + NI)............(3)

But, T′ = D ÷ (S + 1.466)..................(4)

So that

C = 5,280 S N ÷ [2 D + (S T″ × 1.466) + (S N I × 1.466)].(5)

In cases where I may be neglected, equation (5) becomes

C = 5,280 S N ÷ (2 D + 1.466 S T″)........(6)

Fig. 3 represents a typical stub track, and Fig. 4 shows the traffic capacity of three stubs, 300 ft., 150 ft. and 75 ft. long, respectively, for comparison with the loops of Fig. 2. For the sake of simplicity the value of I is assumed equal to zero.

As one would naturally expect, the capacity of a stub track of equal platform length with a loop track, operating under similar

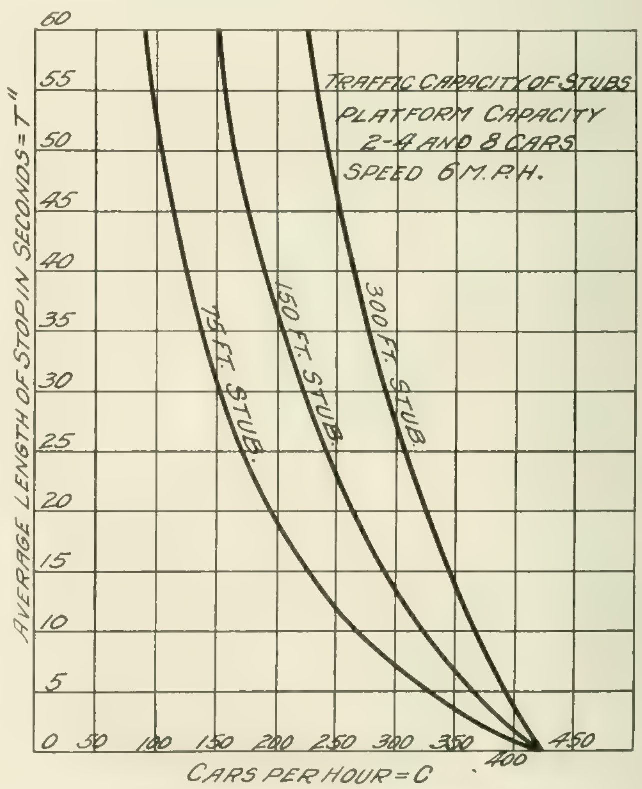


FIG. 2 TRAFFIC CAPACITY IN CARS PER HOUR.

conditions of car size, speed and duration of stops, is always much less than that of the equivalent loop. Thus, with 20-second stops, the 75-ft. loop handles 255 cars per hour, against 195 on the stub, a difference of 31 per cent in favor of the loop. With 30-second stops, the 75-ft. loop handles 190 cars per hour and the stub 153, the difference being but 24 per cent. Comparing 10-second stops on the 300-ft. loop and stub, we find that the loop has an advantage of nearly 81 per cent, while on the 25-second stop it has an advantage of but 58 per cent. This leads to the general conclusion that an in-

crease in the length of stop rapidly cuts down the advantage of the loop in comparison with the stub track of equal length, and that the difference in traffic capacity of loops and stubs grows smaller and smaller and of less advantage to the loop as the length of track diminishes.

Another interesting comparison is the relative capacity of long and short stubs as the stops vary. Thus, with a 15-second stop the 300-ft. stub has a capacity of 345 cars per hour, against 292 cars per hour at a 30-second stop, a reduction of 15 per cent. Under the same conditions the 75-ft. stub carries 225 and 153 cars per hour, respectively, the reduction being 32 per cent. This leads us to conclude that short stops are of greater importance on short stubs than

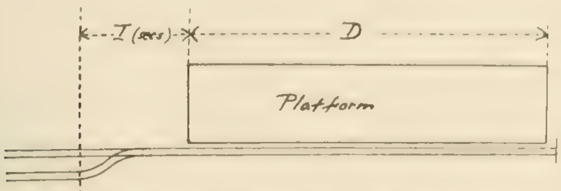


FIG. 3—TYPICAL STUB TRACK.

on long stubs, just as in the case of loop traffic previously discussed.

In practice it is, of course, usual to lay out stub tracks in a parallel group with several platforms, rather than to attempt to handle a heavy traffic upon a single long stub. Hence it is important to compare groups of stubs with the loop or loops which are competitive with them. Neglecting the delays expressed by the value of I, each stub problem can be separately solved by equation (5) under "stubs," and the combined capacity of the group compared with the combined capacity of the loops involved.

Comparing a single loop 300 ft. long (platform length) with four 75-ft. stubs (shown in Fig. 5) we have for several values of stops:

Cars Per Hour.

Seconds stop.	One 300-ft. loop.	Four 75-ft. stubs.
10	660	1,080
20	530	780
40	385	500

Thus, the capacity of these four stubs of a combined length equal to that of a single loop is far greater than that of the loop. This shows the importance of comparing both loops and stubs in preparing terminal layouts.

Still another general conclusion of interest is that the traffic capacity of different stubs is equal when the same ratio exists between the length of the stub and the time of the stops. Thus, a 75-ft. stub, a 150-ft. stub and a 300-ft. stub each handle 325 cars per hour with 5, 10 and 20-second stops, respectively. The same relations were pointed out under the loop problems.

It is necessary to realize, in figuring upon problems of this character, that the determination of car movement is not always the deciding problem in laying out electric railway terminals. In some

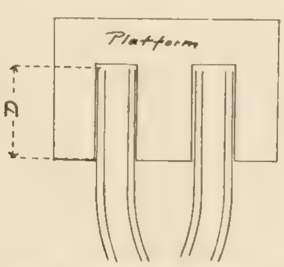


FIG. 5—FOUR STUB LAYOUT.

cases the local conditions absolutely preclude the use of a loop scheme, and in others the stub layout is equally objectionable. The separation of incoming and outgoing passengers is a matter of great importance in many terminals, but unfortunately it is frequently impossible to provide for this. Perhaps the street railway park terminal is as readily adapted to traffic separation as any layout used by large crowds of people. Often a combined loop and stub scheme may be worked with profit. It is urged by advocates of stub terminals that congestion on platforms is better avoided by such layout than [illegible] the loop preference leads many to point out that the steady stream of traffic which can there be handled without delay offsets the spacing afforded by stubs. M[illegible] stubs that can be kept [illegible] tracks as fast as the conditions of clearance will allow, otherwise it is impossible to reap the full benefit of either scheme.

A difficult feature of loop operation often presents itself in regard to the stopping points of cars having different destinations. Unless some scheme of lamp or semaphore signaling is used it is exceedingly difficult to avoid great congestion in the rush hours, on account of the ignorance of passengers as to the berths at which cars will stop. The scheme for informing passengers which berths their respective cars will stop upon as used on the Park St. southbound subway loop in Boston is an admirable instance of what may be done in the way of relieving confusion and consequent congestion

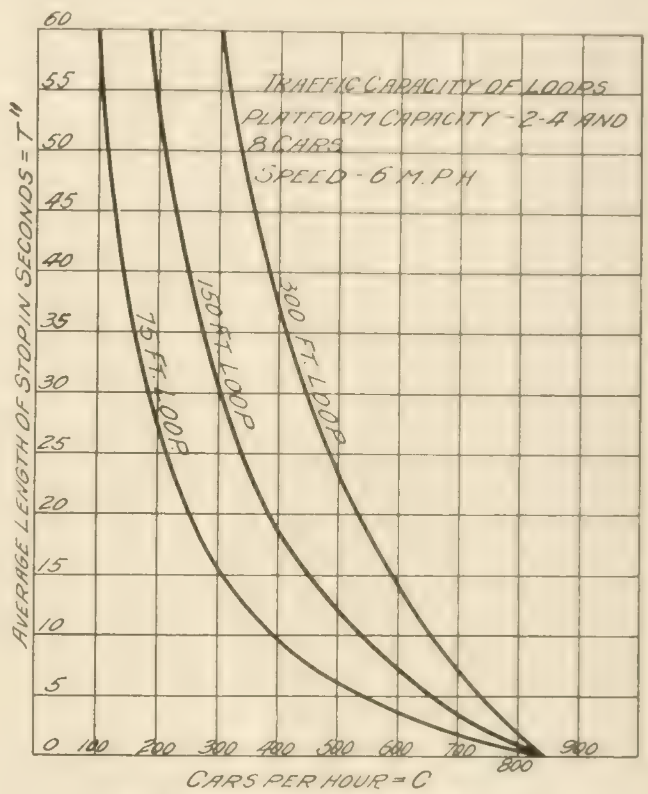


FIG. 4—[illegible]

due to uncertainty upon the car stop question. The stub track has an advantage in that if the same cars always run upon the same track the signs placed at the platform ends of the tracks greatly facilitate the dispersion of traffic to its proper destination.

Enough has been said to show that each case must in part be figured on its own merits, and that many factors enter into a wise choice between loops and stubs. It is safe to say that in many instances of operation the actual number of cars handled is far below the maximum possible, or even desirable. Any line of track which carries a car movement of 450 cars per hour is doing a prodigious business under present-day conditions. To secure the maximum the cars must move with the precision of clockwork, and this, on a system which operates in densely crowded streets, is often an impossibility. A loop capable of 500 car movements an hour is of little advantage if the track feeding it is blocked to a maximum of 200 cars per hour by teams and other street traffic. At the same time it is well to have the means at hand for determining what loops and stubs can be made to do at best, and if the method described in the foregoing paragraphs acquires any usefulness in the future analysis of loop and stub traffic by railway engineers, the object of this article will be attained.

Work has commenced on a large sub-station for the Illinois Traction System at Decatur, Ill.

October Meeting, Ohio Interurban Railway Association.

The fall meeting of the Ohio Interurban Railway Association was held in the German room of the Hotel Chittenden, Columbus, O., October 26th, the meeting being called to order at 10:40 a. m., by President Spring. The minutes of the last regular meeting held at Cedar Point, June 22nd, were read and approved.

President Spring then made a short address to the members of the association, congratulating them upon good attendance at the first meeting of the winter season. The growth of the association during the past year has been very rapid and the work accomplished very satisfactory, but on the resumption of the fall meetings the association is at its most critical stage. Enthusiasm and interest are shown and the best idea now is to take advantage of these so that the association will be able to continue its work with success.

To do this it has seemed advisable to consider the matter of establishing a permanent secretaryship. The American Street and Interurban Railway Association has come to this conclusion after considerable thought and discussion, and also the New England Street Railway Club two years after its organization found the association about at a standstill and solved the problem by electing a permanent secretary. In the latter association the result has been very satisfactory, and the manner in which the matter has been handled has materially decreased the expense of the association so that the office of the secretary is almost self-sustaining. This is accomplished in the publication of the official organ of the association.

It, therefore, appealed to the executive committee that similar action should be taken in the Ohio association and to that end the executive committee at a meeting held in Columbus, Wednesday evening, discussed the feasibility of such a plan. It has been decided by the executive committee to send a circular letter to all members of the association regarding this matter. In order to launch this permanent secretaryship it will be necessary to have some financial assistance and it is proposed that each member contribute five dollars per month to this end. This will enable the association to establish an office and enable the secretary to defray the expenses of his office, cover his salary and launch an official publication which will eventually be self-sustaining, as well as cover the salary and expenses of the secretaryship.

It was also decided that it would be well to question the Indiana association regarding its views on this subject. The executive committee will give this matter further attention between now and the next meeting of the association and action will be taken at that time.

The President then spoke briefly of the work accomplished by the transportation committee in regard to interchangeable mileage coupons, the report of which committee followed.

The Transportation Committee reported that since the June meeting there have been added to the interchangeable coupon ticket agreement, six companies, increasing the total mileage over which these books are accepted from 1,437 to 1,816 miles, divided as follows: 1,138 miles in Ohio, 571 in Indiana and 107 in Michigan. The names of the companies which have been added are: The Indiana Union Traction Co., Ft. Wayne & Wabash Valley Traction Co., Indianapolis & Cincinnati Traction Co., Indiana Northern Traction Co., Indianapolis & Martinsville Rapid Transit Co., Indianapolis & Eastern Railway Co., and the Lake Erie, Bowling Green & Napoleon Railway Co. The committee is at present in correspondence with the Richmond Street & Interurban Railway Co., Indianapolis, Columbus & Southern Railway Co., Indianapolis & Northwestern Traction Co., and two companies in Michigan, all of which it is hoped will be secured as members to this agreement at an early date.

A contract governing the interchange of coupon tickets similar to the one adopted by this association has been adopted by five Illinois companies, with the exception of a few minor details regarding the division of expenses on account of maintaining a bureau and the form of book. The Illinois book is comprised of 120 coupons or six dollars worth of transportation, which is sold for five dollars. Those interested in the Illinois situation advised the committee that they were of the opinion that a consolidation of these companies with the Ohio association in this work could be easily arranged in the event of the establishing of a bureau for the handling of the coupons. Two other Illinois companies, not parties to the agreement, were called upon and the objections raised by them were practically the same as those of the Ohio companies when the interchangeable coupon was first considered. Representatives of these companies stated, however, that in the event of other Illinois companies joining they could not hesitate to become members on account of any personal objections they noted in the agreement.

Revised Bulletin No. 6 is now being prepared by the committee, showing a total of 30 companies accepting interchangeable coupon tickets. There are 3,800 books in circulation in Ohio, 1,900 in Indiana and 400 in Michigan.

The committee has given considerable attention during the past year to the matter of publicity and arrangements have been made through the Associated Press to keep the public advised through various daily papers of additional companies signing the agreement from time to time, in each case publishing a new list. Arrangements have also been made for the publication in connection with time tables in the Central States Guide that interchangeable coupon tickets are accepted on the several properties. Similar arrangements have also been made with the publishers of other guides.

Attention was then called to the apparent disinclination of a number of the companies to mail the coupons to the owning road prior to the 5th of each month and all were urged to give the matter prompt attention.

The Transportation Committee is comprised of J. H. Merrill, chairman, H. A. Nicholl, F. W. Adams, F. W. Coen and Theodore Stebbins.

The report of the treasurer of the association was then read and approved. Since the report for October 1st, initiation fees for membership have been received amounting to $21.00.

The report of the committee appointed to attend the meeting of the American Street Railway Association, at Philadelphia, was then read by Mr. Coen. Mr. Coen briefly called attention to the success of this meeting and the matters of especial interest to the Ohio association.

Mr. E. P. Roberts spoke of the interesting papers read dealing with gas engines and steam turbines, which were of particular interest from an engineering standpoint.

The president then read a letter of regret from Mr. W. Caryl Ely, stating he was unable to attend the Columbus meeting.

Applications for membership to the association were then read and the following gentlemen elected: L. C. Bradley, general superintendent, Scioto Valley Traction Co.; G. O. Nagle, manager, Stubenville, Mingo & Ohio Valley Traction Co.; T. C. Cherry, Ohio Central Traction Co.; E. P. Matthews, Dayton, O.; M. MacDonald, MacDonald Ticket & Ticket Box Co.; S. F. Skeel, Crouse-Hinds Co.; W. P. Cosper, Garton-Daniels Co.

Announcement was then made of the appointment of Judge E. P. Matthews as chairman of the legislative committee in place of the late Dr. J. E. Lowes, of Dayton. Announcement was also made that the November meeting of the association will be held at the Tod House, Youngstown, O., on November 23rd, and that the annual meeting will be held in Dayton, O., in January, at which time it was hoped that Governor Herrick, Mr. H. H. Vreeland and Mr. W. Caryl Ely will be present and address the association. An invitation was then read from the Electric Club of Cleveland, of which Mr. E. P. Roberts is president, extending to the members of the association the courtesies of the club. Meetings of this club are held the first Wednesday of each month at which times very interesting papers are read, a large number of which are devoted to matters of interest to electric railway men. An invitation was extended by Mr. L. C. Bradley, of the Scioto Valley Traction Co., for the members of the association to take a trip over the company's

lines. A motion was then made by Mr. Coen that a committee of three be appointed as a permanent committee on insurance and the following were appointed by the president: F. W. Coen, chairman, Theodore Stebbins and R. E. De Weese.

Mr. Staats was then given an opportunity to present to the association the status of the work he is undertaking in regard to mutual insurance for electric railway and power properties. It will be remembered that this subject was presented to the Ohio association about a year ago and since that time considerable data and information have been gathered which show that the amounts expended for insurance on car barns, power plants and other property is far in excess of the actual cost of insurance. Companies that have gone into this matter very thoroughly have succeeded in having the rates on old line and stock insurance reduced to a considerable extent but there is room for further reduction by the organization of a mutual company. With this end in view, the Associated Railway Companies' Insurance Co., of Cleveland, O., has been organized with a capital stock of $200,000 and surplus at $300,000. While the organization is not yet prepared to write insurance, the Electric Mutual Insurance Co. and the Traction Mutual Insurance Co. have been incorporated under the laws of Ohio and these companies will commence to issue policies as soon as $20,000,000 of properties have been equipped in accordance with their requirements. In order to facilitate matters it has been found desirable to organize a stock insurance company under the name of the Associated Railway Companies' Insurance Co., embodying mutual features and the control of which will be placed in the hands of a number of leading traction companies. It is the intention to write both protected and unprotected risks in this company, taking the present basis rate of the stock insurance companies and granting reduction in rate as the risks are equipped with fire protection appliances. Statistics show that the actual amount of money recovered on fire losses of 420 roads during a period of 10 years was less than 28 per cent of the insurance premiums paid by the traction companies, and it is expected that this new company will bring the net cost of insurance on traction properties and electric light and power stations down to less than 25 cents per annum on each $100 of insurance carried. Several of the larger companies have already subscribed to the capital stock of the Associated Railways Companies' Insurance Co., and there are several other railway companies who are giving the matter favorable consideration. The meeting then adjourned until 1:30 o'clock p. m.

The afternoon session was called to order by the president at 1:30 o'clock and announcement was made that a special car had been provided by the Scioto Valley Traction Co., to leave its station at 2 o'clock for a trip over the Chillicothe Division. The association accepted the invitation and voted to adjourn at 2 o'clock, to continue the meeting enroute. In the meantime, discussion of the subjects to be presented at the meeting were taken up. The first question was: "What should be the proper width of interurban cars in order to give passengers the same comforts which they receive on steam roads? What should be the space between seats and the width of aisle?" The second question was: "What should be the width of the devil-strip between tracks on city and on interurban lines?"

Mr. E. P. Roberts opened the discussion by stating that while the present tendency is to standardize everything possible, local conditions often prevent the adoption of certain practices, and especially is this true in regard to the width of cars and the width of the devil-strip between the tracks. The width of the car is governed on double-track systems by the width of the devil-strip. In city streets it is usually governed by franchises and city ordinances, while the cost of grading often governs to an extent the width of devil-strip on interurban tracks. In practice it is noticeable that those roads having the cheapest grading have the widest devil-strip. Therefore, it is necessary to make the best of the permissible width.

Another condition that has considerable bearing on the width of interurban cars, the width of the aisle and the space between seats is the character of service in which the car is placed. On city cars and local interurban cars where traffic is more or less congested it is desirable to have wide aisles and plenty of space near the doors to provide standing room and to enable passengers to pass each other in boarding and leaving the car. On the other hand, in limited service the width of the aisle might not be as great and more attention [illegible] spacing of the seats and the convenience of passengers. On a short run with frequent stops [illegible] satisfactory. On long hauls the opposite is the case. Mr. Roberts was of the opinion that [illegible] angle of the seat and the back of the seat, that in a great many instances the slope of the seat and back were such that in slowing down or stopping the car a person would slide forward, also that where arm rests were provided they were of such construction as to lend to the discomfort rather than the comfort of the passenger. Arm rests of generous proportions should be provided. The specifications for an interurban car which is to be built for a proposed road with a fair number of stops, include the following: Seats spaced 34 in. center to center; no arm rests; roll back 26 in. high with head roll; top of seats cushion 18 in. from the floor; width of aisle 19 in.; interior width of car 7 ft. 7 in. Measurements taken of a Pennsylvania R. R. coach showed the following: From panel to end of cushion, 39 in.; width of cushion, 20 in.; heights of back, 25 in.; seats, 35½ in. center to center; width of aisle, 32 in.; width of car under eaves, a little over 10 ft.

Mr. J. C. Gillette, master mechanic, Columbus, Delaware & Marion Railway Co., stated that his company has some cars in which a width of 36 in. is had from the side of the car to the inside edge of the aisle; 19½ in. between seat castings; 24 in. between the insides of the seat backs, and 24-in. aisles. These cars are 8 ft. 4 in. overall.

The meeting then adjourned to the special car, where it was expected the discussion would be continued. This, however, was not the case on account of the enjoyment of the trip over the Circleville Division and a portion of the new line to Chillicothe.

The party returned to Columbus at 5 o'clock and after a unanimous vote of thanks to Mr. Bradley the meeting informally adjourned.

Among the manufacturers represented at the Ohio meeting were: E. C. Van Valkenburg & Bro., E. C. Van Valkenburg; Howard B. Arnold, sales agent for electric railway supplies, Dayton, O.; National Carbon Co., A. G. Summerell, Cleveland, O.; Chicago Varnish Co., Fred L. Olds, Chicago, Ill.; H. W. Johns-Manville Co., D. R. Braggins, Cleveland, O.; the Pennsylvania Steel Co., Philip W. Moore, Chicago, Ill.; Galena-Signal Oil Co., James V. Smith and J. Edwin Hall, Franklin, Pa.; Westinghouse Air Brake Co., S. D. Hutchins, Columbus, O.; MacDonald Ticket & Ticket Box Co., M. MacDonald; the Enos Co., Edward L. Stebbins, New York City; the Wollaeger Manufacturing Co., E. F. Wollaeger, Milwaukee, Wis.; Crouse-Hinds Co., S. F. Skeel, Chicago, Ill.

The Garton-Daniels Co., of Keokuk, Ia., was represented by W. P. Cosper, who had on exhibit in parlor C the automotoneer and distributed souvenir pencils.

The Ohmer Fare Register Co., of Dayton, O., was respesented by W. E. Hinmon, general eastern agent, who had on exhibit in parlor E the Ohmerograph and the company's new two-fare register. This latter machine registers and indicates separately cash fares and transfers and is a system that will indelibly print the number of each class of fares collected on every trip, together with the date, the trip number, the number of the register, and the number of the conductor, and also the direction in which the car moves.

A Long Through Route.

The longest through trolley line in New England was inaugurated by the Old Colony Street Railway Co., on Monday, October 9th, going from Boston to Fall River, Mass., without change, a distance of 53 miles. This through line has been considered for some time, in order to connect with the New York boats in Fall River, and its installation is being favorably received. The initial trip was made in 3 hours and 20 minutes. This trip to New York by trolley and boat reduces the rate 45 cents each way over the steam roads, and if one takes the "New Line" of boats between Fall River and New York, the entire cost from Boston is only $1.75.

The Pennsylvania R. R. is considering the advisability of operating its road between Camden and Atlantic City, N. J., by electricity.

THE
STREET RAILWAY REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 Plymouth Place, Chicago, Ill.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York 39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan Ulrico Hoepli, Librairia Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV NOVEMBER 15, 1905 No. 11

CONTENTS OF THIS NUMBER.

CENTRALIZATION.

Due to the nature of the growth of the average city railway system which has been the outcome of a consolidation of several smaller lines serving one general community, it is natural that the offices, shops and power stations should be located as they are, scattered at different points about the city. On account of the extended territory served it is necessary that a metropolitan system have a number of repair shops and storage barns at convenient points on its lines, yet the systems in cities of the average size are not so large but that the operating heads and their several departments can be centralized.

The advantages gained by having the shops, power house and general offices located close together are many and tend to lessen the cost of operation where such an arrangement is possible. It is easily seen that if a manager has, within a short radius of his office approximately the entire personnel under his direction, with the exception of the platform men, much time will be saved. This saving of time has the double advantage that each superintendent is put in closer touch with other departments and with little loss of time from his own department.

The location of the machine shop near the power house where it can be called upon to quickly make necessary repairs to the generating apparatus as well as do the car repair work will lessen the maintenance costs for power house repairs and do away with the moving of heavy parts over some distance. It is, of course, impossible in many cases that all the operating centers be at one location, since for example the economy of the power house operation depends largely on the station being located where coal and water are to be easily obtained and handled. Nevertheless, with a few exceptions, we believe that when the reconstruction time does come to a built-up system, it would be an unwise act to rebuild the out-of-date structures in their former separated localities without first having carefully weighed the advantages and disadvantages of centralizing the entire organization.

Elsewhere in this issue is described the recently reconstructed system of the Topeka Railway Co., the location of whose buildings has been centralized as closely as would seem possible. The general office building, car storage barns, repair barn, carpenter and paint shops, machine and special track work shop and the emergency wagon barn are placed with the outer walls of the buildings in the form of a rectangle, which where the building walls do not connect has been made complete, with the exception of the main gateway, by a high wall. The convenience of this arrangement is readily apparent and economy of operation should result.

LUBRICATION.

At the Philadelphia convention the discussion was especially interesting in regard to the lubrication of street railway motor and car journals, and the relative costs of grease and oil for this purpose. A large number of roads have substituted the use of oil for that of grease, even on the oldest style of motors where grease boxes were provided. There is no doubt that the use of grease lends to the consumption of considerable additional power, and as one member expressed it, "those who used grease would be deterred from doing so if they made dynamometer experiments and measured the current required to perform a certain schedule run." There is undoubtedly a certain thickness of lubrication which gives the best results for a certain pressure, and there is no reason why the lubricant should be any thicker than is necessary to maintain the proper distance between the journal and the brass.

In ordinary street car work the resistance due to journal friction where oil is used, is small and no marked improvement is effected by varying the viscosity of the oil. If a change is made, however, from a fluid lubricant to one which is semi-solid, like grease, the resistance, due to journal friction, increases very greatly. Even at a considerably higher cost for oil, it undoubtedly proves cheapest in the long run, because, aside from the saving in power, there is a great saving in cost of repairs. It is reported in a number of instances that armatures, which were formerly lost by the use of grease, were saved by the use of oil, and the loss was not more than one-tenth of that when grease was used.

In regard to the actual cost per mile for lubrication of a 20-ton car, equipped with four motors, there was a great variety of results reported, the cost varying in different cases from 8 cents to 40

cents per thousand car miles. These figures, however, need some explanation, as it is evident that they were obtained under widely different conditions. In the case of the lowest cost given, the cars are equipped with the best types of oil-feed apparatus and trail cars are also used, which brings down the cost considerably on the basis of a thousand car miles. On the roads reporting the highest costs for lubrication, the motors were generally of the old style, designed for grease lubrication and there was a large waste in the application of oil. It is probable that the cost of lubricating with oil will depend very largely on whether the motors in use are of the modern type arranged especially for oil lubrication, or the old type provided with grease boxes.

The higher cost of oil lubrication is due in many cases to the imperfect methods that are provided for using the oil, which result in losses of oil in the car barns and when the cars are standing still on the road. In order to avoid wasting oil when the cars are standing still a number of oiling devices have been designed to be used on the old style motors, and in most of these oil cups some arrangement is provided whereby the motion of the car releases the oil at a rate which may be adjusted to suit various conditions of service. Several of these varieties of oil cups have been used with very satisfactory results on roads equipped with old style motors. These have cut down the cost of lubrication very materially. It is essential that these oil cups be designed so that each drop of oil reaches the journal and so that there is no waste when the car is standing still.

The wide variation in the cost of oil lubrication on different roads may possibly also be accounted for by the weight and equipment of the different cars as well as by the oiling devices used. The largest interurban cars with high power motors would obviously require more lubrication than a light car equipped with small motors, and it is possible that more uniform results might be attained by basing the figures on the ton-mile instead of on the car-mile.

Experience has proved, however, even on those roads where the cost of lubrication is highest, that ultimate economy is secured by using oil instead of grease. The cost of frequent renewals of brasses, the wear and tear of shafts, and the damage to armatures in the case of grease lubrication considerably more than overbalance the extra cost of oil even when much waste is permitted. The best practice today is undoubtedly to use oil on all car bearings and to provide lubricators which can be adjusted so as to feed oil at the slowest rate consistent with good lubrication, and which will entirely cut off the supply of oil when the car is not in motion.

ELECTRIC RAILWAY INSURANCE.

At the October meeting of the Ohio Interurban Railway Association the plan of work was presented for the proposed new insurance organization which expects to handle street railway and power properties. It appears that already the Electric Mutual Insurance Co. and the Traction Mutual Insurance Co. have been chartered under the laws of Ohio and will be ready to issue policies in the near future. The proposed plan contemplates the founding of a stock insurance company called the Associated Railway Companies' Insurance Co. This is to be done "in order to facilitate matters and to aid in pressing forward to better advantage the Traction Mutual Insurance Co. and the Electric Mutual Insurance Co."

This stock company is to embody mutual features which, we understand to mean, that it will adopt the principle of paying dividends to policy-holders if the business proves profitable. It is not clear whether the plan contemplates the application of the other fundamental mutual principle, which is that policy-holders may be assessed for sums beyond their actual premium in case the business of the company requires such assessment, and that the payment of these additional sums is to be guaranteed in the case of each policy-holder by a note for several times the amount of his premium, this note to be held by the company.

In considering this, or any plan of mutual insurance, it is proper that we should refer to the Factory Mutual Insurance companies, which have been especially successful in handling mill property risks and have succeeded in reducing rates on their risks to a low figure. It may be worth while to consider the reasons for the success of these companies, since they are applicable to the new company, which plans to serve the electric railway field. The Factory Mutuals are careful to assume liability only on high-class risks, and by frequent careful inspections [illegible] condition. The reason for the low rates fixed by the Factory Mutuals is not that through some secret magic, inherent in the name "Mutual," they are enabled to secure a smaller loss ratio, but because by issuing policies only on the more preferred risks among their patrons, their results are better than in the case of stock companies, which write almost any risks, provided an adequate rate can be secured. In recent years stock companies have been issuing "protected" risks at rates approximately the same as those of mutual companies on the same risks.

In order to secure lower rates on railway or power property, it is first of all necessary that nearly all the properties be put in a better condition with regard to fire prevention and fire extinguishing features than is now the case. Such improvements result in low rates, whether the insurance be carried in stock or in mutual companies. Traction companies which have paid particular attention to the improvement of their property have had such efforts rewarded by a reduction in the rate of their policies in stock companies.

The Associated Railway Companies' Insurance Co's. methods differ from the practice of the Factory Mutuals, inasmuch as it is not to confine itself to high-class risks, but is to write insurance on the protected and unprotected property, adopting the present stock company rates, and reducing them as improvements are made. Thus, it will be on the same footing as existing stock companies, with the disadvantage, that the stock companies have, by reason of the distribution of their liability and the great number of risks of all classes which they insure, a strength and stability which would seem to be superior to the condition obtainable in a company which must necessarily accept large properties on individual risks and which will have a comparatively small number of risks on its books, thus being in danger of being seriously injured by even a small number of fires.

In brief, the present rates on railway property are high because the condition of the property is not what it should be from a fire protective standpoint, and here is a sure and certain method by which rates on such property may be reduced, but it is not by organizing new stock or mutual companies, but by decreasing the physical hazard of the property by proper methods of building and of equipment.

HOISTING FACILITIES IN CAR HOUSES.

The importance of effective hoisting facilities in street railway repair shops has often been discussed in these columns, and today no well-informed manager expects to make rapid and at the same time moderate cost repairs to heavy equipment without liberal provision for continuous internal transportation in all directions, from one end of the shop to the other. In some cases the shop end of the problem has received so much attention that the car house itself has been overlooked and the rolling stock has literally been left to shift for itself between the yard and the machine or blacksmith divisions.

In the great majority of car houses the presence of the overhead trolley hampers the use of travelling cranes so much that such equipment is seldom specified. Cars are either run upon pit tracks by their own power or pushed in by other rolling stock, and except in special cases where hydraulic hoists of some form have been installed in pit tracks, the ever-present hand jack constitutes the sole means of raising and lowering car bodies. The tendency these days is to make light repairs in the car house proper, as far as is feasible, and to reserve for the shops the really severe cases of trouble. As knowledge of operating economy increases the importance of keeping the rolling stock in readiness for immediate service is better realized, and less objection is raised to reasonable outlays for equipment designed to shorten the absence of cars from the starter's list of available units. It is slow work handling car bodies weighing 12 or 15 tons with ordinary jacks, and the movement of 3 to 5-ton trucks is a hard problem unless power is available wherever work has to be done. The removal of trucks can often be greatly expedited by installing one or more hydraulic jacks in the pits themselves, breaking the rails at convenient joints to allow dropping down when the car body is blocked in position after having been pushed

up by the jack. The replacement of wheels is quickly effected when such arrangements exist, the car being out of service little more than thirty minutes.

When the complement of pit tracks is small, the importance of car house hoists becomes even greater. In order that good work may be done directly upon the floor, provision must be made for easily and quickly removing the bodies, trucks, motors or wheels to a point where they will not interfere with the necessary repairs to other parts of the equipment. Here a travelling crane capable of sweeping the entire floor would be very useful were it not for the troublesome trolley wire. Every electric railway man who has visited a modern locomotive repair shop must have been favorably impressed with the extensive use of the traveling cranes unimpeded by overhead wiring. The day can not be far off when a wide recognition of the value of a crane's use in car house bays will be general. It is not such a serious matter, after all, to discontinue the trolley wire over three or four parallel tracks upon which light repairs are made. Despite the deep-rooted idea that current must always be applied to street cars through the trolley, it is easy to carry flexible cables about the pits or tracks and by temporary contacts move the motors wherever one desires. This plan has been worked out admirably in the Sullivan Sq. shops of the Boston Elevated Railway Co., where it was naturally out of the question to carry the third rail. The shoes in this car are a convenience as contact points, but the ordinary trolley car is as easily operated, provided a suitable connecting device is arranged either in the form of a telescopic rod of sufficient length to reach the trolley or a plug handle contact for use in a jack.

One of the chief disadvantages of low-studded car houses is the poor light supply in the day time, so that any future design which provides a higher ceiling and a crane over the tracks devoted to light repairs, opens the way toward increased natural illumination. This may be helped along by the use of concrete floors and light-colored walls, and in some cases by special prisms like the installations used in mercantile houses. Although ideas have become pretty well crystallized in car house design of late, the last word has by no means been spoken upon the subject.

When it is not feasible to dispense with the trolley over the light repair tracks—and this is a point which must in each case be balanced against the flexibility of a traveling crane—the stationary hoist may usually be very effectively employed. A two or three-ton hoist arranged to traverse a boom capable of swinging through a complete circle, of which the center lines of two adjoining parallel pit tracks are tangents, is a very convenient device where space is limited. Thus, motors and medium-sized trucks, armatures, and air brake equipment can be handled by a 10-ft. boom with great speed and little labor over an area of 314 sq. ft., which means even more than the figures signify in the restricted aisle space of a car house. In a large car house the placing of such swinging hoists upon several different columns need not be a heavy expense, and the trolley wire can be retained as well. It is important to insulate guy and tie rods attached to such hoists, which are really small jib cranes or derricks, so that neither the trolley pole nor wire can cause a short circuit by flying upward or coming down. In the car house the strains upon overhead wiring are seldom sufficient to loosen or break the copper, but if a fall occurs with a resulting dead short circuit, the consequences may be disastrous, either through shut-downs or fires. This is no imaginary evil, for not long ago a supposedly fireproof storage warehouse caught fire by the short circuiting of a trolley wire to ground through the steel guy rope of a derrick, which was attached to the building. The insulation afforded by a wooden bushing or even a winding of coarse rope is ample for the requirements of such cases.

The report of the passenger traffic of the United Railways Co., St. Louis, Mo., for the quarter from July 1st to September 30th has been filed with the city register by the treasurer. It shows that 44,435,324 revenue passengers were carried in the three months this year, compared with 61,851,515 during the same months of 1904, the World's Fair year. The same period for 1903 shows a passenger traffic of 39,308,027. Although the number of passengers carried this year is larger than two years ago, only 1,269,032 trips were made, compared to 1,398,932 in 1903. The number of trips in 1904 for the same quarter was 1,754,652.

Chicago Traction Situation.

On October 30th, after the defeat of his "contract plan" and the adoption of a referendum resolution that no street railway question be passed by the council unless authorized by a majority of city voters, Mayor Dunne instructed the Local Transportation Committee to prepare an ordinance for the purpose of acquiring ownership of the street railways of Chicago under powers conferred by the Mueller law. As a preliminary step a resolution was immediately passed that the committee be directed to consider and report to the council a method of making a legal test of the validity of the street railway certificates authorized by the Mueller act. An amendment was offered that the committee cease all negotiations with the traction companies except with a view to the purchase of the railway properties, but this was laid on the table withwithout debate. Another resolution was offered urging the mayor to divulge the substance of the Dalrymple report at the next meeting of the council, which resolution was deferred and ordered published.

Since the ordinances of the Chicago City Railway Co. and the North and West Chicago Street Railway companies were submitted in September and October, the Transportation Committee has been busily engaged considering them in detail. Meetings are being held every few days, at which all parties interested are represented. The ordinances are being prepared so as to be presented to the city council as soon as possible. This work has so required the entire attention of the committee that action has not yet been taken towards testing the validity of the Mueller law certificates.

The receivers for the Chicago Union Traction Co. have offered to reconstruct the tunnels at the expense of the corporation if they are permitted to install the overhead trolley system permanently in the loop district. The proposition of the receivers was made in a communication addressed to the mayor and the city council and was referred to the Local Transportation Committee without discussion. Permits to connect the trolley lines of the Chicago City Railway Co. with its new power plants and particularly with the one built at 20th and Dearborn Sts., to enable the company to furnish sufficient heat and power to the new trolley cars during the winter months, and to install and change curves at street crossings for the betterment of the service, were issued by order of Mayor Dunne, November 7th.

Mr. Clarence S. Darrow, special traction counsel to Mayor Dunne, has resigned and it is understood that resignations of other members of the special traction force will soon follow. Mr. Bion J. Arnold has been appointed to examine the engineering features of the ordinances presented by the traction companies and also to supervise possible construction of lines. In a report submitted by Mr. Arnold to the Transporation Committeee on November 8th, he shows the financial plan upon which the traction companies base their offer of compensation to the city in the now pending ordinances.

Service Stripes.

It is the intention of the Ft. Wayne & Wabash Valley Traction Co. to put in service in the near future a system of stars and stripes to be worn by employes. The following letter has been addressed to train service employes by the superintendent of transportation: "It is my desire that each of you furnish this office at your earliest opportunity the exact date on which you began work for the company, stating on what division and where located. We have decided to furnish each employe who has been in the service of the company for more than a year, with a gold service stripe. For each year up until five years, you will receive a 1/4-in. gold braid to be placed on the sleeve of your uniform coat. For the second five years of service a gold star will be placed on the sleeve of your coat above the stripes, each gold star representing five years of service."

Preliminary surveys have been made for the extension of the lines of the Interurban Railway & Terminal Co. from South Lebanon to Morrow, Ohio.

Contracts for the construction of the Grand Rapids & Ionia, Grand Rapids, Belding & Greenville, Ionia & Owosso and Owosso & Pontiac electric railways have been let and work has begun.

November Meeting of Indiana Electric Railway Association.

As announced in the tasty programs sent to its members, the November meeting of the Indiana Electric Railway Association was held at Rushville, Ind., November 9th. Throughout the day the members of the association were the guests of Mr. Charles L. Henry, president of the Indianapolis & Cincinnati Traction Co. The entertainment provided by Mr. Henry included a special parlor car, which left the Traction Terminal station, Indianapolis, at nine o'clock in the morning for Rushville. Several stops were made along the line between Indianapolis and Rushville in order that the construction details of this exceptionally well built and equipped single-phase line might be inspected.

A stop was made at the dispatcher's office just east of the Indianapolis city limits, at the junction of the two lines of the Indianapolis & Cincinnati Traction Co. At this point the cars change from the direct-current trolley system of the city to the single-phase, 3,300-volt trolley of the interurban to Rushville.

The details of construction of this line were described and illustrated in the "Street Railway Review" for February, 1905. It may, however, be of interest to state that the Indianapolis & Cincinnati Traction company's system consists of two main branches extending southeast from Indianapolis. The more southern branch serves the towns between Indianapolis and Shelbyville. This line is approximately 29 miles long, and is operated by the ordinary type of overhead trolley, with direct current. The other branch of the system is a single-phase line from Indianapolis to Rushville. Construction work is in progress on the extension of this branch to Connersville and on toward Cincinnati.

The present completed portion now in operation, between Indianapolis and Rushville, is 40 miles long. The extension to Connersville will add 17 miles to the length of this branch. The entire construction of the road has been carried out in an exceptionally thorough manner. The alignment and grades are such that cars or even trains may operate at high speeds. The road bed on the Rushville line has been graded for double track, a portion of which has been built from Indianapolis eastward. The bridges are thoroughly built, with concrete abutments, carrying in most cases deck-girder spans. As mentioned, this branch is operated by the Westinghouse company's type of single-phase equipment.

The special car stopped at one of the transformer stations, in which the absence of the usual rotary converter was especially noticeable. On reaching Rushville, the new repair shops and power house were inspected. After a walk around the railway property, and a visit to the general office building, the members of the association took luncheon at the Windsor and the Scanlon hotels.

The regular session of the association convened in the parlors of the Rushville Club at 2:00 p. m., with President Henry presiding. The minutes of the October meeting were read by Secretary White and approved. The following paper was then read:

Freight and Express Traffic on Interurban Railways.

BY M. E. GRASTON, INDIANA UNION TRACTION CO.

All who are connected with the electric railways are acquainted with the fact that it is only within the last few years that managers have come to look on the handling freight and express traffic on interurban lines with favor, and I think those that have inaugurated this class of service find it profitable, and that it does not interfere with passenger traffic. The freight and express traffic, as you know, is still in its infancy, yet it has shown that even a small volume of traffic can be handled at a profit.

At the present time nearly every company is confining its traffic to its own line. This traffic could be increased very materially if the traffic managers of the different interurban companies would get together and arrange for a system of through rates between their respective lines on the same rate basis as steam lines have between like points. Until this is done we cannot hope to increase our through traffic, as the sums of the two local rates make our rates so high that shippers [illegible] business. Every company has certain [illegible] connected with the operation of the freight and express department; such as salaries of agents, rent of stations, etc. Through traffic could be handled without any noticeable increase in expenses, and at the same time it would bring in quite a nice revenue, and we can handle it if we will only organize and get through rates into effect.

Our inability at this time to interchange freight traffic with steam lines is working a great hardship on us and I hope the time is not far distant when steam roads can see their way clear to arrange for connections and working arrangements with us whereby we can interchange traffic with them. When we can do this our traffic and revenue will show an increase. Until then we will be handicapped and loose considerable traffic, which we should have for local points on our own lines, as well as traffic to points on connecting lines, as heavy shippers of merchandise refuse to give us any business for the reason that to do so would entail additional expense to them. They claim that they can send all their output to steam lines with one cost of transfer. We should arrange for interchange with all lines as quickly as possible, as I believe will be best for all concerned.

The traction lines of Indiana were very fortunate in so locating their lines that they traverse not only the most thickly inhabited portion of the state, but the very best agricultural districts as well; districts which are especially adapted for dairy purposes, vegetable raising and fruit growing, and I believe we should give the development of these commodities special attention along our respective lines. There is no class of traffic more profitable to traction lines than these commodities. We should assist the farmer in every way possible to find a market for his product as it will encourage him to increase his shipments, and by so doing we increase our revenue as well. It should at all times be the policy of electric lines to put in good side track facilities at each station on their lines, and at such other points where the business will justify the expense, as good track facilities are very important to the traffic department in soliciting business and to the operating department in handling it in a satisfactory manner after it is secured. Good side track facilities enable us to get our trains over the road with the least delays possible, which enables us to keep the operating expense down to a minimum. Take a walk through the yards of steam lines and you will find that they have the very best facilities for handling traffic, and we must do likewise if we expect our proportion of the business.

I think the Official Classification should be adopted by interurban lines, although some few articles are classed too low to be handled profitably by electric railways. One article I call to your attention is household goods. These are classified too low for profitable business on interurban lines, and I think it would be well if traffic managers of electric lines would get together and go over the classification carefully, modifying it to meet existing conditions and publishing an exception sheet covering such articles as are not properly classified for interurban traffic. Care should be taken in making these changes so that the new classifications given on certain articles would permit of application by all interurban lines.

We should at all times hold our rates to the highest possible point, and see that our agents apply them properly to get most revenue out of every shipment. Our rates should be based on the same basis as steam lines. You will find that they are figured on a good profitable basis. Before we publish a new rate sheet, not having the figures of steam lines at hand, we should take the matter up with traffic departments of the lines in the territory for which we are arranging tariffs, asking them for their class rates to and from the points served by our lines and in this way be better enabled to publish our tariffs on the same basis as steam roads. It is necessary if we secure our share of the traffic that we make the same rates as steam lines between the same points.

In billing freight on the Indiana Union Traction lines we are using a waybill, which I think is very complete. It consists of four sheets of paper, the original and three copies This is so folded

that the forwarding agents make all the copies at one writing by the use of carbons. The waybill shows billing station, destination, date, car number, name of consignee, consignor, description of articles, weight, rate and amount of freight. After the forwarding agent makes the waybill he delivers the original and one copy to conductor, who checks his freight to and from the car with it. When the freight arrives at its destination, he delivers the original and copy to agent. When the agent makes delivery of the freight he signs the original and delivers it to the consignee with the goods, which is his expense bill, and he has the consignee sign the copy, which he retains for his receipt of delivery. The forwarding agents then sends one of the two remaining copies to the auditor and keeps the other for his files. The forwarding agent makes expense bill at same time he makes the waybill.

Each company should be provided with sufficient equipment to handle and move all the business offered it daily without delay, for experience has taught that failure to move traffic promptly diverts traffic very quickly, and once lost it is very hard matter to regain it, and for this reason we should be prepared to move it without delay. To overcome this complaint it is necessary to keep a few extra cars ready for immediate use at all times to properly care for any traffic that might be secured. The cars for use in handling freight should be large, 45 to 50 ft. in length, and of good capacity. The motor cars should be so equipped that trailers may be handled without difficulty. Every company should have several good box car trailers to take care of carload business, in addition to the handling of local traffic. I think there should be as much business handled with trailers as is possible to be done as it serves to keep down the operating expense.

Too much care cannot be given to the erection of freight stations and platforms. These stations and platforms should be erected so that the floors will be on a level with the floors of freight cars. This will not only enable trainmen to handle freight more quickly and carefully, but it leaves freight where it will be convenient for transfer men to load on their drays. I find at stations where we are not equipped with such platforms that we are losing considerable traffic. The merchants at these points tell us that they would gladly give us their business if our facilities were equal to those of steam lines.

We should be very careful in the selection of our agents, especially at our most important stations. We should be careful to employ intelligent, sober and industrious men, as they come in daily contact with the business public and on them depends to a large degree the success of the company in the respective cities. These representatives of the company should put forth every effort to please the transfer men, as well as patrons, as experience has taught that the transfer men control to an extent the routing of a very large per cent of the less than carload business in their respective cities, and we should let them know by word and action that anything they could do for our company will be appreciated. When this is done you will find them a great help in securing local traffic in their cities.

One of the greatest difficulties that we are experiencing at present is to get our patrons to understand that we are prepared to handle all kinds of freight. Most of them have the idea that we cannot handle any class of freight but small packages. I think it is very essential to have a good solicitor to call on each merchant and shipper for the purpose of soliciting business and keeping them informed of the facilities and service electric railways offer. Our competitors have solicitors on the road all the time and they have special instructions to give the territory paralleled by interurban lines preferred attention. One of these representatives in conversation with me stated that he had special instructions to do everything possible to be done to divert business from the interurban lines. Steam roads are strong competitors, and it is very essential that electric railways keep in close touch with shippers if they expect to secure a full share of competitive business.

To increase the volume of business requires watchfulness, care and solicitation to foster trade and to take care of it in a way that is sure to give general satisfaction. Industries must be served to best advantage. The ideas of shippers, merchants and business communities must be given consideration. The interests of the business public and a common carrier are mutual and, therefore, all patrons are entitled to courtesy. The business must be developed and small shippers should be accorded the same liberal treatment that is given to shippers of large tonnage. It is quite easy to secure business by cutting rates or making other inducements that mean a loss of revenue to the company, but this must be guarded against at all times. It should be our endeavor to improve the service on our lines and establish a standard for quick despatch and careful handling; free from loss and damage; a service that will commend itself to the business public in general, and one that is far superior to any like transportation afforded by steam lines. To do this, it is necessary that each and every employe give the handling of the business his careful attention and handle it in the most prompt and efficient manner while in his charge.

The discussion was opened by Mr. Fletcher, of the Indianapolis & Eastern Railway Co., who remarked as to the low rates received for the transportation of some goods if the official classification is followed. He favored the plan suggested at the previous meeting, that the heads of the traffic departments of the electric railway systems represented by the associations, should decide upon some standard classification with specific exceptions, which would make more equitable the rates paid for handling some goods now carried at a loss to the railways.

Mr. F. D. Norveil, Indianapolis & Northwestern Traction Co., spoke of the possibilities of freight handling by electric railways. In his opinion, the large majority of interurban roads have reached the limit of increase in passenger business, except as the territory and population which they serve increases. For this reason, it is well to look to the freight traffic for a possible opportunity in which to increase the revenues. Hardly any line now operating is handling over five per cent of the possible freight which might after a proper campaign be made available in its territory, and many lines are only handling what might be called package freight or express. The carload lot freight is undoubtedly more remunerative, and there is plenty of such traffic available if the electric roads had the cars and other facilities for handling the business. As an illustration of the effect of better handling facilities upon the quantity of freight received, Mr. Norveil cited the experience of the Indianapolis & Northwestern Traction Co. When its freight business was inaugurated, this company had no special accommodations for handling freight at Crawfordsville and Lebanon, but loaded the cars, as in the case with many roads, in the streets. Later, freight stations were built in each of these towns, and the freight received increased from practically nothing to an average of one car per day from each town.

The speaker stated that it would be a great help toward increasing freight traffic if an agent were able to immediately quote the rate to a shipper who desired to forward goods from any local point to a destination on a connecting line. He favored the organization of an interurban freight bureau, which would adjust the inter-line rates and publish a standard rate sheet.

Speaking of the amount of freight handled on the line with which he is connected, Mr. Norveil stated that in October, 1904, the freight cars of this line, operating 8,500 car miles, earned $2,091, and for the same period in 1905, 9,000 car miles, earned $3,195. This shows a substantial increase in amount of traffic and receipts per car mile which could be even more benefited by increased operating factilities. The rates on this line are liberal, and are based upon the steam railway classification. When questioned as to the profitableness of handling household goods as ordinarily classified, Mr. Norveil said that such commodities, if weighed on scales before being shipped and the present rates applied, will return a fair amount for their handling.

Mr. Paul H. White, Indianapolis & Martinsville Rapid Transit Co., thought that any outlay for increasing the amount of freight to be handled should be made in an especially cautious manner, as too much refinement would make the venture unprofitable. He believed that the convenience, promptness and care with which freight is handled by electric roads, will bring better results than lowering rates in competition with steam roads.

When questioned, Mr. Norveil spoke of a commodity rate which is made to wholesale houses shipping goods over his line. This rate is about 11 cents per 100 lbs., and when analyzed shows that the returns approximate closely those which would be gained if the standard classification were used.

Mr. F. M. Fauvre, Indianapolis & Eastern Railway Co., stated that while the standard classification as now used would probably

suffice, the electric road operators should be careful not to make the mistakes which have been made by the steam railroads. In order to prevent these errors, should the association have a bureau and make its own standard rates, the added benefits, such as quick service, care and availability should be considered in determining the charges. Care should also be given that discrepancies do not occur in inter-line rates.

On motion of Mr. Norveil, the association voted that the heads of all freight traffic departments of the companies represented by the association meet and consider the establishing of a set of standard freight traffic rates for connecting lines.

When requested, Mr. H. A. Nicholl, Indiana Union Traction Co., described the method of operation and the service offered by the Electric Package Co. of Cleveland. He suggested that a similar scheme would be probably found successful if organized to serve Indianapolis, and the larger Indiana cities.

The association next elected, Mr. Arthur Brady, Indiana Union Traction Co., to fulfill the unexpired term of office as vice-president, made vacant by the death of Mr. J. W. Chipman.

The association tendered a hearty vote of thanks to President Henry, and the Rushville Club, thus showing its appreciation of the interesting and instructive entertainment furnished the guests.

The following paper was then read:

Shall Baggage Be Carried Free?

BY F. D. NORVEIL, INDIANAPOLIS & NORTHWESTERN TRACTION CO.

The subject of this paper, "Shall Baggage Be Carried Free," is one that has been discussed informally at almost every meeting of this association, and is one that I believe can better be handled in open discussion than in a lengthy paper that, in the end, is only a theory.

Early in the current year the Indianapolis & Northwestern Traction Co., under the belief that better results and more revenue would be derived by so doing, put into effect a system of free baggage, 150 lb. to be carried free on tickets, the minimum price of which was 25 cents. Excess baggage was to be charged for at the rate of 25 cents per 100 lb., or fraction thereof, over the 150 lb. allowed free. This rule, slightly modified, is still in force, but on account of the lack of weighing facilities at most places we usually check one piece of baggage free and charge 25 cents for each additional trunk or large suit case, depending much on the judgment of the agent or employe doing the work to do justice to the company and be fair with the passenger as well; based on the theory that only about four to six per cent of the passengers carried have baggage that required checking. I have compiled a report of the number of pieces of baggage handled in September and October of 1904 with revenue derived therefrom, and for the same months of the current year:

	No. Pieces.	Amt. Collected.
September, 1904	1,591	$307.75
October, 1904	1,757	430.25
September, 1905	2,534	243.50
October, 1905	2,210	278.00

During the month of October, 1905, 453 more pieces of baggage were handled than during October, 1904, while there was a decrease in baggage receipts of $161.25, due to the fact that baggage was handled free. However, assuming five passengers to each trunk handled, the increase of 453 pieces of baggage or 2,265 passengers figured at 50 cents per passenger, would amount to $1,132.50 and more than offset the loss in revenue due to handling baggage free. We have no means of getting at the exact figures as to the increase in number of passengers carried, but as the general average is about sixteen or twenty to one piece of baggage it would seem fair to place the increase about five to one; this low per cent I base on the idea that the increase on pieces of baggage does not come from the masses that travel, but from individuals and families who are taking advantage of this free feature, and, all things being equal, travel on the electric railway in preference to the steam railroad.

I would here ask your permission to read an extract from the report of the annual meeting of the Ohio Interurban Railway Association. In discussing the question of carrying baggage free Mr. F. W. Coen, of the Lake Shore Electric Railway Co., said his road had always carried baggage free, and practically on all cars. The steam road between Cleveland and Toledo are selling certain classes of tickets at two cents per mile, or $2.18 for the through trip, and charge for baggage. Their rate of $1.75, with free baggage, [illegible]. During 1904 they carried [illegible] 19,241 pieces of baggage, not taking into consideration the large number of pieces on which excess was charged. This represents one piece to every 139 passengers, or 1604 pieces per month carried free. In Toledo, where baggage is transferred, they pay the transfer on baggage which they deliver to other roads, and other roads do the same on baggage delivered to them. This applies to steam as well as electric roads. He said that in his opinion baggage must be carried free and transferred without expense to the passenger to make inter-line business a success.

The fact that nearly all Ohio roads have adopted free baggage in some form seems to the writer as the best argument that can be advanced in its favor, and I venture an assertion that 12 months hence every electric road in the state will be handling baggage under certain conditions free. Whatever my former ideas were on the subject, I do not now believe that it was ever necessary for interurbans to make the low rates now in effect, and fully believe that, with the ordinary volume of traffic, and all things being equal, the interurbans can get more than an even divide as against their steam competitor; but with good train service on the steam lines, their fast time and free baggage accommodations offered, it is business suicide to expect the public to patronize the electric line, whose fare is higher and every other accommodation which is free with your competitor is charged for by you. I have heard this remark made: "I would prefer the steam line because the time is faster, seats larger, and one can put their feet on the cushion and rest, and I don't have to pay for my baggage." The more frequent train service on the electric line has its effect, of course, but where the steam road has from 4 to 6 trains in each direction daily the additional service is only a small factor.

This argument would have no effect with the road not paralleled by a steam road which has met the electric lines' tariff. We have nearly all adopted free baggage on inter-line business, and why do not the same reasons hold good for local traffic as well. As yet only a few figures are available, but they are, to my mind, very conclusive evidence that there is money in free baggage to any company that has a competitor that meets it on equal grounds and makes any effort to retain its former local traffic.

Mr. Henry did not favor the handling of baggage free, and believes that it is unfair to furnish one passenger more privileges than another for the same amount of money.

Mr. Fauvre described the system of charging for baggage on the inter-line business between Indianapolis and Dayton. On this through line operated by three companies, the company first carrying the passenger receives pay for handling the baggage; the other two companies which make up the line carry the baggage to its destination free of charge.

Mr. Norveil stated that on the Northwestern line, in the month of October, 1098 pieces of baggage were carried free, and excess charges were paid on 1112 pieces. For the month of September, 1640 pieces were carried free, and excess charges were paid on 849 pieces. It is the policy of this company not to make any charges for the handling of baggage except when it is of excess weight.

Mr. C. A. Baldwin, Indiana Union Traction Co., stated that on his road, charges are made for handling baggage, and that where the line parallels the Big Four R. R., the electric cars handle three pieces of baggage to the steam railroad's one, that is from the larger stations. From the smaller stations, the electric road handles ten pieces to the steam road's one. At these rates, the company obtains a good revenue.

After an exended discussion for and against charging for the handling of baggage, the meeting adjourned.

On the return trip to Indianapolis the guests of Mr. Henry were carried in a special car, which except for one meeting point, had a right of way over all other trains. The entire run of 42 miles, including the city mileages in Rushville and Indianapolis was made in the excellent time of one hour and ten minutes, this including a layover of ten minutes at the meeting point. For the first 29 miles from the center of Rushville toward Indianapolis the car covered the distance in 34 minutes.

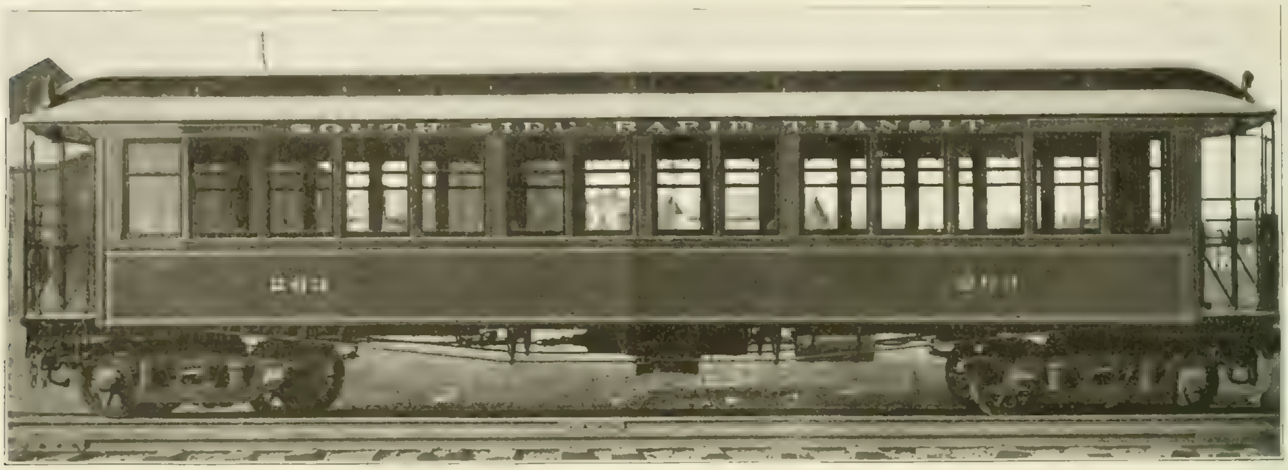
Improvements on the South Side Elevated R. R.

For some months the extensions and general reconstruction of the elevated roadway of the South Side Elevated R. R., Chicago, have been under way. A third track for the use of express trains is being placed alongside the old structure, new passenger stations are being built, sharp curves are being eased and new power equipment and rolling stock is being placed in operation.

The extensions now building make additional power house facilities for this road imperative, as its present plant is already overcrowded. The company has purchased the old car barn of the Chicago City Railway Co., which adjoins the present elevated road power plant, and the extension to this plant is now in course of construction. The new purchase gives the company a full block on State St., from 39th to 30th St. The present plant has a capacity of 7,700 kw. of direct-current generators, and there are two storage batteries floating on the line, one at 12th St. and one at 63rd St. The addition to the plant will consist of two generators, each having a capacity of 2,000 kw., and a third storage battery, which will be located at 13th St.

These additions, which are expected to be completed during November, are in charge of Sargent & Lundy, of Chicago. The rolling stock is being increased by an order of 70 cars, of new design, which are now being received from the Jewett Car Co., Newark, O.

The new cars have steel platforms constructed of I-beams and channels. An improvement was made in the construction of the motorman's cab, which is formed by curtains on one side of the aisle. The motorman is given a separate compartment, in which the engineer's valve, gage and other operating mechanisms are located between the outside and inside lining of the end wall of car. The inside lining has a hinged door over the operating mechanisms, which hangs down when cab is used by the motorman. When used by passengers, the door is closed and the end panel has the same appearance as at the opposite end of the car.



NEW JEWETT CAR FOR SOUTH SIDE ELEVATED R. R.

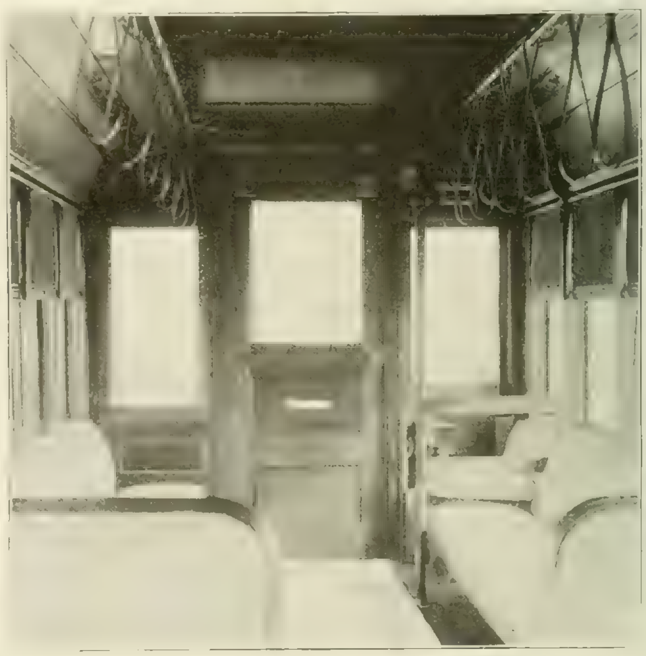
Each cab has two individual seats, the one nearer the end of the car being arranged to slide on top of the other seat, so as to give room for the motorman to sit facing the end window. When not used by the motorman the curtains are raised, the seat slid out and the cab can be used by passengers.

The new end arrangement of the cab increases the seating capacity to eight more than in the present cars, it being 52 in the new cars.

The inside finish is mahogany of a neat design, head lining is quartered oak. The seats are covered with small mesh rattan and all interior trimmings are of solid bronze. Polished plate glass is used and the curtains are of pantasote with pinch handles. The bottom and top sash are arranged to drop into a pocket, making the cars semi-convertible.

The new features and improvements in these cars were suggested by Mr. M. Hopkins, general manager of the South Side Elevated Railroad Co..

MOTORMAN'S CAB, WITH CURTAINS DRAWN.



MOTORMAN'S CAB, WITH CURTAINS UP.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO.

[The decisions which have been reported in the Legal Department of the "Street Railway Review" since 189[illegible] have been published [illegible] by the Windsor & Kenfield Publishing Co. under the title "Street Railway Law," four volumes of which have been printed. Vol. I covers the period from [illegible] to January, 1897; Vol. II from January, 1897, to July, 1899; Vol. III from July, 1899, to April, 1901; Vol. IV from April, 1901, to April, 190[illegible]. Vol. V [illegible]. Bound in sheep: four volumes, $10.00; single volume, $3.00. Bound in buckram, four volumes, $[illegible]; single volume, $2.[illegible]

NO RIGHT TO KNOCK WAGON OFF TRACK.

Strode vs. St. Louis Transit Co. (Mo.), 87 S. W. Rep. 976. May 24, 1905.

Conceding that the driver in question in this case ought to have driven out of the track when he heard the gong, it was plain to be seen that he was making no effort to do so, and that this disregard of the duty, if it was a duty, the supreme court of Missouri, division No. 1, says, did not give the motorman the right to drive his car against the wagon and knock it off the track.

STOPPING ON STREET RAILWAY TRACK TO PULL DOWN LEG OF TROUSERS.

Jordan vs. Old Colony Street Railway Co. (Mass.), 74 N. E. Rep. 315. May 18, 1905.

When a man has at least the whole highway, including a sidewalk devoted to foot passengers alone, to choose from, it is not the act of a prudent man who wants to pull down one leg of his trousers, the supreme judicial court of Massachusetts says, to select a street railway track eight seconds around and away from a corner from which an electric car may emerge at any moment, and to stoop over to pull down his trousers without again looking up until he is run over.

NOT CONCLUDED BY SILENCE DURING PAVING OF STREET.

Louisiana Improvement Co. vs. Baton Rouge Electric & Gas Co. (La.), 38 So. Rep. 444. Jan. 6, 1905. Rehearing denied Apr. 10, 1905.

The mere silence and inaction of a street railway company while streets traversed by its tracks are being paved, the supreme court of Louisiana holds, do not estop it to plead the absolute want of power and jurisdiction in a city council to levy a special tax against the company for street improvement. This doctrine is especially applicable to a case where the contract was let on the basis of payment by the city and abutters, and the evidence shows no benefits accruing to the railway from the work.

DUTY TO PROVIDE MAIL COLLECTORS SAFE ACCESS TO CARS.

Young vs. People's Gas & Electric Co. (Ia.), 103 N. W. Rep. 788. June 9, 1905.

The company operated a street railway system, having, by some arrangement with the postoffice department, boxes attached to its cars for the reception and transportation of mail deposited therein, while at certain intervals a carrier in the postal service was required to visit the central barn or shed in which the cars were stored and collect the mail from the boxes. The supreme court of Iowa deems it sufficient to say that the general obligation of the company to provide the mail carriers safe access to the cars which they were required to visit cannot well be disputed.

CONTRACT TO SECURE CONSENTS AND FRANCHISE AGAINST PUBLIC POLICY.

Sussman vs. Porter (U. S. C. C., N. J.), 137 Fed. Rep. 161. May 5, 1905.

An agreement to procure the consent of property owners for the construction and maintenance of a trolley line in front of their properties, and also to obtain a municipal franchise to operate such trolley line for a fee contingent upon [illegible], the United States circuit court, in New Jersey, holds to be contrary to public policy, and void, and that no part of the stipulated compensation can be recovered. It says that it is not a question whether improper influences were contemplated or used or not, but the contract is vitiated from the fact that it provides for the procurement of legislation, whether municipal or otherwise. The law looks to the general tendency of such agreements, and it closes the door to temptation by refusing them recognition in any of the courts of the country.

CONSTRUCTION OF STATUTES WITH REGARD TO DESTRUCTION OF FRANCHISES BY LAPSE OF TIME.

In re Brooklyn, Queens County & Suburban Railroad Co. (N. Y. Sup.), 94 N. Y. Supp. 133. June 9, 1905.

Section 5 of the New York railroad law provides that if any domestic railroad corporation shall not begin the construction of its railroad within five years after its certificate of incorporation is filed, or shall not finish its road within ten years therefrom, "its corporate existence and powers shall cease." Section 99 of the railroad law, which is found in article 4, p. 1112, thereof, which article is entitled "Street Surface Railroads," provides that in case any such corporation shall not commence the construction of its road, or of any extension or branch thereof, within one year after the consent of the local authorities and property owners, or the determination of the general term of the supreme court shall have been given, and shall not complete the same within three years after such consents, its rights, privileges and franchises in respect to such railroad extension or branch, as the case may be, "may be forfeited." The second appellate division of the supreme court of New York holds that the provision in section 5 must be regarded as a provision which executes itself, while that in section 99 is not self-executing, but requires the institution of legal proceedings to give it effect. In other words, one enactment prescribes the conditions under which the authorities of the state may go into court and ask that a franchise may be judicially declared to be forfeited. The other enactment declares under what circumstances such corporate franchise becomes ipso facto (by the fact itself) forfeited without any judicial proceedings whatsoever. This difference, the court says, removes all difficulty in the way of permitting the provisions of both sections to stand together; and it holds that by virtue of the operation of the provision of section 5 a franchise to construct an extension of a street surface railroad was lost at the expiration of five years by failure within that period to act upon such franchise.

INJURY TO PASSENGER FROM DEFECT IN MACHINERY—DOCTRINE OF RES IPSA LOQUITUR APPLIES—EXPLOSION IN CONTROLLER AND PANIC AMONG PASSENGERS, INJURING ONE.

Chicago Union Traction Co. vs. Newmiller (Ill.), 74 N. E. Rep. 410. Apr. 17, 1905. Rehearing denied June 8, 1905.

A passenger was occupying a seat at the extreme rear, on the left-hand side, of an electric car when an explosion occurred in the controller on the front end of the car, which explosion and flames caused a panic among the passengers, which resulted in the injury of this one. The supreme court of Illinois holds that the case fell fairly within the maxim res ipsa loquitur (the matter speaks for itself). It says that when an injury occurs to a person who is a passenger in the exercise of ordinary care, upon the car of a common carrier, by some defect in the machinery wholly under the

control of the carrier, a prima facie case of negligence on the part of the carrier is established, and the burden of proof is upon it to show that the accident was without its fault. The facts proved in this case made a prima facie case of negligence against the company, and were clearly sufficient to support a verdict in favor of the plaintiff, and therefore justified the overruling of a motion to take the case from the jury.

This instruction, among others, was given: "The court instructs the jury that if you believe and find from the evidence that the plaintiff was a passenger on one of defendant's cars, and while such passenger she was in the exercise of ordinary care for her own safety, an explosion occurred on said car, by reason of which a panic was caused among the passengers in said car, in consequence of which the plaintiff, without fault on her part, was pushed from said car and thereby injured, then the plaintiff has made out a prima facie case of negligence against the defendant, and this places upon the defendant the burden of rebutting that presumption by proving that the explosion could not have been prevented by all that human care, vigilance, and foresight could reasonably do, consistent with the mode of conveyance and the practical operation of the road." The supreme court is of the opinion that the instruction announced correct rules of law applicable to the case, and was not defective in failing to inform the jury that, in order to entitle the plaintiff to recover, she must have shown not only that an explosion occurred, but that such explosion was caused by some negligence on the part of the defendant. The explosion of a part of the machinery under the control of the defendant, injuring the plaintiff in the exercise of reasonable care for her own safety, was prima facie evidence of negligence on the part of the defendant.

VALIDITY OF BUSINESS TAX—EXEMPTION FROM TAXATION.

Savannah, Thunderbolt & Isle of Hope Railway of Savannah, Georgia, vs. Mayor and Aldermen of the City of Savannah (U. S., Ga.), 25 S. C. Rep. 690. May 15, 1905.

This was a bill in equity, brought to restrain the collection of a municipal tax. The tax was imposed under an ordinance of March 22, 1899, providing, by way of amendment to one of the year before, that "street railway companies, whether under the control of another company or not, in lieu of the specific tax heretofore required, shall pay to the city of Savannah, for the privilege of doing business in the city, and for the use of the streets of the city, at the rate of $100 per mile or fraction of a mile of track used in the city of Savannah by said railroad company." One of the plaintiff's grounds of attacks was that the Central of Georgia Railway Company, a steam railway, was not subjected to the tax, and yet that it also did business in the streets of the city by transporting freights from its regular station to various side tracks, and charged an additional or local price. The argument on this point, the supreme court of the United States says, was really a somewhat disguised attempt to get behind the decision of the state court that the tax was a tax on business, and to make out that it was a charge for the privilege of using the streets. But this court sees no ground on which it should criticise or refuse to be bound by the local adjudication. It says that the difference between the two railroads was obvious, and warranted the diversity in the mode of taxation. The Central of Georgia Railway might be assumed to do the great and characteristic part of its work outside the city, while the plaintiff did its work within the city. If the former escaped city taxation, it did so only because its main business was not in the city, and the state reserved it for itself.

If the city had attempted to bargain away its right to tax, probably, the supreme court says, it would have been acting beyond its power. However, it made no such attempt. There was a contract made on the petition of the plaintiff stating its desire to make changes in its line of track "for the purpose of operating its railroad more economically and to better advantage, and at the same time affording more adequate facilities to the public." Various changes were agreed on in the way of moving old tracks and laying down new ones. Among other particulars the railroad agreed to convey, or cause to be conveyed, certain lands in two streets, "preserving, of course, the easement of the said street railway company over said land for its railway purposes." In the last amendment to the contract an extension was agreed to, "and the right to lay down, construct, maintain, and operate said railway through said streets, as before stated, is granted, subject to the control and regulation of the said mayor and aldermen, the same as other lines of railway, as provided in said contract of November 4th, 1897." The court says that none of the expressions quoted imported any exemption from taxation whatever, if it was within the power of the city to grant it.

EXEMPLARY DAMAGES.

Chicago Union Traction Co. vs. Lauth (Ill.), 74 N. E. Rep. 738. June 23, 1905.

Exemplary damages, the supreme court of Illinois holds, cannot be awarded against a defendant unless the act of its servants was willful, malicious, or wanton.

KNOWLEDGE NOT PREVENTING CONDUCTOR RECOVERING FOR INJURY FROM DEFECTIVE STEP.

Shepherd vs. St. Louis Transit Co. (Mo.), 87 S. W. Rep. 1007. June 6, 1905.

A conductor given a car one day which had a defective step was injured by its giving way and throwing him to the ground when he attempted to step on it from the ground in pursuance of his duties. The jury were instructed that it was incumbent upon him to show by a preponderance of the evidence that he did not know of the broken and unsafe condition of the step, and that the alleged condition of the same was not open and obvious to him in the exercise of reasonable care upon his part for his own safety, or that of the passengers carried on said car while he was conducting the same. The supreme court of Missouri, division No. 2, holds that this instruction was erroneous. It says that under the law the conductor may have known of the defect; yet, unless it was so open and obviously dangerous that ordinary prudence would have dictated that he refuse to use it, it would not defeat his right of recovery.

ACTUAL DAMAGES ONLY RECOVERABLE FOR EJECTION FOR TRANSFER BEING TOO OLD FOR DELAYED CAR.

Little Rock Traction & Electric Co. vs. Winn (Ark.), 87 S. W. Rep. 1025. May 27, 1905.

Acting in obedience to the rules of the company as he understood them, a conductor refused to accept a transfer ticket because it was over 15 minutes old, and told the passenger that he would have to pay his fare or leave the car. The conductor was guilty of no unnecessary rudeness. Nor was it the fault of the passenger that the ticket was half an hour or so old when presented. That was due to the fact that the car on which he presented it had been delayed, and was behind its scheduled time. The night was very cold, and the passenger, refusing to pay another fare and being compelled to leave the car, had his feet frostbitten. The jury assessed the actual damages at $100 and allowed $100 additional as exemplary damages. The supreme court of Arkansas thinks that the evidence was sufficient to support the judgment as to actual damages, but declares that it sees nothing in the case to entitle the party to exemplary damages, and reverses the judgment as to the latter, dismissing the claim therefor.

AFTER ALIGHTING ONE CEASES TO BE A PASSENGER—LOCATION OF TRACKS IN RESERVED SPACE CONTROLLED BY PARK COMMISSIONERS FROM WHICH TEAMS ARE EXCLUDED IMPOSES NO EXTRA DUTY TO FORMER OR INTENDING PASSENGERS.

Conroy vs. Boston Elevated Railway Co. (Mass.), 74 N. E. Rep. 672. June 21, 1905.

That part of the defendant's railway with which this action was concerned was in a public way, the control of which was in a board of park commissioners. The railway tracks were in the center of the street in a reserved space from which horses and ordinary teams and vehicles were excluded, but which was open to the use of the public on foot. After alighting from a car, the plaintiff walked upon this reserved space a few feet to a point behind the

end of the car, and then attempted to walk across the part of the street occupied by the tracks. She fell over one of the rails, and was injured. In overruling exceptions to a finding for the defendant, the supreme judicial court of Massachusetts holds that when the plaintiff left the car she ceased to be a passenger, and that the fact that the part of the street where the tracks were laid was not allowed to be traveled by ordinary vehicles imposed upon the defendant with reference to those persons who had been or might be its passengers no duties other than those which a street railway is under because of its location in any street.

CONSTRUCTION OF STATUTES WITH REFERENCE TO VESTED RIGHTS—SUPPLEMENT TO CHARTER NOT INTERFERING WITH PRIOR OR SUBSEQUENT CONTRACTS WITH CITY—LONG ACQUIESCENCE IN ORDINANCES IMPOSING ANNUAL LICENSE FEES FOR CARS CONCLUSIVE.

Mayor, Etc., of Jersey City vs. North Jersey Street Railway Co. (N. J. Supp.), 61 Atl. Rep. 95. June 26, 1905.

The supreme court of New Jersey holds that statutes are not to be so construed as to interfere with vested rights, if their terms admit of any other reasonable construction.

The supplement of 1867 to the charter of the Jersey City & Bergen Railroad company, in enacting that it should not be lawful for the municipal authorities of any city or town to interfere with, hinder, or obstruct the company in constructing or running its railroads, provided the same should be constructed and run according to the provisions of said act, had not the effect of discharging the company from its contractual obligations to Jersey City, previously undertaken by the company pursuant to legislative authority. Nor had said supplement the effect of modifying the express terms of contracts thereafter entered into between the company and Jersey City.

Where ordinances of a city gave to a street railway company permission to construct lines of railway in the streets, and to operate cars thereon, upon terms of paying annual license fees for each car so operated, and the company accepted the ordinances upon these terms, constructed the lines of street railway, and for many years operated cars thereon, the company and its successors which acquired its railway lines and assumed its obligations were estopped from setting up that the terms imposed by the ordinances were ultra vires (beyond the powers of) the municipal corporation.

CONDUCTOR CALLING POLICEMAN IN JOKE TO OLD CAR USED FOR SHELTER NOT WITHIN SCOPE OF EMPLOYMENT AND COMPANY NOT LIABLE FOR INJURY FROM DEFECTIVE PLATFORM—PLATFORM OF SUCH CAR NOT WAY TO WHICH THERE IS IMPLIED INVITATION.

Berry vs. Boston Elevated Railway Co. (Mass.), 74 N. E. Rep. 933. June 26, 1905.

The plaintiff was a policeman, who at a quarter past three in the morning was called by a conductor of a car in the employ of the defendant. The conductor, at the time he spoke, was standing in the doorway of an old horse car, the only use of which was to afford shelter for conductors while off duty. One end of the car and the windows were boarded up. The other end had still a platform, in which was a hole that had been there for some time. The policeman was in the street when called by the conductor, who said to him, "Hey, come here, Berry, I have two crooks for you." The policeman came, and in stepping on the platform put one foot through the hole and was injured. There were only two messenger boys of the Western Union Telegraph Company in uniform in the car at the time, who had received permission to wait there until a car started for Boston. The boys were well known to the conductor, and it was apparent from the evidence that the conductor was playing a practical joke on the policeman. The supreme judicial court of Massachusetts says that, while the car was on the premises of the defendant, it seems to it clear that the act of the conductor was not within the scope of his employment, and that the defendant was not liable. The fact that the act was performed on the premises of the defendant was wholly immaterial. It was contended that [illegible] arrest; but the court says that the platform of an old discarded car, [illegible] an implied [illegible].

CONDUCTOR [illegible] A STANDING PASSENGER TO R[illegible] IN FRONT OF PARTICULAR PERSONS WHEN HE WOULD HAVE TO STAND IN FRONT OF OTHERS.

Guariello vs Union Railway Co. of New York City (N. Y. Sup.), 94 N. Y. Supp. [illegible]

According to the plaintiff's testimony, he was standing on the floor of an open car near the right edge thereof, directly in front of two Sisters of Charity. The conductor told him to remove from in front of the Sisters [illegible] seized him and gave him a pull which caused him to fall from the car. Commenting on this, the supreme court of New York, trial term, New York County, says that the car being full, the plaintiff was obliged to stand in front of some passenger, and a direction by the conductor to him not to stand before the Sisters, while exceedingly commendable to his deference and chivalry to these ladies of a highly respected religious order, was nevertheless a discrimination against the other passengers, before some of whom the plaintiff had necessarily to take a standing position. This command, if given, was not one which the plaintiff was bound to obey, because of its unlawfulness and impropriety. And, because of its unlawfulness and impropriety, it was as improbable that such command was given as was the existence of the assault itself.

STATUTE AUTHORIZING LICENSE TAX NO AUTHORITY FOR ORDINANCE IMPOSING 25 CENTS PER FOOT ON TRACK.

Pittsburg Railway Co. vs. City of Pittsburg (Pa.), 60 Atl. Rep. 1077. Apr. 17, 1905.

Ordinances of the city of Pittsburg provide that there shall be established and levied an annual "license" tax "upon each and every street railway company or corporation the sum of twenty-five (25) cents per foot for each lineal foot of track laid, maintained or operated by such company or corporation within the limits of the city of Pittsburg, exclusive of such track as may be in the yards or buildings of such company or corporation." The supreme court of Pennsylvania holds that ordinances were not authorized by a statute authorizing the city to levy and collect a license tax or fee. It says that the ordinances term the tax assessed a "license" tax; but, no matter what the municipal authorities call it, the question is, What is it? The tax is 25 cents per foot "for each lineal foot of track laid, maintained or operated" by the company within the city of Pittsburg, exclusive of such tracks as may be in its yards or buildings. The tracks of a street railway company are as much its property as are its power houses, car barns, or repair shops; and, if so, could it be seriously argued that an annual tax of 25 cents per lineal foot on a car barn would not be a tax on the property, no matter by what name called, especially if to be collected for general revenue purposes of the municipality? Manifestly, it would be such a tax, and such is the character of the tax which the city would impose on the tracks of this company. The authority conferred on the city by the statute is to levy and collect a license tax or fee. The attempt is to collect a property tax, which is not authorized.

DUTY OF CONDUCTOR SUGGESTING TO PASSENGER TO GO INTO ANOTHER CAR WHEN NEAR CORNER—QUESTION OF NEGLIGENCE IN STANDING ON PLATFORM FOR JURY.

Chicago City Railway Co. vs. McCaughna (Ill.), 74 N. E. Rep. 819. June 23, 1905.

When a woman boarded a cable car there were two or three persons standing on the back platform, and people were holding on to the straps inside. Thereafter she expressed to the conductor a

wish to get a seat, and a companion asked if there were any seats on the grip car. The conductor answered that there were, and told the women that they did not need to wait until the next stop and get off to get one, but that they could walk through the car. The two women then started through the car, and about the time that the woman first referred to was stepping from one car to the other the car was swinging around a street corner and gave a sudden jerk, throwing her from the car. It was at night, dark and misty, and while the woman admitted that she knew of the condition of the track at that place, and knew of the turn, yet she was unable to tell, and did not know that she was at or near that point. But the evidence showed that the conductor knew that the car would swing around that corner, and knew that the car was near the corner when he told the woman to walk through the car. The supreme court of Illinois holds that it was therefore his duty to inform her of the danger of the car making the sudden turn, or to have so controlled the car that there would have been no danger in her passing from one car to the other. Nor does it think it was negligence per se (by itself) for her to be or ride on the platform of the street car, especially under the circumstances under which she came to be upon the platform of the car. Under the circumstances under which she came to be upon the platform of the car, whether or not it was such negligence as would preclude a recovery of damages, and whether the woman, standing upon the platform, was in fact negligent, were questions of fact for the jury to determine from all the facts and circumstances surrounding the transaction.

AFTER DEDICATION OF RIGHT OF WAY AS STREET CITY MAY AUTHORIZE RIVAL RAILWAY THEREON—NO CONDEMNATION OF STREET—STREET RAILWAY NO ADDITIONAL SERVITUDE.

St. Louis & Suburban Railway Co. vs. Lindell Railway Co. (Mo.), 88 S. W. Rep. 634. June 15, 1905.

The supreme court of Missouri, division No. 1, says that it was impossible to escape the conviction that the plaintiff and its predecessors intended to dedicate the portion of its right of way lying within the limits of Hamilton avenue to public use as a street, subject to its right of way thereover, and, being a public street, it was within the power of the city to permit the defendants to construct, maintain, and operate a street railway over the same, and that the plaintiff is not now in a position to claim that such a street railway, even though it be a rival railway, could only be constructed across the plaintiff's right of way after a right so to do had been acquired by condemnation. It says that, in the abstract, where a railroad company seeks to condemn private property for a railroad right of way, the use to which it is devoted is a judicial question. But this rule of law was not determinative in this case, for the defendants were not seeking to condemn the plaintiff's property for a right of way, but were claiming a right to run over the streets by virtue of an ordinance duly enacted by the city of St. Louis authorizing them to do so. Given the premise that Hamilton avenue was a public street, it followed that the defendants could not condemn a right of way over the same, for section 20 of article 12 of the constitution expressly reserves to a city, town, or village the right to say whether or not a street railroad shall be operated on any of its streets. Street railroads constitute a legitimate use of a public street. Such railroads are simply another method of transporting citizens over the streets, and it has been held that they may not only be legally authorized on the street, but that their presence thereon does not constitute an additional servitude.

LICENSE FEES FOR CARS DO NOT BAR FRANCHISE TAX—CONSTRUCTION OF FRANCHISE TAX STATUTE—NO DENIAL OF DUE PROCESS OF LAW.

People of the State of New York ex rel. Brooklyn City Railroad Co. vs. State Board of Tax Commissioners (U. S., N. Y.), 25 Sup. Ct. Rep. 713. May 29, 1905.

The company being required to pay various annual license fees for each car on different routes the contract arrangements between it and the city were subsequently modified in respect to the amount of the annual license fee by authority of a statute which contained the clause: "The said license fees shall be taken in full satisfaction for the use of the streets or avenues, but the same shall not release said company from any obligations required by law to keep such streets or avenues, or any part thereof, in repair, which said obligations and the contracts, laws, or ordinances creating and enforcing the same, are hereby continued in full force and operation." Did these license fees stand as an equivalent for property taxes so that a stipulation in respect to them relieved the property from liability to ordinary taxation? The supreme court of the United States says that this certainly would not be the general rule. A license fee is understood to be a charge for the privilege of carrying on a business or occupation, and is not the equivalent or in lieu of a property tax. Further, in the statute modifying the license fees, which was accepted by the company, it was expressly stated that they should "be taken in full satisfaction for the use of the streets or avenues." Clearly, therefore, the fees being imposed for a specific purpose, they could not exempt the company's property from the tax imposed by the special franchise tax law.

The sections relating to the taxation of franchises, the supreme court further says, were enacted as amendments to and part of the general tax law of the state, and are to be construed accordingly. By one section the valuation is to be determined by the state board of tax commissioners. By another the owner of every such franchise is required to make a written report to the state board. Then, after making the valuation, the state board is required to give certain notice in writing to the owner of the franchise, stating the valuation and date when it will meet to hear and determine any complaint against such assessment, while another section provides for a review of the assessment by writ of certiorari. And these provisions having all been complied with, the court is of the opinion that the company was not denied due process of law in the valuation and assessment of its franchise.

PROVISION ALLOWING MOVABLE SCREENS FOR SEPARATION OF RACES CONDEMNED—WHAT IS MEANT BY WORDS "PARTITION" OR "SCREENS"—MERE SIGN NOT ENOUGH.

Southern Light & Traction Co. vs. Compton (Miss.), 38 So. Rep. 629. June 12, 1905.

The supreme court of Mississippi comments at some length on certain features of chapter 99 of the laws of that state of 1904, which was meant to secure a separation of the white and colored races on street cars, in order to show, as it says, the necessity which exists that the legislature should promptly repeal this exceedingly unfortunate statute, and provide a statute for street cars similar to that for railroads. It thinks the purpose of the statute wise, but the provision that the conductor may have an adjustable screen, and may move that adjustable screen about as the needs of the traffic require, it declares is a provision so manifestly unwise, and so clearly subversive of the dominant feature of the statute, as to make it matter of wonder that this result should have escaped the attention of the lawmakers.

A little piece of board, called a sign, stuck up on the back of a seat, with words painted on it ("White," "Colored"), the court further holds is no partition or screen within the meaning of this law. The very words "partition" or "screens" import complete separation between the races in street cars, so that passengers in one compartment shall be shut out from passengers in the other. The object of the law was absolute, complete and perfect separation, so that there should occur none of the outbreaks and conflicts marring the public peace, and ending, it may be, in bloodshed. Nothing but constant friction could possibly arise from the use of a mere little sign, exasperatingly shifted about from point to point, requiring passengers to change their seats, already assigned, whenever a conductor "drest with a little brief authority" chose.

It ought to be the study of corporations operating street car lines within communities wherein dwell two distinct races so to operate them as to secure to the utmost harmony and peaceful relations between them in public travel. That was the object the legislature had in view in the enactment of this law. That is what the terms "separate cars," "compartments," "partitions," and "screens" intended to secure. The statute has used no such word as "sign," and it is asking far too much of a court to find in a little piece of painted plank, separating nothing, the partition or screen which the law has demanded shall be used.

Piping and Power Station Systems. XI.*

BY WILLIAM L. MORRIS, M. E.

PIPING DETAILS

Under this heading will be shown some details of construction including the assembly of the various parts as well as special details pertaining to these parts. The illustrations of systems previously shown were merely diagrams, and until such diagrams have been laid out, and the selection of the system to employ has been finally decided, but little progress can be made in determining details. Detail work and accurate scale drawings should follow the diagram layouts, and, although the diagrams may be considered the "key"

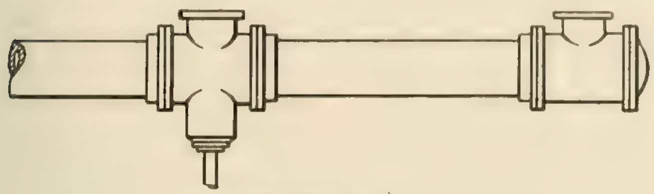


FIG. 67—(A1-1).

to the piping plans, they should not be regarded as final until the details and scale drawings are completed, as it may be found that some minor connection can be made much more readily by slightly modifying the system rather than running a special long or otherwise objectionable connection.

The station pipe work and system should be as simple as it is possible to have them without sacrificing their reliability. It is a very common mistake in pipe work design to complicate the system to such an extent—in the attempt to provide numerous means of supply to station appliances—that the danger of interrupted operation from piping difficulties becomes greater than from the apparatus which is being safeguarded. Power station design should be a well-digested compromise of all the various station requirements. If the designer has an extensive knowledge of but one of the different station requirements, such for instance as electrical work, he will have his "diagram" of such work well developed and provided for.

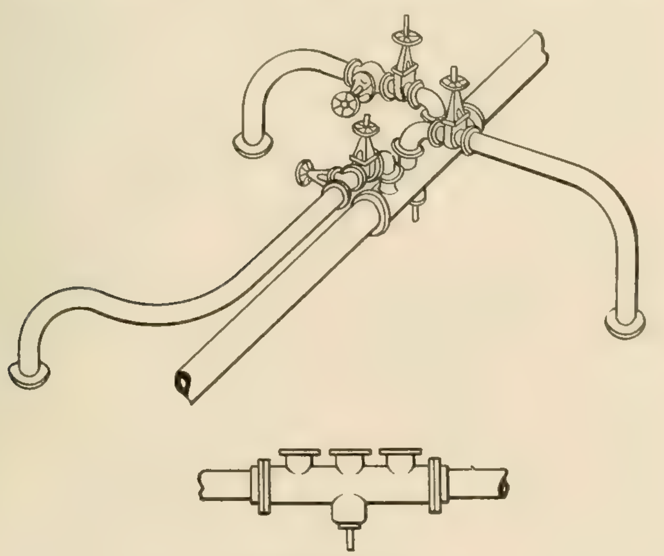


FIG. 69—(A1-3).

If it secures better results to have electrical diagrams well determined before undertaking the details, why should not piping diagrams be given similar consideration?

There are but three factors included in the systems in power station construction, viz., electrical, piping, and coal and ash systems; before any details [illegible] should be laid out in diagram combining all three factors, as each is affected by any [illegible] The [illegible] following pages are classified according to the system to which they pertain; for example, class A will include live steam, class B, exhaust steam, etc. The number affixed to the class letter represents a sub-division of that class; for example, A1 represents "live steam, headers or mains"; A2 represents "live steam, engine branches." The different details of the same sub-classes are numbered serially, as A1-1 and A1-2, etc. At the conclusion of this chapter on "De-

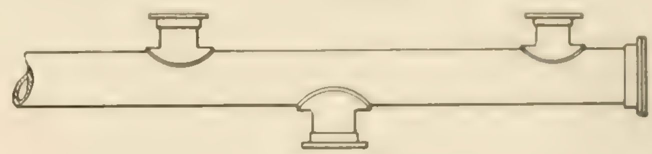


FIG. 68—(A1-2).

tails" an Index of Details will be given, containing all the different classes and sub-classes.

This index will be found specially useful in laying out diagrams, as it will be a reminder of the great multitude of lines and connections that enter into a piping system; and it will draw to the attention of the pipe work designer the many little lines and connections that are easily overlooked in preparing drawings and specifications. These oversights often make pipe work "extras" a very large item in station building, and any one who has had experience in letting contracts knows that many contractors offer bids which permit of but very slight profit, depending upon "extras" to make the job a desirable contract. The index will aid very materially in eliminating these extras, which not only result in a very expensive method of doing the work, but which reflect on an engineer's ability to properly prepare specifications.

Another advantage in using such an index is that it avoids the

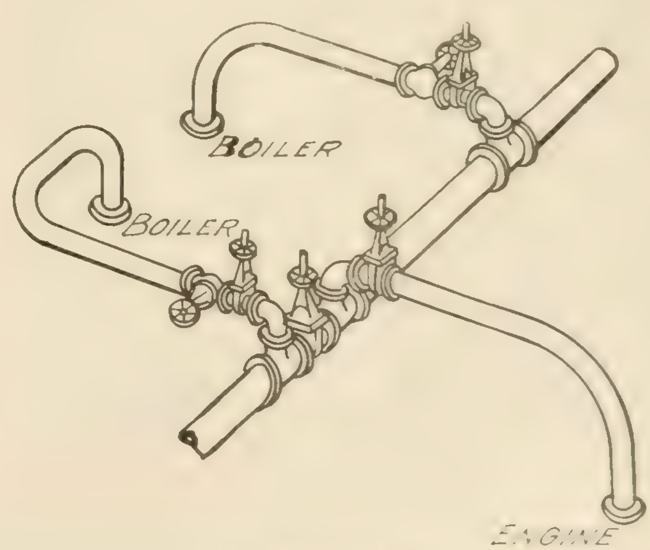


FIG. 70—(A1-4).

necessity of bearing in mind every line and connection required, which means much time saved; a line laid out with a connection overlooked may require much time and study in order to place the missing connection at some point where no provision for it has been made. Space has been left after each class in the index to enable the designer to add lines or connections which may be found necessary but which are not listed.

Piping supports will be shown in detail under this heading and details of standard valves, fittings, etc., will be given under "Manufacturer's Standards."

Class A1—Live Steam [illegible]

Detail A1-1, Fig. 67, shows the most common method of constructing steam mains and headers, using wrought-iron pipe with flanges attached to it, and cast-iron fittings. In fact, there is no other style of construction that the large manufacturing companies will guarantee. The fittings can be finished so as to have parallel and right-angled faces, and the flanges on the pipe can be faced after they are secured to the pipe, insuring a perfectly straight pipe line when assembled.

Detail A1-2, Fig. 68, shows an old method of making headers that has been abandoned, due to the great difficulty of keeping riveted

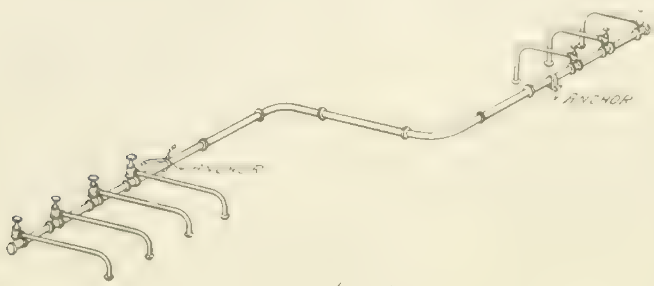


FIG. 71—(A1-5).

work tight. Riveted work should be completely avoided for any lines or branches that are subjected to strains of expansion and contraction. Another objection to this style of header is the inaccuracy of the joint faces. The nozzles are liable to have flange faces on any conceivable plane except the correct one, and the flanges at the ends of the pipes, which are set by hand, are sure to be out of true in some direction, the amount of inaccuracy depending upon the care taken by the workmen in assembling the work. Hand labor is a very uncertain method for securing accurate work. If the conditions are such as to demand the use of nozzles riveted to the pipe the rivets should be threaded, stay bolts screwed tight into tapped holes and riveted over each end to avoid leakage past the rivets. The flange should be a steel casting, so that it can be caulked. Instead of using say two tees in the header for two boilers, and another tee for the engine, it is oftentimes more economical to construct one casting like detail A1-3, Fig. 69, and have fewer joints to care for.

It may occur to the pipe work designer that he would be departing from the manufacturer's standards to call for a manifold of this style; that such a detail would require special pattern work and special arrangement of tools at the factory, making it much more expensive to build than two standard tees, and a cross. Large high pressure fittings are not carried in stock by the manufacturers, therefore they are "specials" in the machine shop even though they may be made from standard patterns. To compare the cost of this manifold with a manifold made from three separate fittings we must consider the cost of patterns against that of four-faced flanges, drilled, with bolts and gaskets, and the labor for making the joints. The manifold made in one piece will invariably cost the least, and if there should be no saving in cost this detail is decidedly preferable from an operating standpoint on account of its easy maintenance.

In order to lay out the desired system it may be found necessary to run long connections, say from the boiler, in order to place the header valves according to the diagram previously determined upon. Such a case is shown in detail A1-4, Fig. 70.

The system should never be sacrificed for any notional idea of symmetry of connections. To preserve the desired system it may be found necessary to increase the length of a boiler connection say 10 or 15 ft., a feature which is neither expensive to construct nor to operate, as it would not ordinarily require any additional fittings or valves. In case the header is not over 200 ft. long it will not require any other provision for expansion than the branches to boilers and engines which should be equal to a full length of pipe in each case. By anchoring the header at the center, the expansion would amount to about two inches at the end of the line, and this would be readily taken up in the boiler and engine branches. The fitter would be able to lighten the strains by drawing the end branches about an inch toward the center of the header when making the joint.

If the connections are flanged so that swings may be used, they will relieve themselves on the flanged faces while the line is heating up, and greatly reduced the strain on the connections. The relief thus afforded can be demonstrated by opening up an old joint and allowing the other joint to throw the pipe connections into a position free from strain.

In cases where extremely long mains are used it becomes necessary to break up the straight line, as shown in the detail A1-5, Fig. 71, and provide anchors for the steam main both at the engine and the boiler branches. In cases where it is desirable to keep the entire length of the header in a straight line, as would be necessary in long, straight tunnel work, it becomes necessary to take care of the expansion at very frequent intervals if elastic details are used to care for the elongation of the pipe. Different forms of expansion connections will be shown later. The U-bend for dividing headers is the most common method used in power stations. If the bend is laid flat in a horizontal plane, the drips will flow either way through it; however, placing the bend in a horizontal plane induces severe side strains on header supports, and these must be well cared for to prevent the header from climbing up on them and raising itself out of line. Placing a U-bend vertically throws the stresses in a vertical plane, which ordinarily would be fully counteracted by the weight of the header and branches; the drips must be cared for in this case at each side of the vertical U-bend. Which of these two difficulties can be the more readily cared for depends upon the surrounding conditions of each individual case.

A very elastic design of header is shown in detail A1-6, Fig. 72, in which the header constitutes merely an equalizer from one manifold to the next. The sizes shown are such as ordinarily would be used for a 1,500-kw. unit. The manifolds should be anchored to their supports, and throw all expansion strains onto the connecting lines. Whatever the design for the header and connections may be, it should be so arranged that the elasticity of the pipe will be sufficient to take care of expansion and contraction. This is the only means acknowledged as being permanent and efficient. There are various special devices for caring for expansion, but their use is confined to emergency cases only, or cases which will not permit the use of sufficient length of pipe to secure the desired flexibility.

Supports for steam mains should be laid out to allow for both expansion and the side movement of the line, as illustrated in detail A1-5, Fig. 71. The points in the pipe line that would be the center of the expansive forces should be anchored to avoid vibration of the lines. Expansion and vibration are two conditions that must be provided for and neither must be permitted to interfere with the other. This subject will be more fully considered under "Piping Supports."

The fittings ordinarily used for large steam pipes are made of cast iron and are extremely heavy. A much more desirable fitting

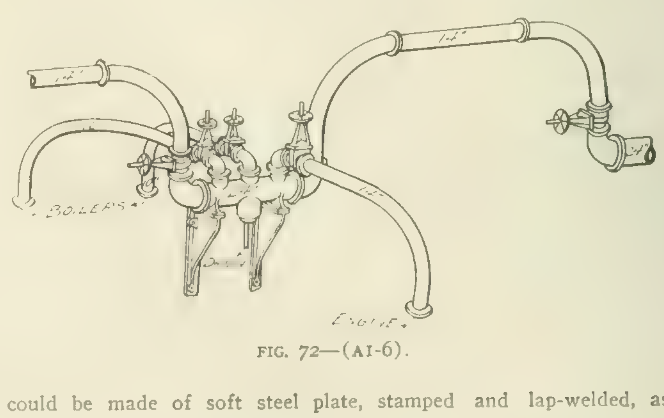


FIG. 72—(A1-6).

could be made of soft steel plate, stamped and lap-welded, as shown in detail A1-7, Fig. 73

The flanges could be of rolled steel, making an all-steel fitting, light and somewhat elastic. If the manufacturer had his factory equipped with proper machinery for making such a line of fittings, he could without doubt produce them for about same shop cost as cast-iron fittings. There is no question but that the engineers would be universally in favor of using the steel plate fitting, and even if their cost was 50 per cent more, large sized fittings would invariably be specified of this make. A demonstration of the general

desire for something more reliable than cast iron is evidenced by the very extensive, and in fact, almost universal use of rolled-steel flanges in place of cast-iron ones, which were formerly used for high grade, high pressure work. Manufacturers are using what they term "semi steel" for high pressure valves and fittings, and for no other purpose than to make them more reliable. Valves cannot be made of light weight and of extremely strong material, as it is necessary to use sufficient metal in them to prevent any possible springing or distortion that would prevent the valve faces from closing tight. Fittings, however, do not have to be stiff and free

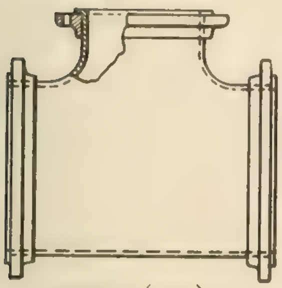


FIG. 73—(A1-7).

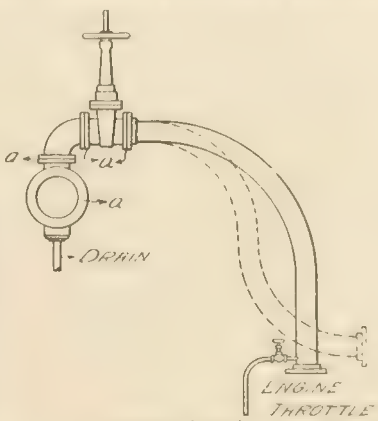


FIG. 74—(A2-1).

from distortion, and in fact the more elastic the body of the fitting, the less strain there would be on the connecting lines.

Class A2—Live Steam; Engine Branches.

The connection shown in detail A2-1, Fig. 74, is quite frequently used, as it allows a swing on the joint faces "a" and the top of the throttle. The engine throttle is placed at the lower end of the branch, allowing the condensation to accumulate over it when closed—a condition that would be very objectionable for a boiler branch, but not with the engine connection. When water is thrown out of a boiler branch it is carried to the engine. Under full speed and in service, an engine branch, if not provided with a drain, will immediately discharge its water into the cylinder and the engine while slowly starting will discharge the water into the exhaust pipe and out of way. The drain is generally the warming pipe, and before the engine is started the condensation is carried off. This style of connection should be used where the header is large, and it acts as a separator and is provided with drains. The dotted lines show a connection to a side-opening throttle which has a "triple swing" connection, the same as shown in solid lines. A triple-swing connection, to be such, must have a horizontal and two vertical joint faces at one end of the connection, and the joint face at the other end is placed so that the axial line passing through its center will not coincide with the axial center line of any of the three joint faces at the other end of the connection. To secure the best results possible in steam pipe connections, it is necessary to use the "triple-swing" connection.

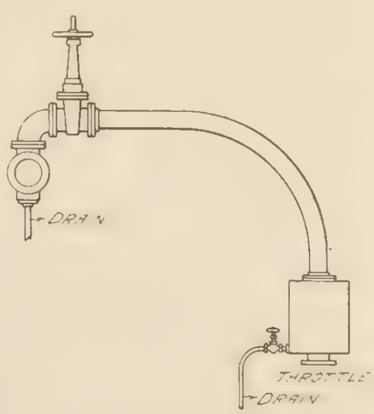


FIG. 75—(A2-2).

Detail A2-2, Fig. 75, shows a very usual, but nevertheless improper connection. The header is small and provided with drains and the receiver also is small and provided with drain. Instead of separating at one point it is designed to separate at two. High pressure drips are troublesome to take care of, and the fewer points there are to drain the simpler will be the system. It is a very common practice to use a large header—about three times the area of the engine connection—and depend upon the slant of the header to remove the water carried over with the steam. This makes a very simple arrangement for caring for drips, as one drip line will care for the entire system. The objectionable feature of the connection [illegible]

[illegible] of just sufficient size to convey the steam—possibly the same size as the engine connection. The separator is say twelve times the area of this pipe, which greatly retards the velocity, and provides a large volume of steam close to engine. This receiver-separator

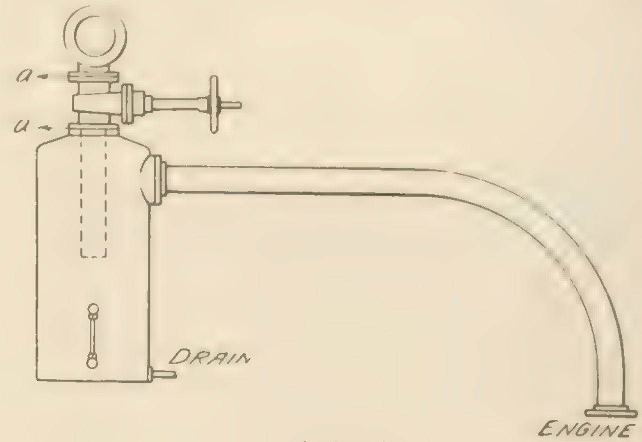


FIG. 76—(A2-3).

would be too heavy to place on an engine throttle, and, as shown, would be a support for the header. The engine branch can be readily connected, as swings are provided at joints "a." To take a branch out of side of the header similar to that taken out of the receiver would be bad detail, as it would not provide the swing that is always necessary for good pipe work. In case the steam header is placed below the floor the same details would obtain for removing condensation. The receiver located below the header is unquestionably the neatest and safest detail of this class.

Detail A2-4, Fig. 77, shows the horizontal receiver-separator which may also be placed above the cylinder with the throttle on top of the cylinder in the usual way, as shown by the dotted lines. One of the great advantages in the use of separators independent of the header is that the header can be made smaller, which permits the use of smaller valves and involves much less labor in making re-

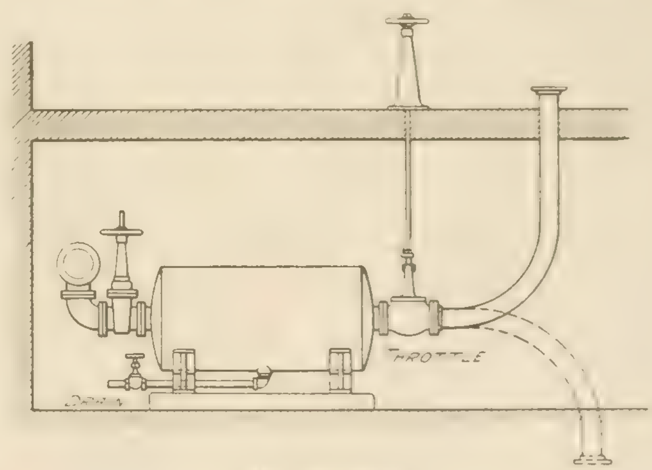


FIG. 77—(A2-4).

pairs, the vibration is reduced and the general operation more satisfactory. A plant that would require a 20-in. separator-header would in case of using receiver-separators be able to use about a 14-in. header. However, the large separator-header should not be considered anything but a means of partial separation, as the diameter is too small—even though it be 20 in.—and would cause the velocity of the steam flow to be about four times that through a regular separator.

Class A3—Boiler Steam Connections.

The connection shown in detail A3-1, Fig. 78, is one of the most approved forms of boiler connection: it has the triple swing, the

same as the engine connection detail A2-1. It is quite difficult, and in fact impractical, to set a boiler or other steam generator by the face of its pipe connection, and the result is that in making the connection between a header and a machine there are slight inaccuracies in every direction; and when pipe work is received and assembled additional inaccuracies become apparent. The triple-swing connection provides means of taking up these variations by rolling the different parts on their faces. In case the elbow was turned up and steam entered the header at the bottom, there would be swings provided the same as shown. The connection shown in detail A3-1 has two valves, a gate valve next to header and an automatic stop valve between the gate and boiler, both valves being located at the highest portion of the branch, insuring a dry branch at all times.

The connection shown in detail A3-2, Fig. 79, has a double

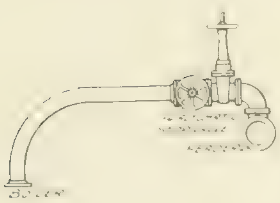


FIG. 78—(A3-1).

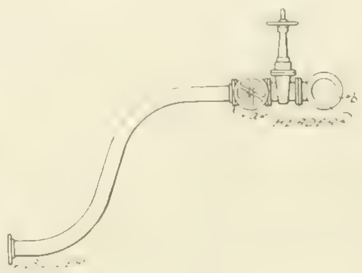


FIG. 79—(A3-2).

swing—on the three flanges "a" and the flange "b." There is no horizontal face to swing on, and if the boiler flange was not parallel with the face of the header tee it would be necessary to make a bend in the pipe connection, or "spring" it by pulling up on the connection bolts. There is no other detail in pipe work erection that will cause as much trouble from joints giving out as "sprung connections," or in other words, forcing two flanges together that do not set parallel, by drawing up hard on the bolts and compelling the pipe work to spring in order to make a joint.

The connection in detail A3-3, Fig. 80, though quite common, is far from good construction. It has but the two swings at joints "a" and "b," and there are two water pockets, one at each leg of the U. In order to operate such a connection it is necessary to place a drain in each leg, and constant attention must be given to draining the connection before opening it into header. If the U is made of considerable height to provide for expansion, it is very possible that the upper portion would vibrate to such an extent as to require anchoring, due to the fact that the connection projects a considerable distance from its supports. The amount of motion that any connec-

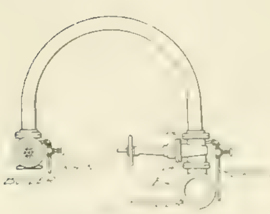


FIG. 80—(A3-3).

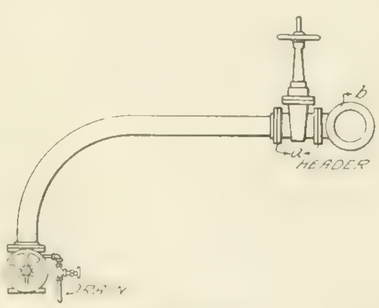


FIG. 81—(A3-4).

tion will permit without endangering its joints is determined almost wholly by its length and not so much by its form. The elasticity of different forms of pipe work will be considered later.

Connection A3-4, Fig. 81, though a poor detail, has fewer faulty features than A3-3. By having the valve next to the header, it would not be a very serious matter to open the lower valve without draining the branch, providing it was opened before opening valve next to header; this, however, is no appreciable advantage, as "regular operation" sometimes means doing the wrong thing until some serious damage is caused. There are only two swings in this connection at "a" and "b."

Connection A3-5, Fig. 82, has the same swings and general construction as detail A3-2. This connection is shown entering the bottom of the header, a detail which is open to some criticism. There are many who believe that drips from the header will return to the boiler through this connection. This belief is shared mostly by the operating engineer, who argues "We get rid of the drips, where else can they go?" It is hardly correct to presume that the current of steam which because of its high velocity carried water into the header would later on permit it to return against this flow. Nor is it possible that condensation will accumulate in the header under a rapid steam flow through the boiler branches, and then return when the velocity becomes less; the drips cannot accumulate in such a header, nor can they flow along header to some boiler

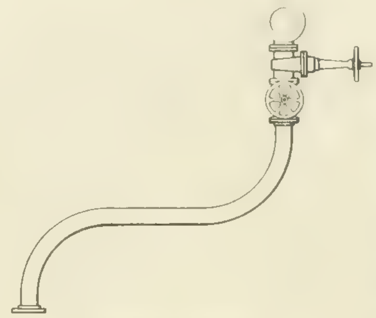


FIG. 82—(A3-5).

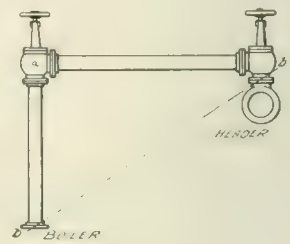


FIG. 83—(A3-6).

which is not being worked so hard, as the drips must then flow into and through the rapidly flowing steam.

Since water of condensation cannot accumulate in the header without flowing with the incoming steam, there is but one path for drips to take, and that is the path of the steam entering the header and flowing to the engine. The mere fact that the header is dry does not indicate that condensation has been returned to the boilers; it merely proves that drips do not stay in the header in "pockets," but keep moving, and this movement is towards the engines. If this is to be the method of discharging drips, it would be quite as safe to take engine branches out of the bottom of the header and keep the latter constantly drained through the engine. Or in other words, do not try to separate the water from the steam—a course which is too objectionable to be considered; objectionable not only in regard to economy, but because it makes it impossible to properly or economically lubricate pistons under such conditions.

The connection shown in detail A3-6, Fig. 83, is objectionable, due to the location of valve at "a," which is placed at a considerable distance from the line of supports, b b. The corner "a" will vibrate even more than the header, due to the amount of weight that is free to move. In case "a" is a fitting, it will also be liable to vibrate to such an extent as to require stay rods run to some support. In designing such branches, care should be taken to keep the heavy portions, such as valves and fittings, either near to the boiler or to the header, or to parts that project considerably beyond the line bb of pipe. Pipe work that requires tie rods and braces to stay the branches is faulty in design.

(To be continued.)

The Ft. Wayne & Wabash Valley Traction Co. has been distributing to the farmers along its lines a pamphlet entitled "Electricity on the Farm," in which it briefly sets forth the advantages of the operation of farm machinery by electricity, and in which are shown a number of installations of motors for driving farm machinery. These motors are used principally for cutting and grinding feed, separating cream, shelling corn, sawing wood, etc., but as the motors are readily moved from place to place, they may be used for driving threshing machines and other machinery which it may be desirable to operate at a distance from the barn. The company states that this pamphlet is creating a great deal of interest among the farmers.

The United Railroads of San Francisco is devoting considerable space in its publication, Transit Tidings, to matters of interest to school children and has offered prizes for the best suggestions for contests of interest to school children and in which they would participate.

Power Improvements of the South Chicago City Ry. and Hammond, Whiting & East Chicago Electric Ry.

The South Chicago City Ry. was chartered as the Ewing Avenue Horse Railway Co., May 31, 1883. The construction work was finished and the road opened for traffic on July 1, 188[illegible], and a month later the change was made to the present name. Until 1893, when permission was gained to use electricity, the cars were operated by horse power. The Hammond, Whiting & East Chicago Electric Ry., which obtained its charters in 1892 and 1904, is operated in connection with the South Chicago City Ry.

The several lines of these companies serve a district adjacent to the shore of Lake Michigan and extending from 63rd St., near Jackson Park, in the city of Chicago, across the Illinois-Indiana state line to the cities of Hammond, Whiting and East Chicago. The accompanying map will serve to illustrate how the several lines furnish transportation facilities between the city of Chicago and these outlying towns. The northern terminus of the line is located at the intersection of Madison Ave. and 63rd St., from which point passengers destined farther north or to the business district of Chicago can transfer to either the South Side Elevated Ry. or the steam suburban trains of the Illinois Central R. R.

The South Chicago City Railway Co. owns and operates that part of the combined system in the state of Illinois and the Hammond, Whiting & East Chicago Electric Railway Co. owns and operates the portion of the system in the state of Indiana. While the operation of the two portions of the line is kept as distinct as possible, there is no transfer of passengers required at the state line, but the cars operate through from 63rd St. in Chicago to 150th St. in East Chicago, and to the center of the city of Hammond, as indicated on the map showing the routes. A 5-cent fare is charged for the ride on either of the systems, thus making the fare 10 cents from 63rd St. to the southern termini of the lines. The present total track mileage of both systems is 60 miles, of which 37 miles are in Illinois and 23 miles in Indiana. During the past year a portion of the track work has been rebuilt and several improvements made in the power distribution system.

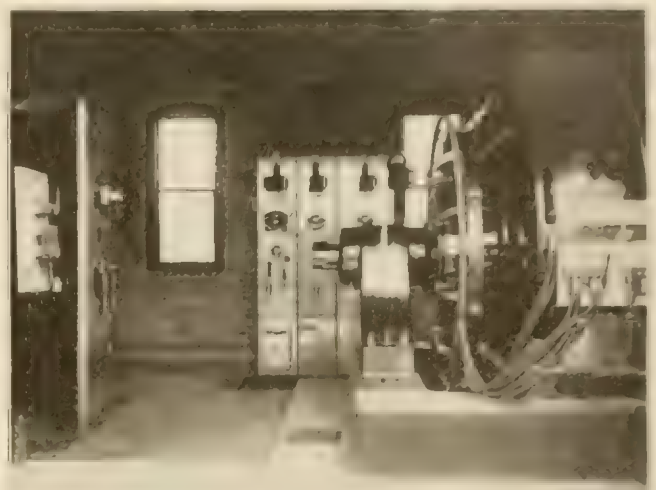
The regular schedule of operation furnishes 20-minute service

DOUBLE CURRENT GENERATORS IN 93RD ST. POWER HOUSE

between 63rd St. and Hammond, and also between 63rd St. and Whiting and East Chicago. Between South Deering and 63rd St. a schedule with cars on 12-minute headway is maintained. For the convenience of passengers the South Deering cars carry red signal lights and signs, the Whiting cars green signal lights and signs and the Hammond cars blue signal lights and signs. The company issues a folder describing the route of each line of cars and stating the details of the schedule [illegible] operation the [illegible] require [illegible] double-truck type with cross seats.

Power House.

The power house for the [illegible] the lines is located at 93rd St. and Ewing Ave., the relation of



INTERIOR OF HAMMOND SUB-STATION

which location to the general distribution system may be seen by referring to the accompanying map of the lines. At this location are the repair shop, storage barns and general offices of the system.

The power house, which was built some few years ago, has within the last year been partially remodeled and some new machinery has been installed. The building is of brick, well lighted by side windows and finished with a composition roof supported on steel trusses.

In the peak of the roof of the engine room are two electrically-driven fans 50 in. in diameter. The capacity of these is sufficient to change the air in the entire room in 4½ minutes. The engine room is 100 x 100 ft. in floor area, the boiler house 100 x 60 ft., and the office portion two stories in height, 100 x 40 ft. in size.

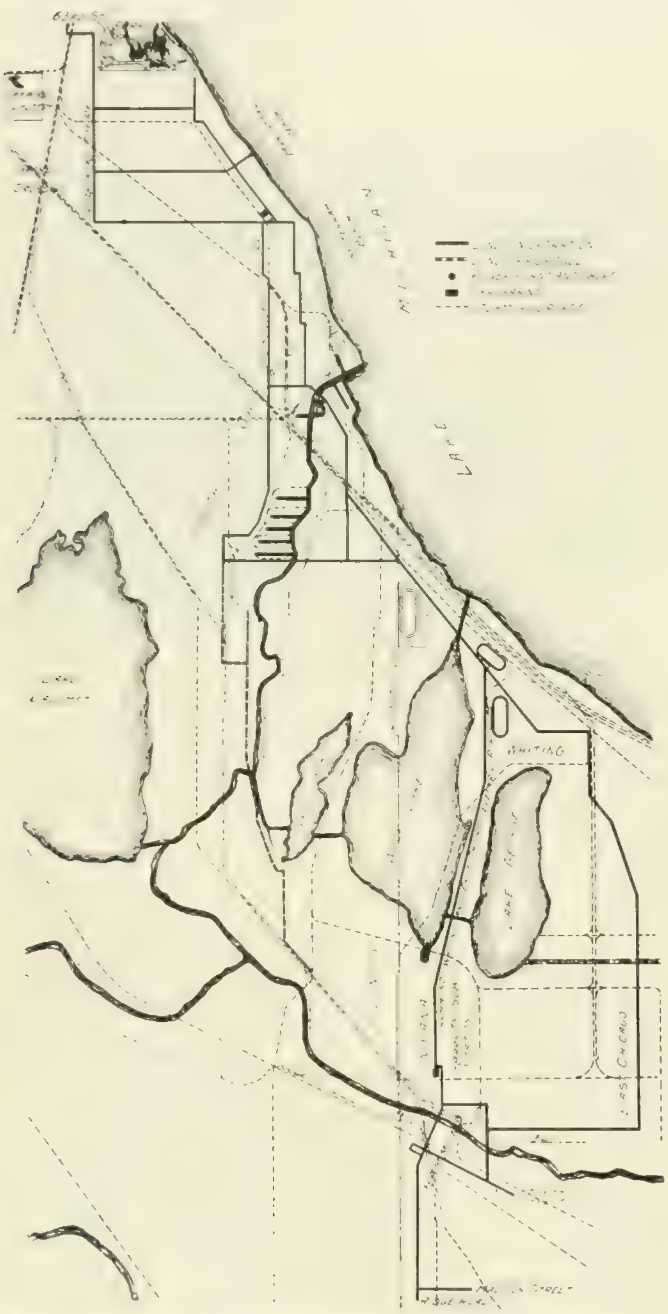
The boiler equipment consists of four 350-h. p. Sterling boilers set in pairs in which steam is generated at 130 lb. pressure. The gases after passing the boiler tubes are led through a Green fuel economizer consisting of 10 sets of standard tubes with four rows in each set. At the rear and between the two pairs of boilers is the combination brick and steel stack 186 ft. high and 8 ft. in diameter.

Coal is brought by a steam siding to the side of the boiler house and unloaded direct from cars onto the boiler room floor in front of the firing doors. The boilers are hand fired.

The method of removing ashes from the fronts of the boilers is interesting. This is accomplished by means of a chain with scrapers which travel along a concrete trough built under the floor of the boiler room directly in front of the boilers. From the pits under the grates the ashes are raked forward and out of the doors in the boiler setting fronts where they fall through openings in cast iron floor plates and are dragged along the trough, a cross-section of which is shown, by means of a conveyor chain. In front of each ash door is an automatic sprinkler so connected that the ashes may be cooled by water as they are raked from underneath the grates, thus allowing a man to stand close to his work. The trench along which the chain conveys the ashes and clinkers consists of a lining of brick at the bottom of which is a layer of cement covered with one inch of sand. On top of this sand a concrete trough is built

is a series designed to [illegible] the scrapers of the conveyor chain. The layer of sand was placed in the trench below the trough so that when the trough becomes too much worn and it is necessary to replace it, the concrete may be broken and thus removed without destroying the other portion of the trench construction. This trench is 96 ft. long extending in front of all the boilers and to the south wall of the building. Here the conveyor chain dumps its load into elevating buckets which carry the ashes to cars on a switch track outside the building.

The main steam header 18 in. in diameter is parallel with the



MAP SHOWING LINES CONNECTING SOUTH CHICAGO, HAMMOND, WHITING AND EAST CHICAGO.

row of boilers, but on the engine room side of the partition wall between the boiler and engine rooms. Each boiler unit may be cut off by either or both of two valves, one near the boiler outlet and one at the header. By means of two gate valves the header may be divided into three sections. The connections between the boilers and the main steam header tap into the bottom of the header and the engine connections lead off from the top of the header, each through a valve. There are drip taps on both sides of the valves which control the boiler connections. The main header is connected with a vertical free exhaust pipe extending through the roof and provided with an Excelsior back pressure valve.

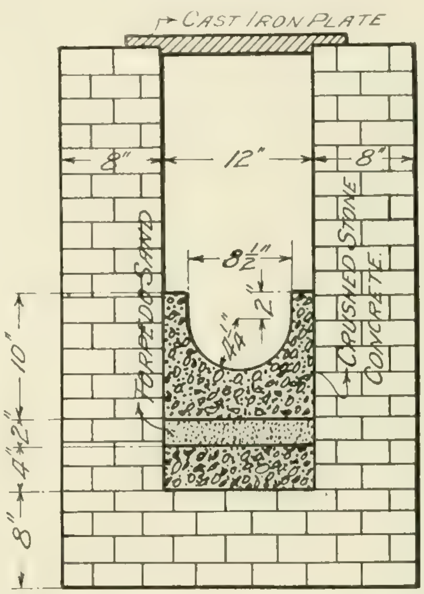
There are three E. P. Allis horizontal corliss engines with cylinders 22 x 48 in. These engines are designed to run at 80 r. p. m. and have flywheels each 20 ft. in diameter with a 30 in. face.

The engines drive, by means of 34-in., 3-ply leather belts, three Bullock double-current generators each of 300-kw. capacity. The machines are designed to generate direct current at 550-575 volts and 3-phase 25-cycle alternating current at 360 volts pressure. They run at 375 r. p. m.

A fourth generating unit consists of a 20 and 48 x 48-in. Green-Wheelock cross-compound engine operating at 90 r. p. m. This engine has a 40-ton flywheel 20 ft. in diameter and is direct connected to a 500-kw. 575-volt Westinghouse direct-current generator.

There is installed on the engine room floor for cleaning purposes a Westinghouse steam-driven air compressor.

The Green-Wheelock engine exhausts from the high pressure cylinder through a reheater to the low pressure cylinder. The steam from the low pressure side passes through a feed water heater and then to a Green-Wheelock jet condenser located directly under the engine. The condenser installation consists of two air pumps and two boiler feed pumps on the same belt-driven shaft. The condensers on the single cylinder Allis engines were furnished by



CROSS SECTION ASH CONVEYOR TRENCH.

the E. P. Allis Co. and are belt driven and of the same general type as that on the cross-compound engine.

As the boiler pumps on these condensers operate whenever the engine is running, a relief valve has been installed in the boiler feed main. This valve so operates that when the gages are full the water pumped is automatically wasted to the sewer. There are two connections for feed water to the boilers, one being in the top drum and one in the bottom drum.

The drips collected from the headers and separators are run to a Bundy steam trap which discharges into an open heater, thus saving the heat in the drips. A small steam pump is installed to take water from the hot well and circulate it through the heater which extracts the heat from the drips adding it to the boiler feed water.

In connection with the three double-current generators is installed a set of three 150-kw. Bullock transformers which step up the voltage of the machines to 6,600 volts, at which pressure current is transmitted seven miles to a rotary converter sub-station in Hammond. All wiring between the machines, transformer and switchboard is carried in concrete lined trenches sunk beneath the floor and covered with cast iron floor plates. These trenches are 12 in. deep and 24 in. wide and provided with oak racks on which the cables rest.

In event of any trouble to the high tension line, the entire system can be operated by direct current and use is then made of a booster set for raising the voltage on long feeders. This set consists of two 50-kw. series boosters mounted on a shaft with a 150-h. p. motor. The boosters are designed to raise the voltage from 550 volts to 675 volts.

The switchboard for the entire plant is made up of 20 panels gray marble fitted with recent types of switching apparatus. In order that the current supplied the separate lines may be properly charged to the operating companies, recording wattmeters are placed between the machine panels and the proper feeder buses for the direct-current lines feeding the portions of track in Indiana. A meter is also placed on the alternating-current feeders connecting the power station with the sub-station at Hammond, Ind. This alternating-current line is equipped with reverse-current circuit breakers.

The sub-station at Hammond, Ind., which supplies direct current to the feeders for the southern portion of the lines is located close to the car barn as shown on the map. The sub-station building is of brick walls with concrete floor and roof, there being no inflammable material in the building with the exception of the window framing and doors.

The building accommodates one Bullock rotary converter of 575-volt, 700-ampere capacity. The transmission current is stepped down from 6,600 [illegible] three 175-kw. oil-cooled transformers. The control board for the rotary is made up of the three [illegible] arranged to [illegible] on the alternating-current side. The board consists of one machine panel and two feeder panels.

In addition to the 3-phase transmission line which is made up of three No. 5 weatherproof wires on 45 and 50-ft. poles, the power house and sub-station are also connected through a direct-current feeder which can be fed through the booster at the power house. This direct-current feeder, which is seven miles long, is graded in size from 500,000 c.m. [illegible] at Hammond. An accompanying illustration shows the interior arrangement of the sub-station in Hammond.

The officers of the South Chicago City Railway and the Hammond, Whiting & East Chicago Electric Railway Co. are D. F. Cameron, president; D. M. Cummings, vice-president; O. S. Gaither, secretary-treasurer, and Wm. Wamsley, superintendent.

Freight Development by Interurban Roads.*

BY E. F. SEIXAS, GENERAL MANAGER, NIAGARA, ST. CATHARINES & TORONTO RAILWAY & NAVIGATION CO.

The transportation service performed by the railways includes the movement of freight, the carriage of passengers and the transmission of mail and express matter. Each of these services merits careful consideration. Whether viewed from the standpoint of public benefit or considered with regard to the volume of business done and profits received by the company, the transportation of freight is the most important service performed by the railway. The income from the passenger business is about one-fifth of the total income and earnings of the railroads in the United States, while the receipts from freight amount to seven-tenths. Moreover, the social welfare is more dependent upon cheap and unfettered movement of commodities than upon inexpensive and speedy means of travel. However important it may be that the relatively few people who may at any one time desire to take a journey should be able to reach their destination promptly and comfortably, it is of incalculably greater consequence that producers should be able to dispose of the commodities upon the sale of which their livelihood depends, and that consumers should have the power of drawing upon distant, as well as near, sources of supply for the satisfaction of their wants and the gratification of their desires.

The volume of freight transported increases rapidly with the progress of civilization and the diversification of men's wants. The freight business is carried on to enable men to secure what they want, and the more complex their demands, the more goods will be produced and transported. The growing demand for the freight service has furnished a most powerful stimulus to inventors and engineers to lessen the obstacles to the movement of commodities by improving tracks, cars and locomotives, and making other changes in the railway mechanism whereby the costs of transportation have been reduced to their present small amount. Whether the endeavor of railway companies to increase the speed of their passenger trains or their efforts to lessen the cost of freight movement have been the more potent incentive to mechanical improvements, it would be impossible to say, but the results accruing to society from these improvements have come more largely from the greater facilities for the shipment of goods. So writes Prof. E. R. Johnson, in his very excellent review of American Railway Transportation, and with this summary we may for the present dismiss our friends, the steam roads. The conditions that have caused such signal success in the passenger business on interurban lines that depend on electric energy for their motive power are to a great extent responsible for the hearty greeting with which the average shipper, be he merchant or farmer, hails the advent of the trolley, and for the great complaisance with which he views the humming, whizzing cars that frighten his team of colts and send clouds of dust into his wife's otherwise immaculate parlor.

*Read before the Canadian Street Railway Association

The first condition that tells in favor of the interurban line is the frequent service and the frequent stopping places. The second is that the interurban line is more or less of a local affair, and for that reason is more intimately cognizant of local necessities. In the battle between the piston rod and the trolley pole, passenger rates have suffered to a more or less extent, while freight rates have pretty generally remained where they were. The interurban lines have not found it necessary to inaugurate a rate war to get freight business from the steam roads, for they receive and are justly entitled to their proportion of the business on account of the increased facilities.

The present Niagara, St. Catharines & Toronto Ry. was originally a steam road, constructed in 1886, and changed to electricity in 1899 and 1900, the first electric car running July 19, 1900, from Niagara Falls, Ont., to St. Catharines. Prior to the change in 1900 the road had, through poor management and consequent poor patronage, fallen into the hands of a receiver, and was sold by the courts under the hammer, afterwards converted into an electric line, extended to Port Dalhousie, and communication established with Toronto by steamers, which are also owned and operated by the company. A track connection had by the original company been arranged with the Michigan Central R. R. at Niagara Falls, Ont., which has been since maintained, and which affords free interchange of cars to and from all points in Canada and the United States, thus forming a line in competition with the Grand Trunk R. R. in the territory covered by the electric line and its steamers, for which purpose the road was intended. The gross annual freight earnings of the line prior to 1900, or during the operation by steam, were less than $10,000, and the freight handled was confined to low classes of carloads, such as coal, this being in fact the principal traffic handled. Very little attention was paid to the higher class traffic, such as package merchandise, and it was not until 1901 that any marked increase was shown. This upward tendency was caused by an energetic and persistent endeavor on the part of the management to increase the development of the facilities which were practically dormant, in taking care of higher class traffic and leaving the low class to itself. The methods of handling had to be improved, a system organized, and particular attention paid to the despatch of business taken hold of. There was no attempt made to reduce rates, the traffic being carried on exactly the same conditions as steam lines under all circumstances. It was found that accomodation to patrons had a great deal more effect than any benefits derived from useless rate-cutting. Cars are placed at convenient points for shippers to load, and they are picked up at convenient hours, and shipping receipts are given at the counters of the business firms by a responsible man who has the freight train in charge, thus saving the customer the trouble and time of going to the railway station to make shipments. All

this tended to increase popularity, and consequently, by increased shipments, revenue, until for the year ending Dec. 31, 1904, we are able to show an earning of 460 per cent greater than in 1900, and [illegible] operating expense of 55 per [illegible] The package freight must stay with the electric roads, as their methods will, if properly organized, hold it against steam roads, unless congestion is allowed, when the great advantage of quick handling will be lost. The handling of low class freight involves the expense of terminal facilities which in large cities is practically prohibitory, and unless there is assured enough freight to keep a regular competitive service against steam roads fully alive, it is better that electric roads confine their business to the higher classes of merchandise. With us it is found also that switching service is a source of revenue, which, if facilities are available, is remunerative. We have arrangements to switch loaded cars to and from the Grand Trunk R. R., our competitor, and for industries located on our tracks. This service is easily performed and at very little expense, the distance usually being short and the cargo quickly handled, and it pays because ordinary power is employed at times when we can afford it without detriment to our other interests. There is, in our opinion, ample revenue in the development of freight service for interurban lines, provided, as has been done in our experience, that low class traffic is not sought after too closely and only taken care of when it involves the higher classes. No freight can be handled at a profit that pays less than one cent per ton per mile, and even at that figure there is not enough revenue to warrant short-haul lines seeking it. To sum up, all that is necessary to make electric lines a factor in freight traffic is to seek high class freight, handle it quickly, and attend promptly to customers' requests.

We have found that working arrangements cannot well be based upon a mileage rate unless constructive mileage is allowed the smaller line, and it is not practicable to do this in our case (although conditions with other lines may be different and groupings may be obtained from connecting lines), because ours is a lake and rail line, peculiarly situated and breaking bulk, and our connections do not, therefore, favor percentage arrangements. We have worked out almost our entire traffic on an arbitrary basis receiving as our proportion on classes one to six under the official freight classification the following figures, viz.:

Class	1, 2, 3, 4, 5, 6
Cents	8, 7, 6, 5, 4, 2½

per 100 lb. for our haul, whether long or short, and not participating in any reductions made by connections due to competition from various causes. I therefore submit that interurban lines are in a better position on an arbitrary basis than on a percentage arrangement, although the disadvantage of having no voice in rate making without consent is apparent by reason of non-participation in the reduction of rate asked, but this is only a matter of correspondence, we find, and is generally acceded to readily by connections upon representations of facts. The classes shown do not cover the low class or commodity traffic which I have alluded to in the first part of this paper, which are carried only by special arrangement between lines interested and generally calls on the short lines to reduce their earnings to merely what it cost to handle, hence the assertion that it is better to leave it alone except where it may carry other higher traffic with it, when it cannot profitably be turned down, because the manufactured product might be lost, and as this is high class it is profitable. We unfortunately had to take hold of an existing line, with its rates and obligations fixed, and we were unable to alter the existing divisions of rates, although we have from time to time endeavored to do so. Initial errors are costly, and upon interchange being arranged, care should be taken to have all traffic arrangements thoroughly arranged by competent men, fully conversant with such subjects. The earnings per ton per mile should be fixed as high as possible, and never allowed to be less than what steam lines earn. Short mileage allows fair revenue such as our earnings, being not less than 25 per cent minimum of through rates, and upon extension of line minimums could be increased correspondingly. Conditions of traffic in Canada differ, however, from the United States in many respects. For instance, we have in large centers cartage to perform, which is forced upon us by an old existing arrangement made by the Grand Trunk R. R., when it was practically the only line in Canada. It was inaugurated by that line to take care of friends. This is a burden, because the expense is not covered by extra charge made above freight rates, part being absorbed in the rate. Another factor of expense in handling is the freight car equipment, which costs interurban lines per diem rate of 20 cents for every calendar day if foreign lines permit the use of cars. No line should be dependent upon equipment belonging to others, nor should they undertake to do more than deliver on cars at convenient points, unless the circumstances are very exceptional, as every transfer or movement necessarily costs money and increases the operating expenses materially. Rates should be maintained, and although steam roads are liable to cut with a view of forcing the business from electric roads, the public soon finds that the real object is to force the electric road out of the business and enable the steam line again to put up its rates with all the old disadvantages of slow time and poor service. Another commending advantage to interurban lines is that their business is done on main roads in a number of cases, where there are no terminal expenses, unless they endeavor to enter into active competition with steam lines, when terminals must be provided.

The handling of fruit is an important item in our season's business, Toronto being the central market. To handle our heavy freight traffic with the quickest despatch at a minimum cost has brought us to a point of efficiency whereby we find it necessary to allow our boats only 30 minutes at terminal points to load and unload from five to seven carloads of freight. To meet the requirements of our traffic we built a number of four-wheeled platform trucks, the platform of which is similar to express trucks seen on steam lines and capable of carrying two tons. On these we load all merchandise and package freight, ready to run aboard the boat on her arrival. The incoming freight is received from the forward gangway, and the outgoing freight is run on board over the after gangway. To handle out fruit traffic with despatch we have erected at points along the line fruit platforms, on which we keep a supply of these trucks. The farmer drives to this platform, loads his fruit on the trucks, and this is picked up by our freight train, which consists of flat cars the same height as the platform, and run to make connections with each boat. This train carries three men, who run the loaded trucks from the platform on the cars. At Port Dalhousie they are run directly from the cars on to the boat. This prevents handling, which is very damaging to the fruit, and also permits the fruit grower to use a cheaper grade of baskets, thereby effecting a great saving for him.

On the whole, therefore, freight business of interurban lines will pay if confined to the higher class of traffic, and if particular attention is paid to despatch and accommodation to the public.

An Accident to a Cross Compound Engine.

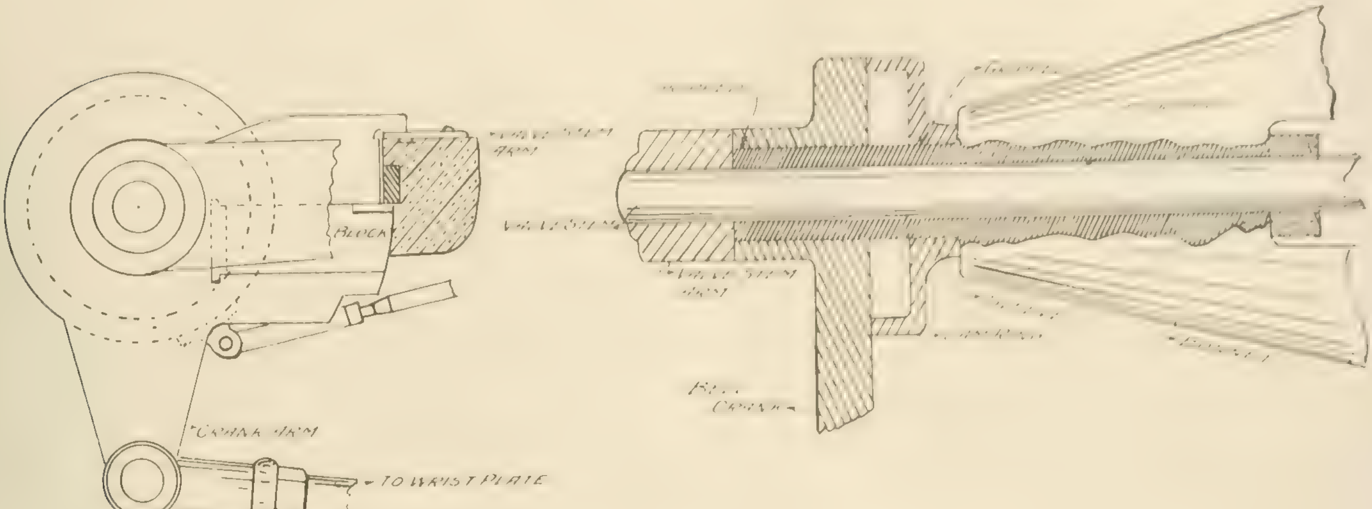
BY H. C. REAGAN.

Accidents to the steam or electrical machinery in a power station are very annoying and at most times call for quick action and decision, especially where the station machinery is in full operation without any reserve units to fall back on.

In the case about to be cited a new plant was erected with a view of installing additional machinery. The units were direct connected with cross-compound engines of well-known make, which no doubt will be recognized by the sketch. The units were started up by the writer and ran along very nicely, taking the load without any unnecessary heating of any parts, the load being that of an interurban railway. In addition to the regular load, for one week after starting, a fair held at a point along the line increased the average number hauled per day by about 7,000 people. The writer had the privilege of organizing the new power plant force as he saw fit, except that of first assistant engineer, and during the period mentioned kept very close watch on the plant operation day and night.

Believing that the time had come when the first assistant should take the night shift, the change was made. Things ran along for several weeks, until one morning, about three o'clock, the writer was called to the power house. The assistant stated that one of the engines was broken down. Upon reaching the plant, the engineer stated that the engine shut down itself, being the one unit in operation. Being questioned closely, he said that he was awake and did not notice any unusual noise or action with the engine or

valve motion, which seemed ridiculous. As there was no overload or broken belt, and plenty of steam, the outward appearance did not indicate any thing wrong. Further questioning brought out the fact that the governor balls were jumping up and down previous to stopping. This furnished a clue. Wishing to ascertain more, steam was applied to the high pressure side, with the result that



SKETCH SHOWING NATURE OF THE ACCIDENT.

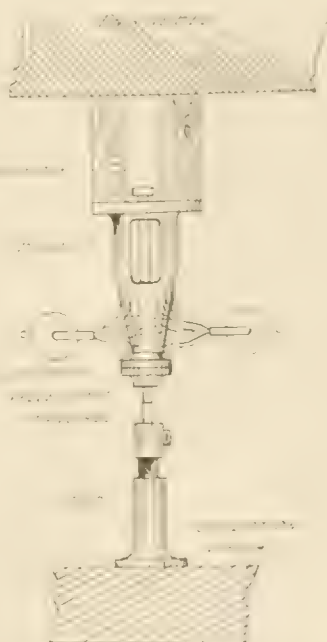
there was a groan and springing of the valve rod between the rocker arm and wrist plate valve-stem arm of induction, or live steam valve of the low pressure cylinder. An examination was made and it was found that the valve stem had welded fast in the sleeve or bonnet. The bell crank had gripped the sleeve outside of the stem, the cam ring carrying the cut off. This also had gripped the sleeve. The sketch shows the construction of the mechanism, it being a Bass-Corliss release gear. The arrows show the parts which gripped the sleeve. The one thing that saved the rods from being bent and broken was the eccentric slipping on the shaft.

A task and a surprise awaited the writer. The valve rods were disconnected and bonnet taken down to remove the valve stem. A small jack was applied, but to no purpose. Seeing that it would take some time to make repairs, with the shop 900 miles away, the low pressure side was disconnected and part of the load carried with high pressure side. After so doing our attention was turned to the valve stem. A 60-ton hydraulic jack was procured and a mild steel rod about the diameter of valve stem was used as a mandrel. The bonnet was blocked up against the engine foundation as shown in the sketch, the jack against the foundation wall, and two men operated the jack, which produced no movement of stem. Then two large blow torches were procured and a flame from each brought to bear against the sleeve or bonnet. In due time a slight movement was perceptible and continued until the stem was driven out of the sleeve, taking about eight hours to do so. It required care and alignment in order not to upset the end of the stem or spring it out of line.

In the meantime the general manager suggested that it was impossible to do anything with it but to take a sledge hammer and break the bonnet, send to the shop and get a new one. The writer reasoned and persevered in the matter, with the result that the stem was gotten out. After which the stem was dressed up smooth, the sleeve trued up, the same with bell crank and cam ring, the parts reassembled and the engine connected up and full load put on. The result was the saving of the expense of a new bonnet and about three days' time. The fit of the crank arm and cut-off disk was so neat that when the sleeve swelled up, due to heating from the valve stem, they struck the cuttings from the sleeve and valve stem and caused the sleeve to swell also, a trifle, but enough, and all for the want of oil.

The cause of the above accident is due to a circumstance which teaches a lesson. The railroad, desiring a right of way through a certain property, cast about for a means of getting it. This means was through the assistant engineer, who was an intimate friend of the property holder. The agreement was that if the engineer was assured a position, the right of way was to be had with proper compensation. No questions were asked as to the engineer's past record,—this was readily accepted by the president of the company. The writer objected strongly to the engineer, but was given to understand that he must stay. The next day after the accident the truth came out by threatening the dismissal of the oiler and fireman.

It was subsequently found that the engineer had passed out of the power house the fore part of the night and gone to a saloon across the street, from which he came back drunk, and the men were all asleep when the accident occurred. The habit of drink the engineer



DRIVING OUT STEM BY EXPANSION.

had carefully concealed up to that time, but careful search of his past record revealed the same. The president requested his immediate dismissal.

The property of the Kokomo (Ind.) Railway & Light Co. has been taken over by the Kokomo, Marion & Western Traction Co.

The People's Light & Railway Co. and the Streator Gas & Light Co., Streator, Ill., have been combined and the properties of both taken over by the recently incorporated Illinois Light & Traction Co. This latter company is negotiating for the traction and lighting properties at Ottawa, Ill., and will construct an interurban line between the two points.

How to Obtain a Suitable Car Varnish.

BY ARNOLD FRENCH, MASTER PAINTER, RHODE ISLAND CO.

It is a fair subject for consideration whether the matter of providing the painting departments with suitable varnish is being advanced along the same broad lines that are so noticeably shown in the other departments of the average repair shops. In other words, is the same careful attention being given toward obtaining the most suitable varnish as is shown in the selection of wood, iron, steel and other raw materials? The vital importance of securing lumber and metals of the best known quality is obvious, because the life and service of a car constructed of these materials depend directly upon them. But of equal importance is the study of methods for preserving this material by protecting it from the destructive effect of the elements. This preservation is absolutely necessary because of the danger which may arise by reason of oxidation or decay weakening the essential parts of the work so that they will be unable to stand the stresses imposed upon them. Just as long as the elements are excluded from the vital parts of a car, the fabric of these parts remains intact and the excessive expense for repairing them is escaped.

This problem is best solved if a portion of the time allotted to choosing car building material is devoted to the study of obtaining a proper armor whose chief office is to render the materials out of which the car has been constructed impervious to all destroying elements. The varnish question is one that should not be regarded too lightly, because it is safe to say that large sums of money are often thrown away on worthless material passing under the name of varnish, the appearance of which when first applied bears all the semblance of the standard article.

Varnish flows into the paint shop through different channels, according to the ideas and the operating methods of the general management. In choosing a varnish there are always two points of view. The close relation of these requires that both should be considered, in order that no complication may arise which would in any way endanger the accomplishing of successful results. As viewed from one of these points, the purchasing point, the discounts on price lists very often absorb much more attention than a reasonable estimation of the qualities and ultimate durability of the material which is being purchased. These discounts, which are generally accepted as a reduction in the price on one grade of varnish, are often but a price given on another poorer and less expensive grade. For this reason, and because the ingredients for making varnish are so numerous and varied, it is possible to produce a varnish which can be sold at almost any price. Values on varnish invariably keep step with the prices paid for them, and this fact should always be kept well in mind, unless the too earnest desire to make a good showing on first costs obscures a future in which there is always a reckoning time.

From the other point of view, the practical point, attention is equally divided between the present and the future. This broader view will always reveal the fact that the best results can finally be accomplished if the anxiety occasioned by the narrower idea of considering the present exclusively, is forgotten long enough to view the whole matter in its proper light.

Surely the matter of choosing the most suitable varnish and one that will meet all the requirements put upon it can best be done by viewing the question from the practical point of view. The painter, having the advantages which can only be gained from practical experience and with a full knowledge of all details and requirements, is certainly in a better position to select the most suitable make of varnish than the purchaser, whose knowledge of varnish has been obtained from a very limited source. On the other hand, the purchaser, with his valuable knowledge of market conditions and the mysteries of shrewd buying, is placed in a peculiar position in this case. It is very natural that the painter should desire the purchase of one particular varnish which he has tested in company with many other makes and which has shown itself to him to be a superior article. If the recommendations of the painter are accepted by the purchaser there is but little scope left for him in which to drive a bargain at a fair price. Yet the chance of incurring a most disastrous mistake by buying untested varnish are so probable that a purchaser knowing this fact should hesitate before proceeding far beyond the confines of his scope. Any injudicious calculation of first cost whereby 25 or 50 cents might be saved on a gallon of varnish may lead to much greater loss in the future when it is too late to rectify the thoughtless mistake.

A discussion of the subject of testing varnishes may cast more light in such a way that both economy in first cost and increased length of service may be gained. Very few railway repair shops are fitted with the proper facilities for analyzing paint material and the detecting of spurious ingredients in varnish. Unquestionably, access to a laboratory would be of great value to a master painter in more ways than one, yet this is not absolutely necessary for varnish testing. For instance, a chemical analysis might prove that a certain make of varnish was composed of perfectly pure ingredients, yet such analysis will fail to foretell the future of the varnish when after oxidation the film is exposed to the elements. There being no method, either scientific or practical, that will positively determine the ultimate durability of varnish while it is yet in solution, there is but one course left, and that is the practical local test.

The positive assurance that one make of varnish has passed a successful test in a certain locality is of little weight as a recommendation for the use of this same varnish in a locality far removed from the first one. If the destroying elements which continually attack varnish after it has been applied to a surface were exactly the same in all parts of the country, then the varnish durability question which now absorbs so much time and patience might happily be avoided. But such is not the case. The fact that conditions vary with different localities makes it necessary that a close study be made of the varnish question in all of its details before any useful conclusions can be drawn. It is safe to say that if a number of varnishes made from the best of stock and compounded from different formulas were to be tested collectively in as many different localities as there were samples, these testing places being widely separated, the results obtained would vary in the different localities. It is probable that each sample owing to its own peculiar make-up could be used in a climate whose destroying elements would affect this sample less than any of the others in competition with it. The dissimilarity of conditions sometimes existing in places that are not far distant from each other is remarkable, but the cause can easily be traced to the different material deposits in the earth or to varied climatic conditions.

Consider, for example, the alkaline soil that exists in some portions of the West; here is met one of the worst natural conditions that a varnish surface has to endure. The varnish is continually exposed to a decomposing element equivalent to a diluted solution of "varnish remover," and in order to give a reasonable service it must be fortified by some strong neutralizing agent. In such localities the neutralizing power of a quick drying varnish offers but little resistance to the effect of the alkali on account of its lack of oil. The more oil that can consistently be used in a varnish which is exposed to alkaline conditions the better. And yet the quick drying varnish which contains little oil will give a much better service in other localities under different natural conditions. And so the intense heat of the South, the extreme cold of the North, the salt mists of the far East and West are conditions having their own peculiar effects on varnish. Such peculiarities of attack necessitate the choosing of a varnish which will offer the greatest resistance to the action of the consuming chemical properties peculiar to these different local conditions.

Obviously no one make of varnish, however well made, will successfully meet all these different conditions and as each manufacturer produces but one or two high grades of varnish, and the assembling of the ingredients of these varnishes must always be made

from one standard formula in order to secure uniformity, therefore it is useless to argue that one make of varnish will prove satisfactory in all localities. The discovering of a varnish which is adapted to any peculiar local conditions and will resist them the longest can only be accomplished by exposing samples of the different varnishes to the elements of this particular locality. Theory in this case is of no more value that hearsay. The matter must be threshed out with the elements before the final understanding can be had.

Before proceeding farther with the subject of the practical testing of varnish, it may be well to mention a few facts relative to varnish test samples, which might possibly be inadvertently overlooked. Good varnish, like good wine, greatly improves with age, and it is fair to presume, if not otherwise specified, that all varnish samples sent out from the factories are judiciously drawn from oldest material stock in the plant; a stock possibly kept for this very purpose. Of course these special grades cannot be duplicated in larged quantities, because if they were offered to the general trade the source of supply would soon be exhausted. The writer has in his possession a quantity of varnish of English make that is 18 years old, having never in this time been unsealed. Beyond doubt, this fine old varnish now has 50 per cent more value as a protecting medium than it had when it was first made 18 years ago, and it is easily seen that this varnish would insure a large order if submitted as the regular stock of that English firm. It therefore seems true that if interest enough is taken in the varnish question to carry on a number of endurance tests it also seems advisable that care should be taken that no valuable time be lost in testing samples which are not part of the regular sale stock. A better idea of a certain make of varnish might be obtained if this sample was purchased from some local dealer who handled this make of varnish. In the latter manner the results of a test would furnish much more valuable purchasing arguments.

The two most common methods employed in varnish testing are the application of the sample directly to the car body or to a test-board. Opinions differ regarding the efficiency of these two methods, each of which holds its position from apparently good and sufficient reasons. The advocates of the test-board method, with a knowledge of expense of removing old paint and varnish, object to using sample varnish on a car body in an experimental way, because of the possibility of the results being unsatisfactory, thus causing premature repairs, to say nothing of the loss entailed by the car being out of service. After careful consideration of these two methods the car body test method seems to have the advantage for several reasons. Placing a varnish sample on a test board mounted in some conspicuous place with a south and west exposure is indeed a very severe test and might be considered conclusive if these were the only conditions which are met in actual service on the car. But these test boards are never at any time liberally spattered with city mud which contains many injurious elements, such as the alkali from horse-manure and decayed matter. And the test boards do not experience the sudden changes in temperature which the varnish on a car is subjected to when after standing for some time in a warm pit-room it is suddenly exposed to zero weather. The test board is never subjected to the vigorous application of the car washer's sponge charged with grit. There are many other conditions of minor importance which when added to these just stated plainly show that any information derived from the results of a test board experiment is more of a speculative rather than the practical nature, and under these circumstances will leave an existing doubt until the matter has been proved in a practical way.

Ten years may be considered the average length of time that the body of varnish built up by adding one coat of varnish each year, will remain useful. The time when the usefulness of these united coats ceases is a matter of opinion which is liable to be divided anywhere between the first appearance of the cracking of the varnish and the last stages of disintegration. But a life of 10 years should not be considered excessive as cases are on record where such coats have lasted 17 years before the signs of final decay were much in evidence. Assuming that 10 years is the standard life of a varnish body composed of first-class varnish, what value would the report of a year's test of a varnish sample be if the sample is revarnished each year and is expected to last ten years? Any high grade varnish from a reputable house is expected even under the worst conditions to last through the first year without showing any signs of decomposition, and this expectation might be extended to the second, and possibly to the third year in some cases, before any indication appears that will predict its future success or failure. Again the testing of two different samples placed in similar positions on a car may show no different appearance after 12 months' exposure, and still after revarnishing for a second year's service the relative value of the two samples might still remain unchanged, yet the writer has known cases of this description where at the end of the third year a noticeable change had occurred in the two samples; one retaining its elasticity showed no vulnerable points whatever, while the other weakening at this time showed the minute cracks accompanied by the omnious discoloration on either side of them, which are the telltale signs of disintegration.

An estimate of the possible loss, which might follow the unwise choice of an inferior sample after only a preliminary examination had been given, can be calculated by the number of cars which might have been varnished with it before the mistake was discovered. The two samples being of apparently equal value after the first test, the inferior varnish might have been purchased on account of a slight difference in the relative cost of the two. This illustrates the folly of jumping too hastily at the conclusions which may be drawn from varnish tests. The opportunities for reducing the cost of car body maintenance are so favorable when viewed in a conservative manner that hasty decisions, whereby subsequent losses are incurred, seem inexcusable.

Since the first gum copal was brought from Mexico in the 16th century, study and research and experimenting have greatly aided in the acceleration of methods in general until at the present time everything is expected to progress in accordance with 20th century ideas of speed, but the uncontrollable elements which directly affect varnish are subject to no man's will and absolutely refuse to allow any saving in the time necessary for properly testing car varnishes. This fact is often ignored and reports of a test are even demanded after a varnish has been exposed for but six months' time. The quality of a varnish that would show any signs of decomposition in such a brief test would surely be indicated by the price paid for it and, therefore, the time wasted in testing it would be very foolishly expended.

The Rail Joint Co.

The Rail Joint Co., of New York City, has recently been organized, filing a certificate of incorporation with a capital stock of $1,500,000, of which $1,000,000 is common stock and $500,000 preferred stock. This company will take over the business and properties of the Continuous Rail Joint Co. of America, the Weber Railway Joint Manufacturing Co. and the Independent Railroad Supply Co. It is expected that the new organization can materially reduce the cost of manufacture and distribution and does not in any way monopolize the joint business. The officers of the new company are: President, Frederick T. Fearcey; vice-presidents, Lawrence F. Braine and Percy Holbrook; treasurer, Fernando C. Runyon; secretary, Benjamin Walhaupter.

Eastern Wisconsin Railway & Light Co. Personnel.

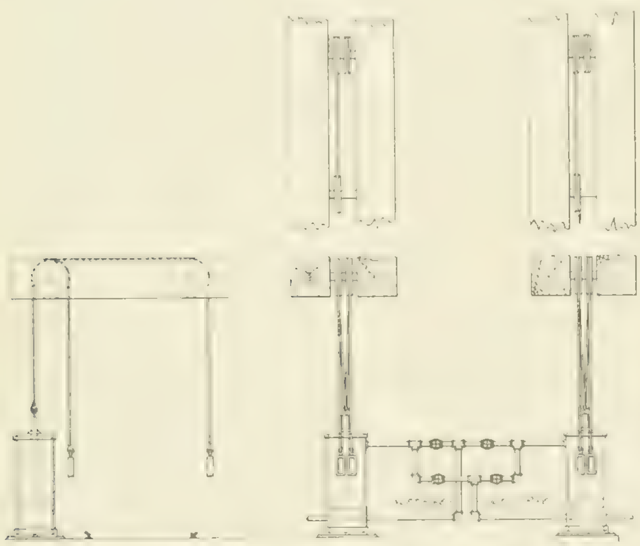
The recent death of President F. B. Hoskins and the resignation of Mr. T. F. Grover, vice-president and general manager, which were noted in recent issues of the "Review," have necessitated some changes in the personnel of the Eastern Wisconsin Railway & Light Co. The appointment of Mr. F. B. Huntington, former secretary of the company, to succeed Mr. Grover as vice-president, was noted in the October "Review." The present officers of the company are: F. B. Huntington,, vice-president and secretary; N. C. Draper, vice-president and general manager; W. E. Cole, treasurer; John Davey, master mechanic; L. E. Holderman, superintendent electric lighting department; E. H. Gimper, superintendent gas department.

The first work of laying rails for the extension of the Indianapolis & Cincinnati Traction Co's. line from Shelbyville to Greensburg has begun.

Car Hoists for Electric Railway Repair Shops.

An examination of the designs of several recently built electric railway repair shops, reveals the noteworthy fact that modern practice is sanctioning the gradual elimination of the familiar shop repair pit. In the modern plant, if the pit finds a place at all, its use is chiefly for superficial inspection purposes, and for that comparatively limited class of work which from its nature must be done from beneath the truck. The later day architect provides in place of the old time dark, dirty, cramped and unsanitary repair pit, some means by which car bodies may be lifted from the truck and the truck rolled to a convenient point in the shop where all brake, motor, wheel and truck inspection and repair work can be carried on with ample light and under advantageous conditions.

Various devices and apparatus have been suggested for hoisting car bodies free from the truck, and every master mechanic has his own ideas concerning what constitutes a good hoist. A serviceable hoist can be built for $100, and it is quite possible to spend $1,000 for the apparatus, if a saving of a few minutes is a vital consideration. Compressed air, hydraulic pressure and electricity have been utilized in various ways as motive power for car hoists, and all of them have their advocates. Hydraulic pressure is undoubtedly the cheapest form, where a sufficient supply of water at 90 lb. pressure or thereabouts can be obtained from the city mains at small expense. Electricity is the logical motive power for an electric railway repair shop, and second hand car motors can usually be utilized for the hoist. Compressed air is expensive and will find a place only in those shops where a compressed air plant is operated for other purposes.



FIGS. 1, 2 AND 3—HYDRAULIC HOIST AT ATLANTA, GA.

For the general information of master mechanics and others, descriptions and illustrations of several of the representative types of hoists in use today are here given.

Hydraulic Hoist at Atlanta, Ga.

The Georgia Railway & Electric Co. is using an hydraulic hoist (Figs. 1, 2 and 3) that was built at a cost of something less than $100, and is doing the work satisfactorily. It consists of two cast-iron cylinders, set on end and bolted securely to the floor timbers, close beside one of the tracks in the repair shop. Each of these cylinders has a piston to the end of which are attached two cables which pass up overhead sheaves and come down on each side of the car. The ends of these cables carry sockets, in which, when a car body is to be raised, are placed bars on beams which go under the car body near the ends, this ensuring to the car an even hoist free from any twisting motion. The motive power for the hoist is derived from water, entering at the city pressure of 130 lbs. The arrangement of valves is shown in Fig. 1. The water enters through a common inlet pipe, and passes directly to each cylinder, slowly forcing each piston down and raising the car body. When the body is to be lowered, it is merely necessary to close the two valves in the inlet pipe and open the two valves in the outlet pipe, and the weight of the body forces the water out slowly through the outlet pipe. The dimensions of the apparatus will be determined by the average length of the bodies used on the system, and by the space available. The size of cylinders and of inlet and outlet pipes will be determined by the pressure at which water is obtainable. With water at 130 lb. per sq. in., cylinders 28 in. in diameter and 3 ft. high were used. The cylinders were made of cast iron and were cast in the company's shops.

Electric and Pneumatic Hoists at Philadelphia.

In Fig. 4 may be seen one of the repair tracks with the jib and overhead cranes which serve all the tracks in the new Kensington Ave. shops of the Philadelphia Rapid Transit Co. The overhead cranes are of the company's own manufacture and are equipped with driving motors taken from National Electric Co. air-compressor sets. There are four such cranes over each of the tracks in this shop, two on either side of the transfer table. With two of these cranes a car body may quickly be lifted from the trucks and placed on horses. The supported columns for the second-story floor system are of such a distance apart that the space between them will accommodate two pairs of trucks. Each column supports a jib crane with a Curtis air hoist hung from the crane carriage. The dimensions of the parts of these cranes and the arrangement along the track are such that there is one crane for each pair of trucks that can be placed on the repair tracks.

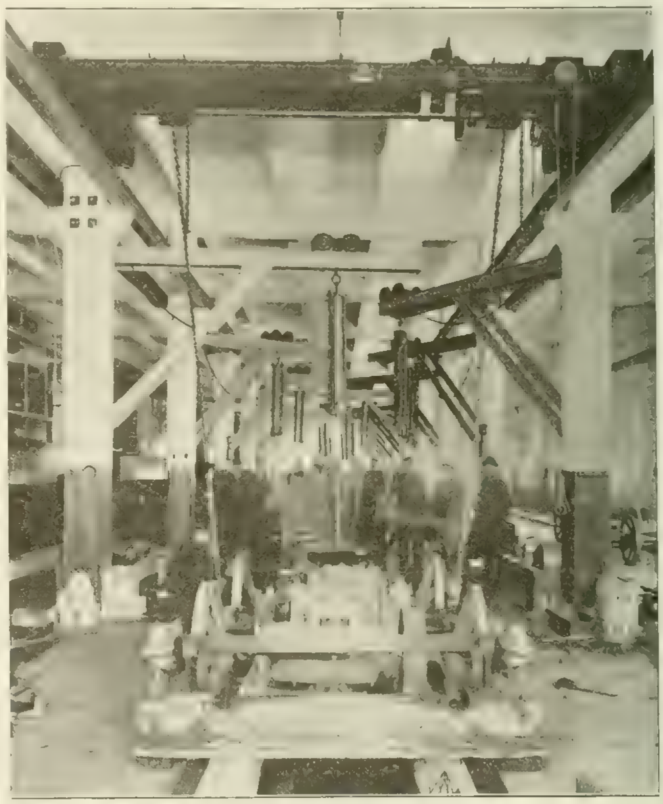


FIG. 4—PNEUMATIC HOIST AT PHILADELPHIA.

The Philadelphia Rapid Transit Co. does no repair work in car pits, but raises the car bodies and takes the trucks out when making truck or motor repairs. For raising the bodies, the old Kensington Ave. shops are provided with an elaborate system of traveling electric hoists. One hoist is made to serve two tracks. Each set of hoisting cranes and their driving motor are mounted on a

FIG. 5. ELECTRIC HOIST, OLD KENSINGTON AVE. SHOPS, PHILADELPHIA RAPID TRANSIT CO.

traveling crane which is wide enough to span two tracks, and travels to any point over the tracks as would any ordinary crane. The traveling crane consists of two I-beams upon which in turn travel the hoisting cranes and their driving motors. The arrangement will be understood by reference to Figs. 5 and 6. The driving motors are controlled by rheostat switches, operated by means of chains from the floor. With this apparatus a body can be raised from its truck in 12 seconds, and, if need be, can be carried to any point on the two tracks. Apparatus of this kind wi[illegible] and is adaptable for use only in large shops where time is a more important element.

Electric Hoist at Newark.

The North Jersey Street Railway Co. has used for some time an electrical car hoist which was described in the "Review" for April, 1902. For convenience of reference, the drawings and description of this device are reproduced herewith. (See Fig. 7.)

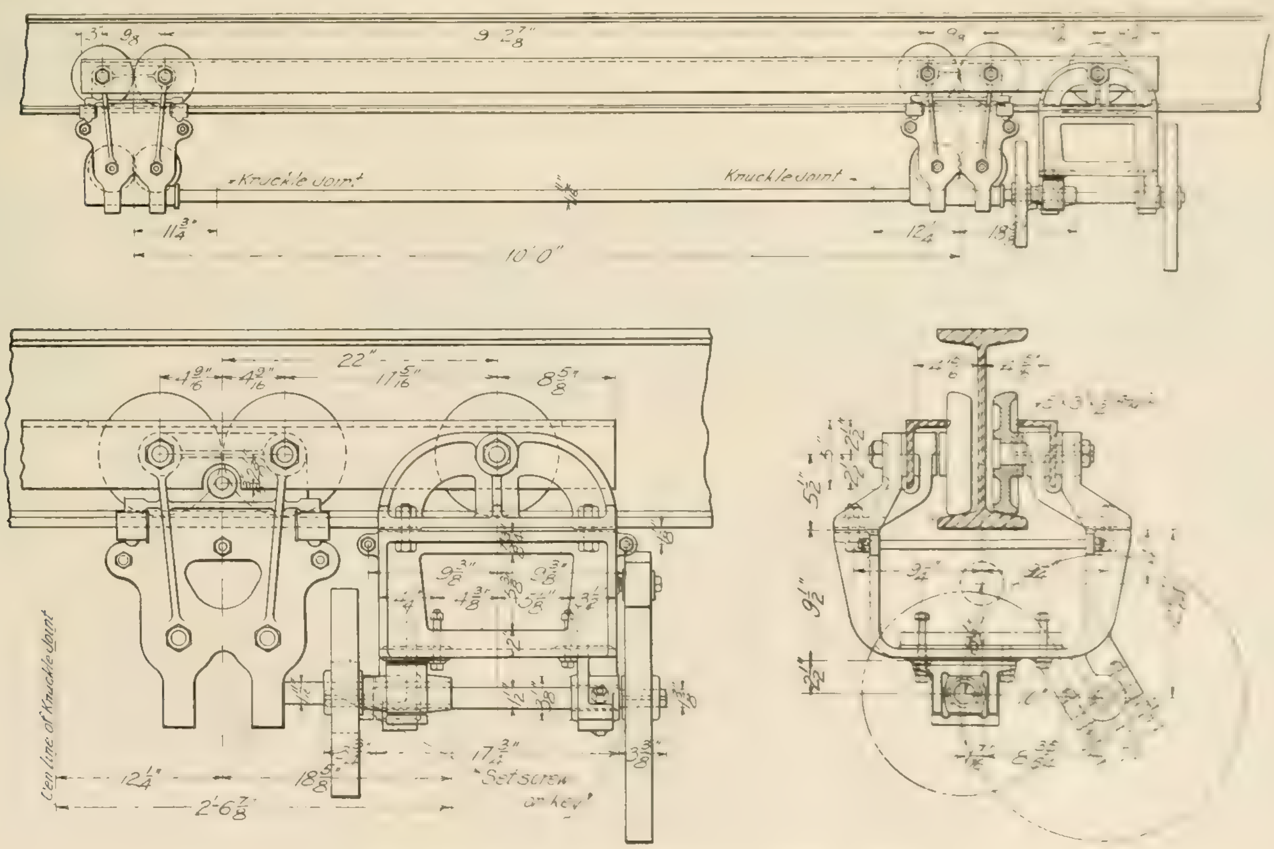


FIG. 6—SIDE AND END ELEVATIONS PHILADELPHIA HOIST.

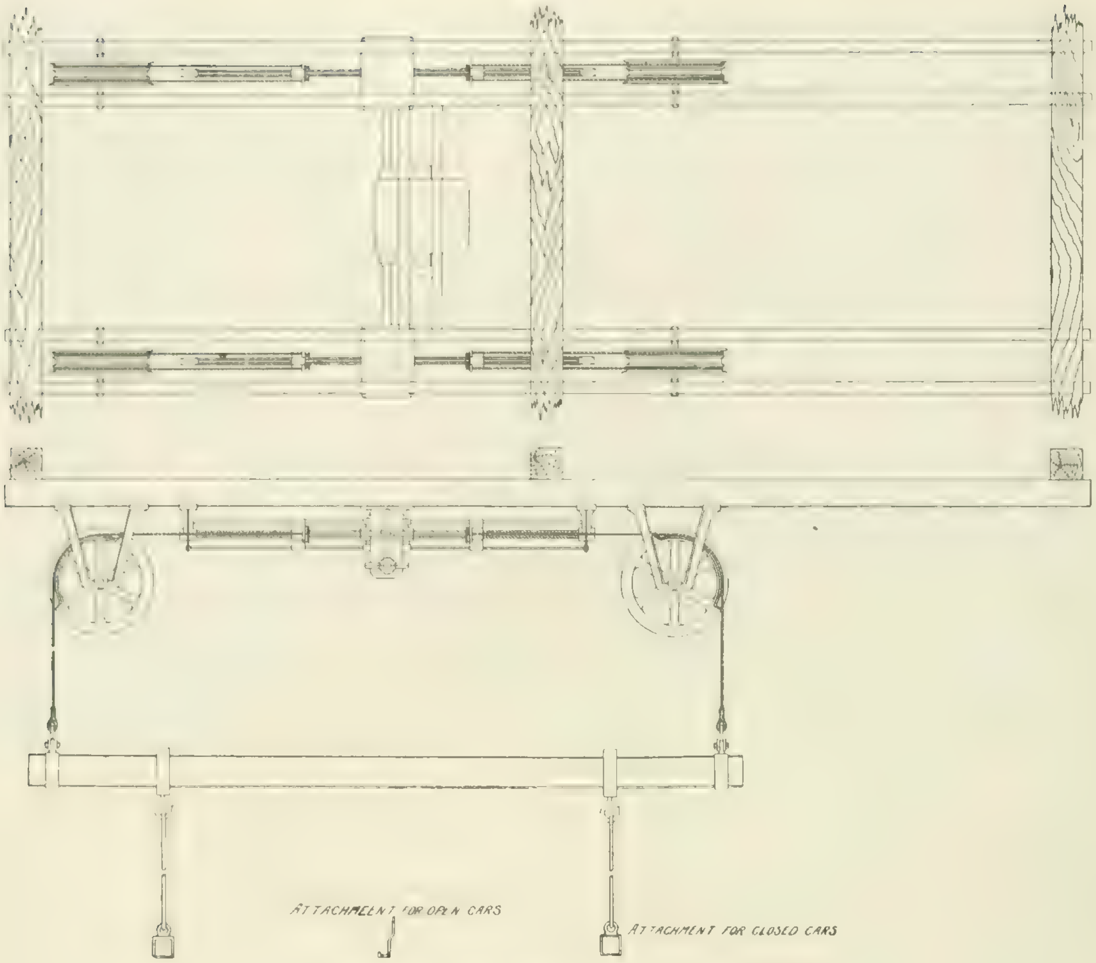


FIG. 7 PLAN AND ELEVATION NEWARK HOIST.

The device consists of a framework suspended from the ceiling girders over the car pits. The framework comprises four 12-in. I-beams about 25 ft. long and the two inside beams spaced far enough apart to clear widest car body. At the center of these are cross I-beams supporting the direct current railway motor, which drives a shaft about 11 ft. long by 3 in. in diameter. The two ends of this shaft are provided, one with right hand worm and the other with left hand worm, these worms being 5½ in. in diameter by 1⅛ in. pitch. These worms engage the worm wheels, which are about 18 in. in diameter, 2½ in. face and 1⅛ in. pitch keyed to the shaft as shown in sketch. Running from each worm wheel is a screw shaft 13 ft. long and 3 in. in diameter, cut with right hand thread at one side of the wheel and left hand thread on the other, the outer ends of these shafts being carried in bearings suspended from the main I-beams by special castings. Traveling upon the screw shafts are special carriers provided with nuts which engage the threads of the

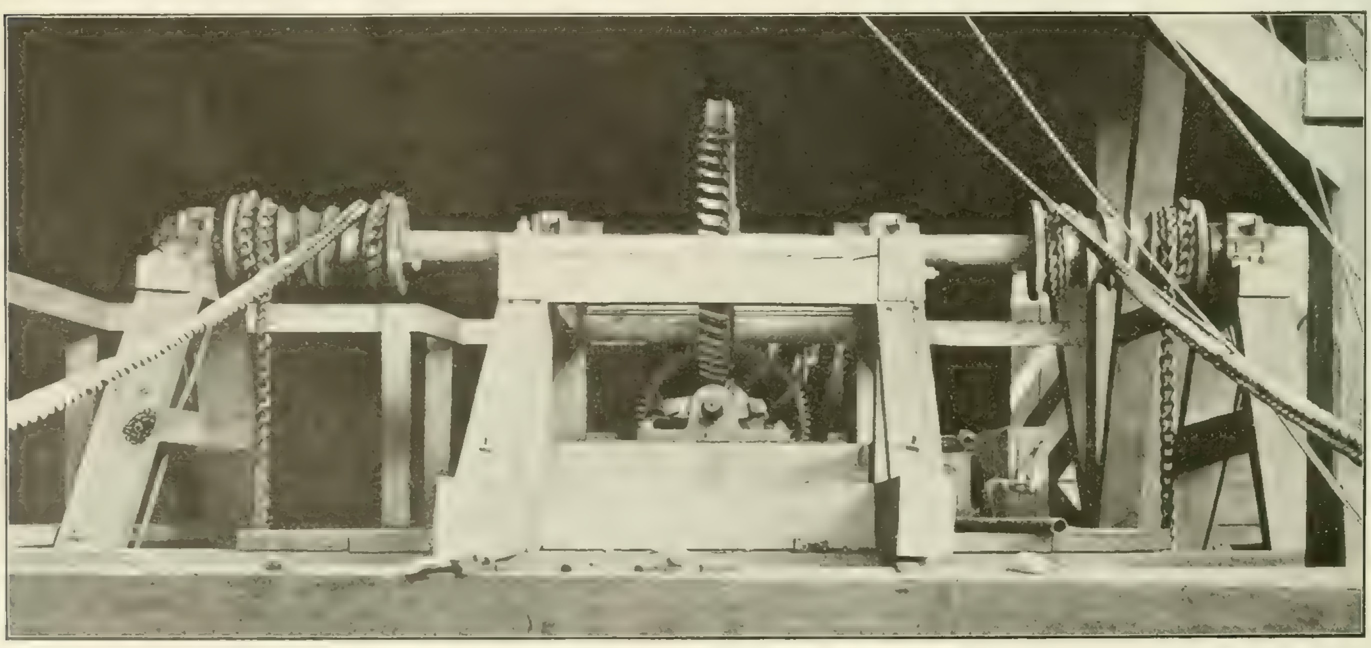


FIG. 8—VIEW OF DETROIT HOIST SHOWING SHAFT AND DRUM.

screws. These carriers slide upon stationary guide rods and to them are attached the ends of the hoist ropes. The rope used is 5/8-in. wire rope and about 215 feet are required for the hoist. The rope passes over sheaves of 36 in. pitch diameter built to support a weight of five tons. At the lower end of the rope are attached 10-in. I-beams and to these I-beams in turn are fastened the attachments for engaging the car body. When raising closed cars, it is customary to place beams or sections of T-rails under the body at each end and these rails are carried in small square castings suspended as shown. For open cars the cross pieces are not required, and hooks are used which engage the lower edge of the main car sills.

Current for the motor is taken from the line current and is controlled by a rheostat box or controller on the car barn floor. The worm gearing gives a very powerful quick acting hoist. The whole arrangement, including everything except the motor, will cost, if built by an outside contractor, about $1,000, but could probably be built in the company's own shops for considerably less than this, especially if timbers were substituted for the I-beams.

Electric Hoist at Detroit.

The electric hoist used in the shops of the Detroit United Ry. is a home-rigged affair, the construction of which will be understood from Fig. 8. Here a single motor is mounted on a framing over the shop track, and is geared to a worm wheel mounted on the center of a shaft extending at right angles to the track. At each end of this shaft is a drum upon which the hoisting chains are wound when the car body is being raised. Each drum has a set of right hand and left hand helical grooves, so that but two drums are required for the four chains. This apparatus can probably be rigged up at almost any shop for from $150 to $200.

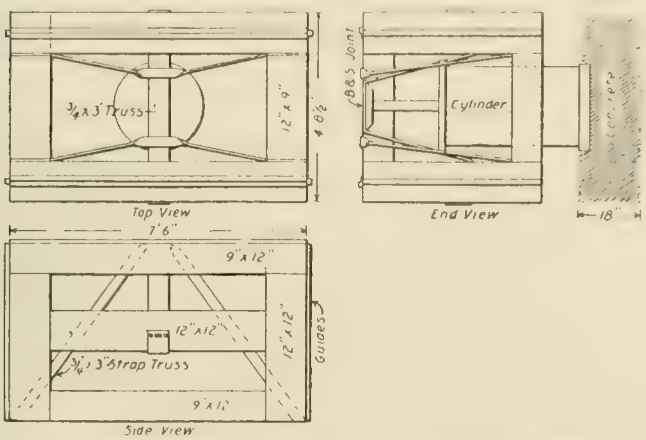


FIG. 9—DIAGRAM OF FRAME, SYRACUSE HYDRAULIC JACK.

Hydraulic Car Jack at Syracuse, N. Y.

The Syracuse Rapid Transit Co. does not depend upon overhead hoists for raising car bodies, but uses a home-made hydraulic jack, mounted in the center of the track. This was described in the "Review" for April, 1901, and is shown in Fig. 9. The essential part of the jack is an old but water tight engine cylinder 24 in. in diameter, fitted with a piston having a 42-in. stroke. Around the cylinder and resting upon the head of the piston is a heavy wooden framing, which acts as support for the car body. The piston is actuated by admitting water at the botton of the cylinder at the city pressure of 90 lb. This is an inexpensive apparatus and seems to serve every purpose, although it does not give the security when the body is in a raised position that is derived from an overhead hoist.

Hydraulic Lifting Jack at Providence.

A hydraulic lifting jack similar to the device at Syracuse is in use at the new shops of the Union Railroad Co. at Providence. This was described in the "Review" for May, 1902, page 261. In this case, water at sufficient pressure was not available, and a motor-driven Quimby pump was therefore installed to give the desired pressure. The pressure tank from which the water passes to the jack cylinder has a capacity of 500 gallons, and carries a pressure of 90 lb. The water, having been used in operating the jack, returns to the discharge tank, from which it is drawn by the pump, and is forced under pressure back into the pressure tank. The pump is automatic in action, and starts itself whenever the pressure in the tank drops below a pre-determined point. The jack is used particularly for removing and replacing wheels and motors, but the principle is applicable to raising car bodies.

Missouri Valley Electric Railway Co.

The Missouri Valley Electric Railway Co. has been organized under the laws of the state of Missouri for the purpose of constructing an electric line from Kansas City to St. Joseph, following the Missouri River, with spurs to Leavenworth and Atchison. To manage the affairs of the company during the construction period a committee has been chosen consisting of Warren Bicknell, president of the Lake Shore Electric Railway Co.; L. W. Prior, of Denison, Prior & Co., of Cleveland, and George B. Blanchard, of Thomas Nevins & Sons, bankers, of New York. The committee will add to their number two others to be chosen by them from the underwriters. The underwriting is in the hands of Denison, Prior & Co., of Cleveland and Boston, and Thomas Nevins & Sons, of New York.

MAP OF MISSOURI VALLEY ELECTRIC RY.

The capitalization of the company is as follows: $7,500,000 five per cent 30-year bonds authorized; $5,000,000 five per cent 30-year bonds issued; $7,500,000 common stock authorized; $5,000,000 common stock issued.

Following the line of the road from Kansas City, which bends to the northwest with the river, a number of thriving villages, towns and cities are crossed. The town of Parkville is the first important point touched, nine and one-quarter miles from Kansas City. Further to the northwest are touched the thriving communities of Waldron and Farley, and a little further north a spur of the road runs directly west for Leavenworth. The main line of the Missouri Valley Electric railway, after passing the junction with the spur for Leavenworth, runs north through Beverly Station and northwest around the bend of the river through to Weston, Iatan,

Bean Lake, Sugar Lake, Armour Station and on to Rushville. At this last named point a spur runs southwest through Winthrop, across the Missouri River to Atchison. From Rushville the main line runs northeast, following the general trend of the river through Eveline and Kenmoor to St. Joseph, passing the famous resort of Lake Contrary on the way.

The following table shows the populations of the cities of the territory from which the Missouri Valley Electric railway will derive passenger and freight traffic:

	U. S. Census 1890.	U. S. Census 1900.	Estimated 1905.
St. Joseph, Mo.	52,324	102,979	120,000
Atchison, Kan.	12,000	15,722	18,000
Leavenworth, Kan.	19,768	20,735	30,000
Kansas City, Mo.	132,716	168,752	180,000
Kansas City, Kan.	38,316	51,418	60,000
Intermediate	10,000	15,000	15,000
	265,124	374,606	423,000

According to the above figures the average increase during the ten years shown has been 41 per cent; assuming that the percentage of increase will be one-half during the next ten years, the increase by 1905 will be 10 per cent over 1900 figures, or by 1905 the road will serve a population of 423,000.

The mileage of the Missouri Valley Electric railway is distributed as follows: Kansas City to Leavenworth Junction, 23½ miles; Leavenworth Junction to Atchison Junction, 19½ miles; Atchison Junction to St. Joseph city limits, 15 miles, making a total of 58 miles. The spurs will cover about eight miles, making a total main line trackage of 66 miles, together with about twenty-nine miles of double-track and siding. The road will be located on a private right-of-way for the entire distance with overhead crossings of all railways and most wagon roads will have an easy grade with few curves, permitting a schedule speed of 45 miles an hour outside of the city limits with safety. At this speed the road can easily compete with the steam roads, and together with a much greater frequency of service should command a very substantial share of the passenger traffic between the various cities, towns and villages reached.

The road will be built in the most modern style as a high speed electric railway, on its own right-of-way, using 70-lb. rails, ballasted with crushed rock, with overhead crossings of steam roads and wagon roads and double track from Kansas City to Leavenworth, where a 30-minute service will be necessary. The power station will be equipped with 3,000 k. w. steam and electrical equipment of the most modern character. The power house will be built of stone and brick with slate roof and will be fireproof in every particular. None but the most modern machinery and labor-saving devices will be installed and everything will be done to make the power house a model of its kind. The rolling stock of the road will be in keeping with the high character of its construction, and the motor cars will be equipped with high speed motors, permitting the use of cars in trains or singly, and geared for high speed. As there are no heavy grades or excessive curves, a high rate of speed can be maintained for long runs with perfect safety. Freight equipment has been planned to take care of the large coal traffic already offered, and the general freight business in garden truck, milk, and merchandise promises to be large and steady.

Electric Railways in Japan.

Since the completion of the Hanshin Electric Ry. between Kobe and Osaka, a short description of which appeared in the "Street Railway Review" for October, its effect on steam railway traffic has been watched with interest. The following paragraph regarding this appeared in a recent consular report published by the Department of Commerce and Labor:

The Kobe Chronicle of recent date says that it looks as if there will be a boom in electric railways before many months are past. The Government railway passenger traffic between Kobe and Osaka has been so affected by the Hanshin Electric railway that the imperial railway working bureau is considering the advisability of establishing an electric line between the two cities and so meeting the competition. The bureau is also considering the establishment of such a railway between Tokyo and Yokohama, and so forstalling enterprises. This competition may be bad for the railways which suffer by it, but it is all to the benefit of the traveling public. The extent of this benefit may be judged when it is considered that the business man living in Kobe, who has to make frequent visits to Osaka, by using the electric railway not only saves enormously in the amount of fare, but travels nearly as quickly. He uses the electric route at this season of the year from choice, because of its freedom from soot and smoke.

It is interesting to note in connection with this subject that the equipments were made by the National Electric Co. and are of the New York office of the firm of Takata & Co., Tokio. This company furnished the complete motor equipment, which is the Westinghouse Electric & Manufacturing Co's. make. The trucks, upon which the car bodies are mounted, were made by the J. G. Brill Co., and the car bodies themselves were built in Japan. The air brake equipments were made by the National Electric Co. and are of the well-known Christensen type, and the car fenders were of the Eclipse type, made by the Eclipse Fender Co., of Cleveland, O., all this apparatus being supplied through the New York office of Takata & Co.

New England Street Railway Club.

The New England Street Railway Club held its first fall meeting this year October 26th at the American House, Boston. President Potter presided. The speaker of the evening was Mr. A. H. Armstrong, of the General Electric Co's. Railway Engineering Department, who delivered an informal address upon the "Electric Locomotive in Heavy Haulage Work." Prior to the address, dinner was served in one of the private dining rooms of the hotel, and a number of new members were elected.

Mr. Armstrong's address was illustrated by numerous lantern slides showing the evolution of the electric locomotive from the early types designed for yard work to the "6000" type designed for the terminal and suburban traffic of the New York Central & Hudson River R. R. Speaking of the most advanced type of suburban and interurban railway thus far developed, Mr. Armstrong stated that the present maximum schedule speed is about 35 miles per hour in certain western service; the cars are run in trains of two or three cars each, with about 500 h. p. in motors per car and making one stop in two or three miles. The maximum speed attained is about 65 miles per hour.

With three or four trains per day in each direction over a steam railroad line it is now possible in most cases to show a saving in operating expenses by using properly designed electrical equipment, but the great gain comes from the increased traffic which can be handled by electricity. The electric locomotive was first developed for factory haulage and terminal work, and slides were exhibited of 35-ton locomotives for yard work, and also of the later 40-ton locomotives developed for the same service, each being capable of hauling from 400 to 500 tons and being equipped with about 600-h. p. in motors. The maintenance expense of these machines has been much less than the cost of keeping in service the steam locomotives which formerly did the work. The later type is equipped with end platforms to secure greater operating convenience. In the case of a 50-ton shunting electric locomotive for commercial service which was illustrated, Mr. Armstrong said that the cost of maintenance actually has been less than $100 per year.

The 80-ton locomotives of the Baltimore & Ohio R. R. were illustrated, both the earlier and later designs being shown. These are each equipped with four 250-h. p. motors. The New York Central's electric locomotive was discussed at considerable length, several of the preliminary designs being thrown upon the screen. Some thirty or forty tentative designs were made before the machine work began in the shop. An interesting point is that the dead weight per axle is less than with many steam locomotives, and this notwithstanding the fact that the armature is mounted rigidly upon the shaft without any form of gearing. One of the points of difference in electric locomotive design is the necessity of using small diameter in the driving wheels, as compared with 72 in. or over in steam locomotives. Mr. Armstrong stated that the "6000" type of locomotive being tested daily on the experimental track near Schenectady has now covered successfully about 30,000 miles. The acceleration possible and attained with such a locomo-

tive of 3,000 h. p. is tremendous, and a good illustration was given by the speaker. The "6000" type locomotive, with a seven-car trailing load, was brought to a standstill upon the test track just as the Empire State Express passed at a speed of about a mile a minute. The electric train was started just as the Empire locomotive reached the rear end of the train, and it caught the steam locomotive before the last car of the steam train passed the electric locomotive.

Mr. Armstrong closed with a short description of the single-phase motor manufactured by his company and briefly outlined the possible usefulness of the gasolene-electric car for branch line service in sparsely developed regions which will not as yet bear electrification.

New Publications.

OHIO STATE UNIVERSITY BULLETIN, Vol. X, No. 1; October, 1905; being a catalog and announcements of the University, the College of Agriculture and Domestic Science, Arts, Philosophy and Science, Engineering, Law, Pharmacy and Veterinary Medicine, the Graduate School, the Summer Term, departments of instruction and reports of officers of the university, etc. The Bulletin is issued monthly during the academic year, and this issue includes the usual announcements and catalog for the year 1905-6. The publication consists of some 290 pages, 5¼ x 7¾ in., carefully indexed, with list of officers, members of the faculty and other instructors, and alphabetical lists of students of the various colleges.

POOR'S DIRECTORY OF RAILWAY OFFICIALS. Poor's Railroad Manual Co., 68 William St., New York City, publisher; edition of October, 1905; 168 pages. This publication is in its nature supplementary to Poor's Manual of Railroads and contains a list of the officials of all the railroads (steam, electric and other) in the United States, Canada and Mexico. In addition to this, special lists of purchasing agents, master mechanics and chief engineers of all the railroads are included. Accompanying the directory of railway officials is an introduction to Poor's Manual for 1905, showing general exhibit of statistics for the fiscal year, together with comparative statements of mileage, equipment, liabilities and assets, traffic operations, earnings, interest and dividend payments, etc., for all steam railroads, 1897 to 1904 inclusive.

TUGMAN'S INDEX TO THE MANUFACTURERS OF THE UNITED STATES. Published quarterly by the Index Publishing Co., 420 Sansom St., Philadelphia, Pa. Subscription price for domestic edition of four parts published at intervals of three months $5.00; single copies $2.00. This publication is published in four parts as follows: Part I, Pennsylvania, New Jersey, Maryland and Delaware; Part II, New York and Ohio; Part III, New England States; Part IV, central, southern and western states. This work is printed in English, French, German, Spanish and Portuguese, and includes an index containing the names of several thousand manufacturers and their lines of products, as well as a few short articles calling especial attention to the various American trade journals which deal with the progress and development of various industries. The consultation of this extensive set of books will enable those who are interested to keep posted regarding the development in all branches of science and industry.

PHYSICS, by Charles Ribord Mann, University of Chicago, and George Ransom Twiss, Central High School, Cleveland, O.; 453 pages, 5¼ x 7½, cloth; publishers, Scott, Foresman & Co., Chicago. This publication is primarily a text book for high schools, but will be found of considerable value and interest to mechanics and artisans as well as manufacturers and others who may wish to brush up on the general subject of physics. Especial attention should be called to the plain, simple and straightforward style, and the large number of plates and illustrations, which aid in making the book both interesting and valuable, there being some 8 plates and 237 illustrations. The publication contains no mathematics beyond simple arithmetic and the first principles of algebra and geometry, and even a knowledge of these is not necessary to the comprehension of the greater part of the book. The authors have endeavored to strengthen the presentation of this subject by first arousing interest, then developing the scientific habit of thought, and lastly, by presenting some of the principles from an historical standpoint, in all of which they have succeeded.

MANUFACTURERS OF THE UNITED STATES. [illegible] tion, 2700 pages, [illegible] The fifth edition of the [illegible] recently appeared. The original volume, the first edition, came out in [illegible] and was a pamphlet [illegible] has grown to 2,700 large pages, each arranged in two columns. It is a very carefully compiled, arranged and indexed directory of the manufacturers of this country. It gives the particulars of no less than 512,734 different manufacturing concerns, and reports their products under 52,596 separate names of articles. The book is coming to have such a circulation in foreign countries as its importance and the care devoted to its compilation warrant; and any domestic house which ever finds it advisable to address circuluars to, or to get into communication with all the manufacturers in a certain line throughout the country cannot do better than have this book within reach. It is proposed hereafter to put out a new and revised edition every year. The publisher is the Manufacturers' Red Book Publishing Co., 225 Fourth Ave., New York City. The book is not sold; it is loaned to subscribers at $15 per year.

Electrical Trades Exposition.

The first annual electrical show of the Electrical Trades Exposition Co. will be held at the Coliseum, Chicago, commencing at 7 o'clock p. m., on Monday, January 15th, and continuing until 10:30 p. m., on Saturday, Jan. 27, 1906, and will be opened daily, except Sunday, from 10 a. m. to 10:30 p. m. Realizing the possibilities for a successful electrical show in the middle west, the Electrical Trades Exposition Co. has recently been incorporated at Chicago for the purpose of managing the affairs of such an exposition. The officers of the company are men prominent and well-known in the electrical field and include the following: President, Samuel Insull; vice-presidents, Edward B. Ellicott, Elsworth B. Overshiner and Charles E. Gregory; treasurer, John Jay Abbott; secretary, Stewart Spalding. Mr. Thomas Mercein is general manager of the exposition, and his past experience as secretary of the Northwestern Electrical Association for 11 years and his acquaintance among managers and engineers, as well as manufacturers, well fit him for the duties involved in the management of such an exposition.

The Coliseum, which is one of the largest buildings of its kind in the country, is particularly well adapted for expositions, and has been obtained for this occasion. It has been divided into 10 sections, 4 on each side, 1 at each end and 4 in the center of the building. Arrangement has also been made for the Coliseum Annex to be used as a receiving room for exhibits and for a restaurant, buffet and smoking room. Goods may be delivered at the receiving room, commencing January 12th, where a receiving clerk will be on duty there for the accommodation of exhibitors. Men and maid servants will be in attendance in the smoking and rest rooms, and every effort will be made to make it a pleasant and attractive meeting place for both ladies and gentlemen. A full mtilitary band of 30 pieces with soloists will be in attendance afternoons and evenings and render musical programs.

For the convenience of exhibitors storage will be provided for empty cases, telephone, telegraph, messenger and stenographic services will be installed and mail for exhibitors during the show may be addressed to the Coliseum, and will be delivered promptly at the respective spaces. Insurance, if desired, may be placed by the exhibitors themselves, but the management will employ a number of uniformed men as guards, and details from the city police and fire departments will be in attendance.

The Electrical Trades Exposition Co. reports that it has already received a very large number of inquiries regarding space, and everything tends to a very successful exposition. The officers of the company are at 464 Monadnock Building, Chicago, and any inquiries regarding the exposition will receive prompt and courteous attention at the hands of Mr. Thomas Mercein, general manager.

The Trolley Express Co., of New Haven, Conn., has been incorporated to conduct an express business on the lines of the Consolidated Railway Co.

The Cincinnati & Columbus Traction Co. has placed in operation its line between Milford and Hillsboro, Ohio.

Question Box of the Mechanical and Electrical Association.*

COMPILED BY S. WALTER MOWER, SECRETARY

17. Is there a satisfactory oil cup for use on old style motors with gravity grease cups?

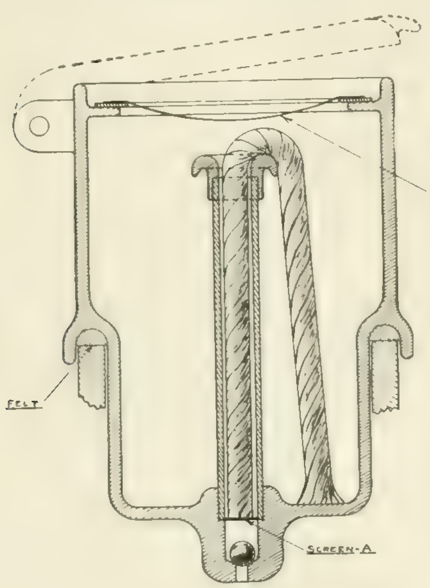
1. Yes. Several have been described in railway publications.

No. 2.

2. A satisfactory oil cup may be had by fitting a cup into the gravity grease cup with a ¼-in. brass pipe threaded into its center and coming up even with the top, into which felt wicking is drawn as tight as possible. A hole is drilled in the pipe near the bottom, allowing the oil to feed the shaft only through the felt. A regulating attachment may be made by placing a second piece of brass pipe outside of the standpipe, close fitting, and with holes of different sizes drilled to meet the hole in inner pipe. The feed may be regulated to a great extent by bringing the hole of the desired size opposite the inner hole. While this is quite satisfactory, we are still looking for an oil cup that will stop feeding when the car stops.

No. 5.

3. There are various designs of oil cups for use on old style motors with gravity grease cups, and though they have several defects, such as clogging of wicks (if such are used) and a possibility of becoming loose, the superiority of oil over grease as a motor lubricator should warrant their adoption. The flow of oil can be regulated by means of the number and size of wicks used, and should be determined by actual tests, as the size of bearings and grade of oil used must be taken into account. The accompanying sketch shows a type of cup commonly used. If in addition to the screen "A" another were located at the opening "B," the clogging of the wicks would undoubtedly be reduced.



OIL CUP FOR OLD STYLE MOTORS.

The design of the cup can be such as to utilize the old covers.

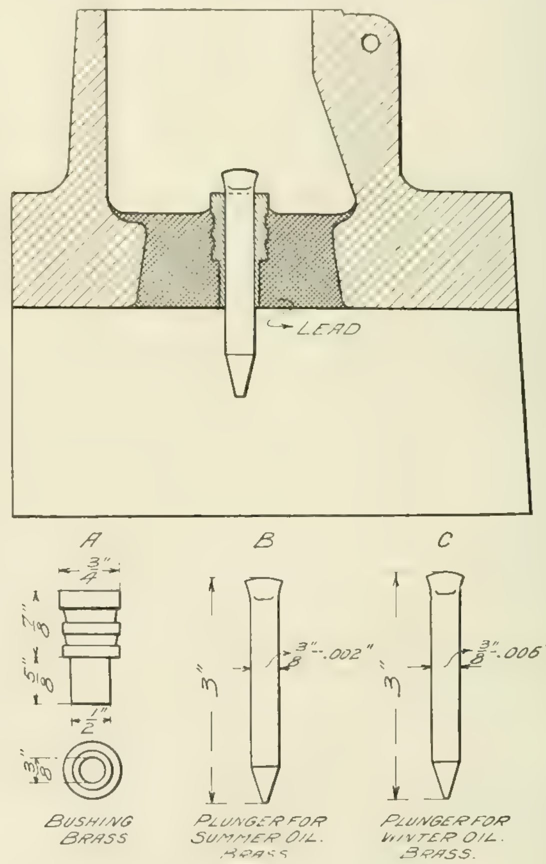
No. 13.

4. We doubt very much as to there being a satisfactory oil cup for use on old style motors—i. e., where a motor has been designed for grease lubrication. When we say satisfactory, we mean a cup that is reliable and at the same time "fool proof," and while the desire for oil lubrication has created a demand for an oiling device that will give results, the efforts so far have been unsatisfactory.

In our experiments we have used 7 different devices with indifferent results. Of these, 3 were of the adjustable gravity feed type, and 4 were gravity feed without adjustment.

We have discarded all cups with adjustable feed, as we found that no dependence could be placed in them, as a slight particle of grit, or in fact any foreign matter getting into the oil, would either stop the feed entirely or would prevent the automatic valve from closing and allow the oil to run out, and the result in either case would be the loss of an armature. Of course, some will say that foreign matter has no business in an oil cup, but we are speaking of conditions as they exist and not as they should be.

As to the best method of lubricating with oil where grease was used, this is a matter which is largely governed by local conditions and the number of cars. As, for instance, roads with from 1 to 150 cars could probably get good results from a cup with an adjustable feed, as the master mechanic or person in charge of the rolling stock could give the matter close personal attention. A case in point is a road in Ohio operating 150 cars, principally single truck, where the cost of oiling was 11 cents per 1,000 miles with an adjustable feed cup. This same cup has since been modified and made with a feed that is non-adjustable, but which depends on the vibration of the motor to feed the oil. The result was a greatly increased consumption of oil.



OIL CUP FOR G. E.-2,000 MOTOR.

We are now experimenting with a method in which we have great confidence, which consists of simply packing the grease cup with a wool waste. The method is as follows: We fit a piece of wood (perfectly tight) in the slot at the bottom of the grease cup. This wood should be driven in to allow no oil to leak through. We then bore a ⅛-in. hole in the center of it, and fit a piece of ¾-in. felt in the bottom of grease cup. This felt has previously been soaked in oil and is used to retard the flow of oil. We then pack the remaining space with wool waste, packing very tight, and pour in 2 or 3 tablespoons full of oil. The first car thus equipped ran 320 miles, the waste was removed for examination, and oil could still be pressed out of the waste with the hands. This test was made with G. E. 1,000 motors, in which the grease boxes are somewhat less in depth than the later motors. We have since equipped with this

*Continued from Preceding Issue.

method a car having four 50 h. p. motors, and the results have been equally as good as on the smaller motors. Aside from this method, we are using a syphon lubricator—i. e., a cup with a tube extending to within ½ in. of the top of a ¾ in. wick. Th[illegible] whole, except the cost of oil, is, in our opinion, the most satisfactory device so far for several reasons, the principal ones of which are the immunity from grit or any foreign substance getting into bearings, as it matters not whether the oil is clean, the wick will only take the clear oil and deposit it in the bearing, and as long as there is any oil in the cup you can depend on the bearing being lubricated. No. 11.

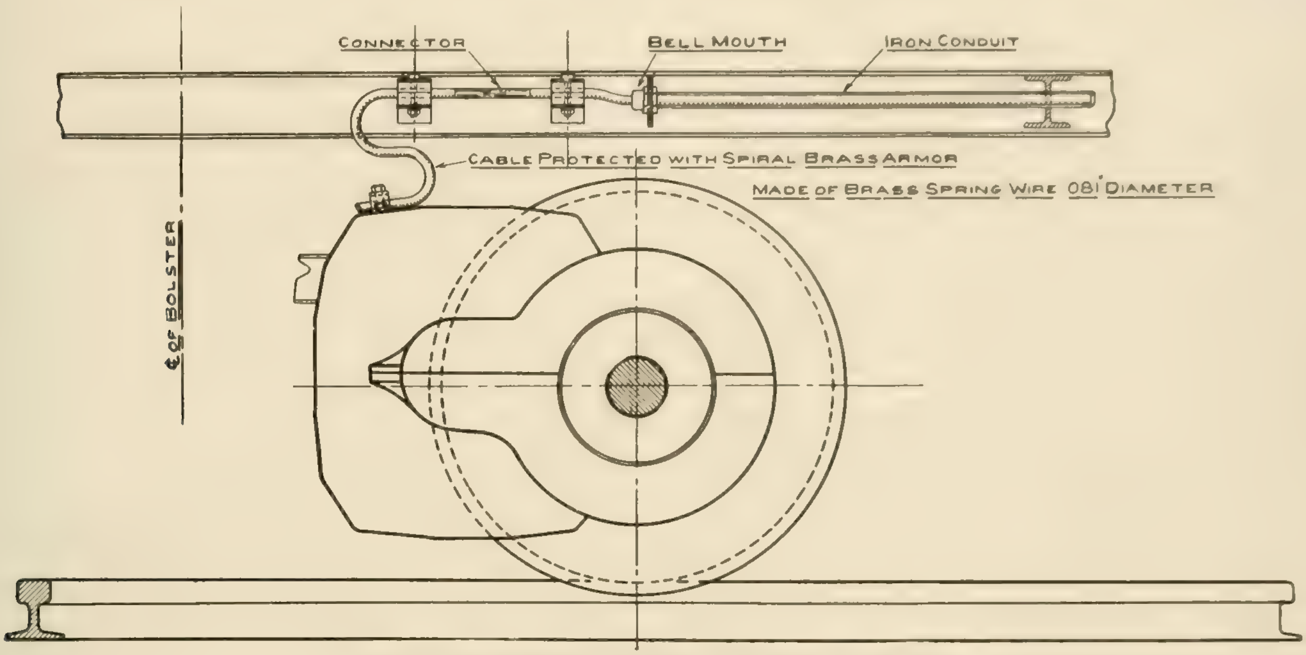
5. The accompanying drawing shows an oil cup that we use on G. E. 2,000 motors. This is a very cheap method of lubrication. All armature bearings on a four-motor car can be lubricated with this for four cents per 1,000 car-miles. When the car is stationary no oil will be fed to the bearings. No. 14.

4. For interurban [illegible] intervals and the contr[illegible] cuit breakers seem to be [illegible] car equipment.

On cars operated in [illegible] quent intervals, more chances for trouble occur incident to opening of circuits at the controller [illegible] employ fuse boxes in series [illegible] short circuit either at the controller or in the car wiring, sufficient current may flow to badly burn the controller or car body without opening the circuit breaker. If the short circuit is maintained, however, the fuse will soon burn out, as it will not stand an overload for any length of time. In case of a sudden short circuit to ground, the circuit breaker will open before much damage is done, and the fuse may not be burned out owing to the time limit of fusing. No. 8.

5. Use both fuse box and circuit breaker. Without the fuse box a continued overload would heat the motors and may not trip the circuit breaker, where, if the fuse is used in connection with the circuit breaker, you will have some protection from a continued overload. No. 12.

6. I do not think a circuit breaker is safe without a fuse box, as I have had cases where they did not cut off the arc on a heavy ground, and burned the controller badly and scorched the vestibule. We use a fuse box in addition to the circuit breaker. No. 5.



DESIGNS OF BELLMOUTH AND METHOD OF SECURING THE LEADS.

18. How shall we do away with the breaking of motor leads where they leave the iron conduit recommended by the Board of Underwriters?

1. A bellmouth should be used at the end of the iron conduit, so designed as to hold the leads firmly to prevent any possible chafing. A cleat should then be used at a distance of about 6 in. from the bellmouth, with a second one about 13 in. from the first, allowing the connector to come between the two cleats. This method has been used and found satisfactory. The accompanying sketches show the designs of bellmouth and method of securing the leads. No. 13.

2. Bring the cable leads out from the center of bolster to the motor, if motor is outside hung. Carry the motor leads over center of motor to the cable leads and connect, leaving just enough slack to curve well. We have very little trouble with broken wires in this way. No. 5.

3. Where wire leaves the conduit we wind friction tape around the wire and then screw a T. & B. bushing, which is bell-mouthed, on to the end of the pipe. The bushing squeezes tight onto the tape and thus avoids chafing of the wire. We have had no trouble with work done in this manner. No. 14.

---

19. Do you consider it good practice to depend entirely upon car circuit breakers, or do you use a fuse box also?

1. For ordinary city service, circuit breakers should be sufficient if the equipment is properly taken care of. For heavy suburban or interurban service one circuit breaker for all motors and independent fuses for each motor is better practice. No. 2.

2. It is not good practice to depend entirely upon a circuit breaker. It is a complicated piece of apparatus, subject to mechanical as well as electrical failures. It is necessary, therefore, to use fuses in addition to the circuit breaker. No. 13.

3. An automatic circuit breaker can be depended upon if properly inspected, closely adjusted and well lubricated. No. 4.

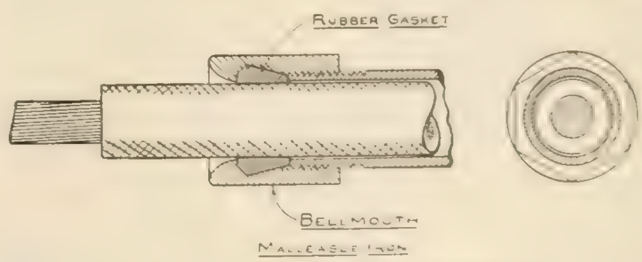
---

20. What is the best composition for trolley wheels?

1. A good composition for trolley wheels is: 91 lbs. copper, 5.5 lbs. tin, 3.5 lbs. zinc. No. 2.

2. One part tin to 9 of copper.

3. Our trolley wheels are 90 per cent copper, 3 per cent zinc.



BELLMOUTH AT END OF [illegible]

6 per cent tin, and 1 per cent lead. We have found that if a trolley wheel is too hard it will spark on high speed cars, wasting considerable current. No. 5.

---

21. What can be done to increase the life and prevent the wearing out of trolley wheel bearings?

1. Have the tension of the wheel against the wire as light as possible, and keep the bearings well oiled. No. 6.

2. We use a trolley wheel bored to ⅞ in., with an oil way in the center into which a piece of felt is fitted. Bushings are pressed in from each side to the felt, just tight enough so the oil will not flow through too fast, and a reamer run through the bushing and felt for the pin. It is oiled through a screw hole on the side of the wheel every three days, the screw being kept in. By keeping the side contact springs in good repair, the bushings will last as long as the wheel. No. 5.

---

22. How large a trolley wheel can be used to advantage on high speed interurban lines?

1. The size of the trolley wheel is limited by the difficulty in sustaining weight at the end of a trolley pole. By reducing the wearing cross-section of the wheel (which may confidently be done, owing to the slower speed due to larger circumference, hence less wear), the weight of the wheel may be considerably reduced. A 6-in. wheel so constructed gives very satisfactory service on high speed interurban lines. The spring in the trolley base, however, should be of proportionate strength.

Wheels used in this service should be made of very clear, hard metal, of high conductivity, and should be subjected to the greatest care in construction and maintenance.

The practice of allowing a groove to wear one side of the wheel and flat surfaces to form is the cause of the majority of broken trolley wires. New wheels should be properly milled, and wheels in service which become unequally worn should be immediately removed and, if possible, be remilled. Bearings should be graphite bushing of ample size running on hard steel pins, the pins being so attached to the harp as to prevent any lost motion at this point.

The common practice of tying the rope around the pole adjacent to the harp should not be allowed. This is a frequent source of trouble, preventing the trolley pole from slipping through frogs, etc., when the wheel leaves the wire. A metal loop at least 6 in. long should be fastened in an eye in the throat of the harp, to which loop the trolley rope should be spliced; no loose ends of rope must be allowed in the joint, as the arc caused by the trolley leaving the wire frequently ignites these loose ends, burning off the rope. No. 10.

2. We find a 4-in. wheel for city service, and a 6-in. wheel for suburban cars to be entirely satisfactory. No. 5.

3. A 6-in. trolley wheel for high speed interurban. No. 12.

---

23. What mileage should a trolley wheel run? How often can it be economically turned down?

---

24. What methods of trolley wheel lubrication can be employed which will prevent oil from dropping on the car roofs?

Design a harp that will collect all drippings and automatically use them over again, or make the pin hollow with an oil well in head of pin and feed oil out with wicking. No. 6.

---

25. What tension (in pounds) should a trolley wheel have against the wire?

1. Sufficient tension should be put on base springs to enable the trolley pole to support a 20-lb. weight attached to trolley rope with the wheel at the height of trolley wire, or to give a pressure of 20 lb. on the trolley wire. - No. 10.

2. This depends entirely on overhead construction, and other conditions; 16 to 18 lb. is ordinarily used. No. 2.

3. For city service, 25 lb. on wire; interurban high speed, 35 lb. on wire. No. 12.

(To be continued.)

Proposed Betterments for Mexico.

The eighth ordinary general meeting of the Mexico Electric Tramways, Ltd., was held in the offices of the company at London, E. C., September 27th. In his annual report the chairman stated that those lines now operated by animal traction should be converted for electrical operation and that the traffic in suburban districts which are served by single track lines is becoming so heavy that it will soon be necessary to double track these lines.

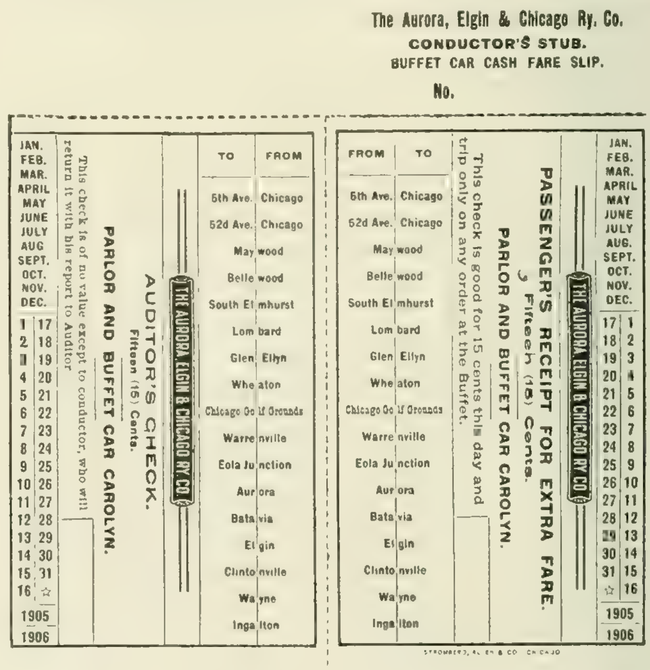
During the past year negtiations were entered into with the government and the company has secured a sound basis for future operation and for such extension and development of the system as will be necessary to meet the development of the territory served.

An interesting innovation that has attracted much attention was the introduction of a lottery scheme in the company's ticket system which was adopted in order to afford an extra safeguard against dishonesty. The lottery system gives every passenger an interest in the demanding and retaining of every ticket that he receives, which ticket has a chance of gaining a substantial prize at the end of the month. The report recommends the gradual construction of the various new lines for which concessions have been obtained, the double tracking of some of the suburban lines, the conversion of a portion of the mule lines for electric operation, the providing of a considerable amount of new rolling stock, the installation of a new water power plant and other matters of a similar nature.

Buffet Cash Fare Slips.

The Aurora, Elgin & Chicago Railway Co. has established a novel practice in connection with its buffet-parlor car service between Chicago and Aurora and Elgin. The excess rate charged on this car between these points is 15 cents, the conductor issuing a cash fare receipt to the passenger for the extra fare paid for the privilege of a chair in this car. The service on this car is practically the same as that on steam railway cars. The passenger may obtain anything from a cigar or liquid refreshments to a full meal.

This cash fare receipt issued to the passenger is good for 15 cents in trade and may be applied on any order at the buffet on the same day and trip only. The caterer of the buffet car collects these checks, which are presented in payment of any order, and makes a daily report similar to the conductor's trip report, enclosing the number of the check he has honored. For each order served for which he accepts this check in payment or part payment, he turns over the stub of the customer's order blank to the conductor, showing the number of orders served. The conductor in his report turns in these stubs, together with the auditor's check, and these are



BUFFET CASH FARE SLIP.

balanced against the number of passenger's receipts that the caterer turns in with his report.

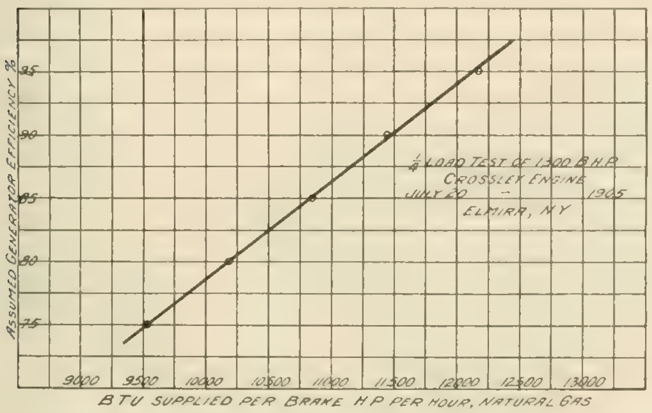
The buffet car cash fare slips are shown in the accompanying engraving. The slip consists of three parts, the conductor's stub, the passenger's receipt and the auditor's check. These three are printed on one piece of paper, folded with the auditor's check directly underneath the passenger's receipt, so that the date in stations may be punched in both at one time. The slip is perforated so that the passenger's receipt may be delivered to him, the auditor's check forwarded with the conductor's report and the conductor's report and the conductor's stub, showing the number, remains in the book in which it is bound.

Efficiency Test of a Large Gas Engine.

During the past summer the Elmira Water, Light & Railroad Co. has had a number of tests made of the performance of a 1,300-h. p. four-cylinder Crossley gas engine, manufactured by the Power & Mining Machinery Co., Cudahy, Wis., and installed in the company's main generating station in Elmira. For a load this engine drove a three-phase alternating-current generator feeding current to the regular distribution system.

The tests were carried out and the results compiled by Herman Diedericks, assistant professor of experimental engineering, Sibley College, Cornell University, Ithaca, N. Y. The results of the economy test of this engine, as derived by Prof. Diedericks, may prove of interest as showing data of the actual performance of a gas engine operating with natural gas when under test to determine the number of heat units required per brake h. p. per hour at one-quarter load.

The methods for testing were according to the accepted standards as far as the circumstances would allow. No indicator cards were taken. During some preliminary work, reducing motions were put on the engine, but they soon went to pieces owing to the severe service. The reducing motion, which had been used by the erection gang, while possibly accurate enough to judge of the character of an explosion, was not thought accurate enough for scientific work and was, therefore, not used. Neither were any jacket water readings obtained. A single meter serves the engine, and since the quantity of water passing through this meter is divided into about 20



EFFICIENCY CURVE.

parts around the engine, no idea of the heat lost through jacket water could have been obtained even if temperature readings had been taken. During the three-hour test, the water meter showed that the engine used approximately 1,000 cu. ft. of water an hour, but nothing is known as to the accuracy of this meter.

The economy guarantee being based upon the brake horse power, it was, in this case, really necessary to obtain only the amount of gas used per hour, the heating value of the gas per cu. ft., the electrical output, and the general efficiency at the load used.

The amount of gas was determined by a Wylie meter, No. 1459. This meter was afterwards taken to Pittsburg and carefully calibrated under the supervision of Mr. R. N. Robertson, by the Equitable Meter Co. A regulator was interposed between the meter and the suction piping of the engine. The suction pipe was of considerable length and had a number of elbows in it. Owing to this, the fluctuations in the suction pipe probably had but small effect upon the reading of the meter. There was an apparent fluctuation of about 2 in. of water in a total pressure of approximately 9 in. of water on the meter, but the Equitable Meter Co. explained that this was most likely due to the action of the tally meter, and therefore the meter was calibrated without pulsations.

The heating value of the gas per cu. ft. was found in two ways, by aid of a Junker's calorimeter erected in one of the testing rooms of the plant itself, and by a chemical analysis on a sample of gas taken to the university laboratory at Ithaca. The results of these tests will be found in the accompanying tables.

For the test run a load was placed on the three-phase generator driven by the engine. The load was fairly constant, averaging about [illegible] of all three phases of the alternating current. The corrected read- [illegible]

With these quantities just mentioned it is possible to compute the heat supplied to the engine per e. h. p. per hour. The figures for the generator efficiency at the time of computing the test were not available. For the purpose of obtaining an idea of the quantity in question, that is, the B. t. u. supplied per brake h. p. per hour, a series of generator efficiencies was assumed and computations made for each of these efficiencies. The generator efficiencies assumed in the computations were 75, 80, 90, 90.2 and 95 per cent. The efficiency of the generator at one-quarter load, upon recommendation of the Elmira Light, Water & Railroad Co's. engineer, was taken at 90.2 per cent, and hence this figure is used in computing results.

As showing the final results at a glance, a curve is shown, illustrating the relation between the assumed generator efficiency per cent and the B. t. u. supplied per brake h. p. per hour. This curve shows that if the generator efficiency is only 75 per cent, that the thermal units supplied per hour are 9,550; if the generator efficiency is as high as 95 per cent, the thermal units supplied are 12,180. At an efficiency of 90.2 per cent, the figure given by the company's engineer, the B. t. u. supplied per brake h. p. per hour are 11,520. The generator efficiency is most likely to be between 85 and 90 per cent, making the B. t. u. supplied per brake h. p. per hour from 10,870 to 11,470.

In view of these results, Prof. Diedericks reported that the guarantee of 13,500 B. h. p. per brake h. p. per hour at one-quarter load was fully met.

The following tables will be of interest as showing the detail results of the test:

Gas Analysis.

The chemical analysis showed the natural gas to have the following composition: CH_4, 94 per cent, and C_2H_6, 6 per cent.

This analysis gives 1054.5 B. t. u. as the heating value per cu. ft. of this gas under standard conditions.

The determinations with the Junker calorimeter gave the following figures:

Average gas temperature in calorimeter, degrees F.	92.2
Average gas pressure, inches of water	.20
First determination of heating value	977.17
Second determination of heating value	974.93
Average lower heating value B. t. u. per cu. ft.	976.05
Average amount of water condensed, pounds	.033
Average higher heating value B. t. u. per cu. ft.	1007.93
Lower heating value, B. t. u. per cu. ft., standard	1091.1
Higher heating value, B. t. u. per cu. ft., standard conditions	1126.6

Ratio of Air to Gas.

This ratio of air to gas can be roughly ascertained from the position of the air and gas valves. The position of the valves for each of the four cylinders during the test showed an average ratio of gas to air of 26.7.

From the chemical analysis as given it is found that the theoretical air supply necessary is 17.3 cu. ft. of air to 1 cu. ft. of gas. Assuming that the scales on the air and gas valves indicate the port areas correctly, it is found that the excess coefficient was $26.7 \div 17.3 = 1.54$

Dimensions of Engine.

Rated brake h. p.	1300
Rated r. p. m.	[illegible]
Number of cylinders, single-acting	4
Diameter of pistons, inches	32
Length of stroke, feet	3.0
Direct-connected generator, kw. capacity	750

Data.

Duration of test, hours ... 3
Load on generator, average kw. ... 205
Per cent of rated load ... 27.3
Gas, total, cu. ft. ... 10380
Gas temperature, degrees F. ... 79.5
Gas pressure on meter, inches water ... 8.94 = .32 lb.
Gas per hr., cu. ft., standard conditions ... 3009
Ratio air to gas by volume from valves ... 26.7
Ratio air to gas, theoretical ... 17.30
Excess coefficient ... 1.54
Heating value of gas, B. t. u., per cu. ft., as determined by Junker calorimeter:
Lower ... 976.05
Higher ... 1107.93
Gas temperature in calorimeter ... 90.2° F.
Gas pressure in calorimeter, inches water ... .20 = .01 lb.
Heating value of gas per cu. ft., standard conditions:
Lower ... 1091.1
Higher ... 1120.6
Heating value per cu. ft. from chemical analysis, higher value ... 1054.5
Revolutions, total ... 24796
Revolutions, per hour ... 8265.3
Revolutions, per min ... 137.76
Barometer, 29.8 in. of mercury ... 14.63 lb.

Results.

Average e. h. p. ... 274.70
Average brake h. p.:

Generator efficiency assumed per cent						
Brake h. p.	367	344	323.5	305.5	304.5	288.5

Gas per e. h. p. per hr. standard conditions, cu. ft. ... 11.68
Gas per brake h. p. per hr., cu. ft., standard conditions:

Generator efficiency assumed per cent	75	80	85	90	90.2	95
Cubic ft. of gas	8.74	9.33	9.93	10.50	10.54	11.12

B. t. u. supplied per e. h. p., per hour ... 12,780
B. t. u. supplied per brake h. p. per hour:

Generator efficiency assumer per cent	75	80	85	90	90.2	95
B. t. u. supplied	9550	10200	10870	11470	11520	12180

Thermal efficiency on e. h. p. ... 19.90
Thermal efficiency on brake h. p.:

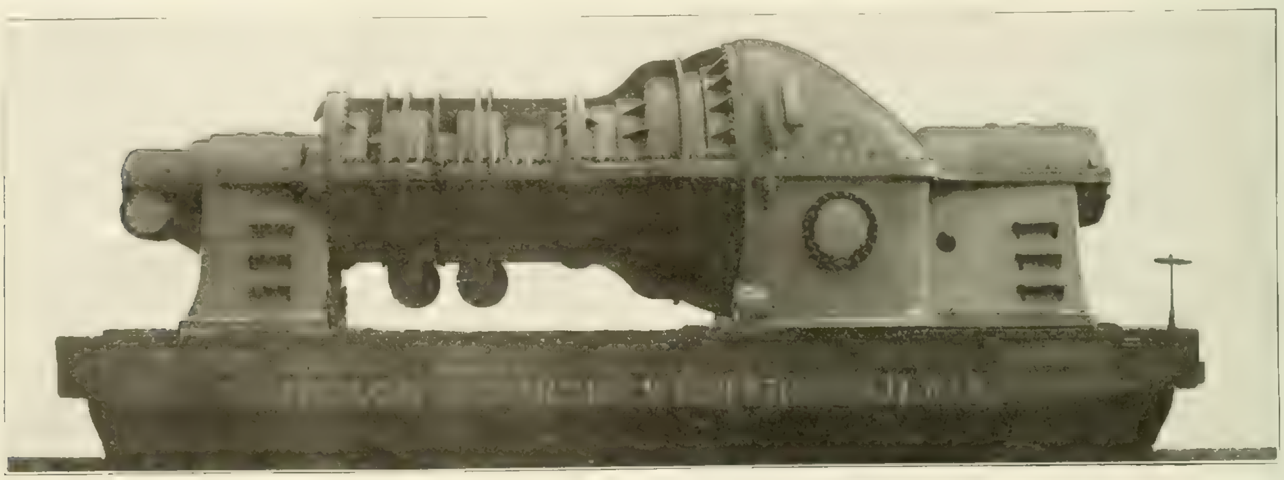
Generator efficiency assumed per cent	75	80	85	90	90.2	95
Efficiency, per cent	26.70	24.95	23.45	22.10	22.05	20.95

Allis-Chalmers Steam Turbine for the Brooklyn Rapid Transit Co.

The Williamsburg station, in Brooklyn, which has been erected near the bridge of that name, is designed to accommodate a total of nine steam turbine and generator units, three of which are now being installed. One of the most interesting of these is the Allis-Chalmers 9000-h. p. unit. A view of the body of the turbine, as it appeared when loaded on a 36-ft. flat-car, for shipment from the West Allis works of Allis-Chalmers Co. is shown in the illustration.

The turbine is of the horizontal multiple-expansion, all-around, parallel-flow type, generally known as the "Parsons" type, operating at 750 r. p. m. The generator is a "Bullock" alternating current machine built by the Allis-Chalmers Co. at its Cincinnati works. It will carry 25 per cent overload continuously and 50 per cent overload for three hours with but small temperature rise. A noteworthy feature in the construction of the Allis-Chalmers turbine is the blading; the blades are made of a special alloy and of such form and dimensions as will secure the highest economy. The individual blades are mounted in groups, each group forming one-half of a circular row. The inner ends of the blades are swaged, firmly secured in accurately spaced slots in foundation rings and riveted in slots in their respective channel-shaped shrouds. The blade rings are secured by special calking strips in accurately machined grooves in the cylinder and rotor, thus insuring against throwing out due to centrifugal force.

The channel-shaped shroud secures the blades in a substantial manner at the proper angle and spacing, and eliminates the danger



9,000-H. P. STEAM TURBINE, FOR BROOKLYN RAPID TRANSIT CO.

of stripping, permitting the turbine to be safely operated with a minimum radial clearance. This special design of blading does away with hand-work. The machine construction insures great strength, perfect alignment, and uniformity in the spacing of the blades. Having adopted the proper working principle, the efficiency of a steam turbine depends on the accuracy of angles, spacing and form of blades. These factors are obtained in the construction of the Allis-Chalmers turbine. The lubricating arrangement is free from complications, complete and efficient. It is equipped with a direct-acting steam pump for use on starting up the turbine. The turbine and generator rotors are direct-connected by a flexible coupling, each being carried in two bearings of the ball and socket type. In the generator design especial attention has been given to thorough ventilation.

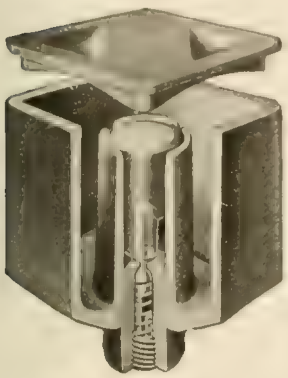
The turbo-generating unit measures approximately 47 ft. in length, over all, 13 ft. 3 in. in width, and 11 ft. 6 in. in height above the engine room floor. Its height above the foundation is scarcely more than that of the low pressure cylinder of a reciprocating engine, of equal capacity, above the upper platform, and such cylinders are frequently more than 30 ft. above the engine foundations.

The Texarkana electric railway, owned and operated by the Texarkana Light & Traction Co. has been placed in the hands of a receiver, Col. E. J. Spencer, president of the owning company, being appointed by the United States District Court.

The Jolt Lubricator.

It has been the general experience of street railway men that oil is a much better lubricant for street car journals than grease, although the latter has heretofore been used to a large extent. There has been considerable trouble experienced, however, in the use of oils as it has been found difficult to supply just the amount of oil needed to properly lubricate the journals, and still not to waste the oil. Another trouble with the use of oil has been that when a sufficient quantity of oil was used to properly lubricate the cars while in motion, this supply of oil would continue to be fed to the journals when the car was standing still, thereby occasioning considerable waste of oil and a corresponding waste of money. To obviate these difficulties the Jolt lubricator, made by the Jolt Lubricator Co. of Providence, R. I., has been devised in a form which is applicable to railway motors that were originally built for grease lubrication.

The accompanying illustration shows the details of the Jolt lubricator, which, as its name implies, feeds oil to the journals by means of the jolting it receives when the car is in motion. The opening at the bottom of the lubricator is covered by a valve which opens downward and which is held against its seat by means of a coil spring. The tension of this spring is adjustable by means of a screw, and this tension determines the amount of oil which the journals receive. A cylindrical weight which fits loosely between sets of lugs is fastened to the stem which projects from the top of the valve, and at every jolt of the car this cylinder, which is free to move, compresses the spring by an action similar to a hammer blow, and opens the valve momentarily, permitting the oil to flow through to the bearing.



JOLT LUBRICATOR.

It will be seen that the lubrication by this device depends entirely upon the jolting of the car, and when the car is at rest the oil valve will remain closed, and the waste of oil is thus avoided. These lubricators can be fitted to any car without laying up or delay, and they insure automatic and economical lubrication with oil, the amount of which to be fed can be regulated at will.

The Jolt lubricators have successfully passed through the experimental stage, having had over a year of service on one of the prominent New England roads. This extensive trial has been made with the result that the railway company is now equipping all of its cars with this type of lubricator.

Yale & Towne Triplex Chain Blocks.

Modern shop practice requires that much material and machinery be handled in an economical and prompt manner, and to meet these demands many labor-saving devices have been perfected during the past few years, among which are chain blocks. The Yale & Towne Manufacturing Co., 9-15 Murray St., New York City, is manufacturing three kinds of chain blocks in 15 sizes; the "Triplex," for greatest ease and quickness; the "Duplex," for ease and handiness, and the "Differential," a less expensive, but simple and reliable chain block.

The hoisting mechanism of the "Triplex" chain block consists of a balanced train of spur gears, from the small central pinion to the shrouded internal gear, of heavy pitch, constituting a part of the frame and of the full diameter of the block. The two intermediate gears are carried by a circular frame or "pinion cage," keyed to the load-chain sheave, and revolving within the internal gear, thus forming a sun-and-planet motion which gives the desired leverage. The sustaining mechanism consists of a set of friction disks, one of which has external ratchet teeth engaging with a drop-forged pawl. The hand wheel is screwed upon the central hub, and in hoisting clamps the disks solidly together. In lowering, the reverse motion of the hand wheel releases the engagement of the disks, and allows the load to lower smoothly and rapidly, but only so long as the hand wheel is revolved backwards; when this motion [illegible]

[illegible]

sheaves are made with such accuracy as will insure smooth operation and are of high class material and workmanship.

These blocks are used very extensively by the Philadelphia Rapid Transit Co. in its car barns and shops, as well as in construction and repair work, being used on riveting machines, in loading rails by using blocks on a small davit at each end of the wagon. These

TRIPLEX BL[illegible]

blocks were also used [illegible] after the recent accident on the Metropolitan Elevated R. R., New York City, and because of their speed, efficiency and instant availability are much used as emergency hoists, as well as the hoisting mechanism on traveling cranes.

Stone & Webster, Boston, have purchased the Nooksack power plant of the Bellingham Bay Improvement Co., Bellingham, Wash.

The Falk Co's. '04 Frog.

The Falk Co., Milwaukee, Wis., steel founder and manufacturer of electric material, has placed on the market for use on street railway systems where tracks are of T-rail construction, using either the high Shanghai type or the low standard steam road sections, a frog, called the '04 frog.

The cut herewith shows the frog assembled, and also on either side the separate blocks, which together with the rail make up the frog. The four loose pieces shown are the two wing knees provided with guard and throat-way of similar section to the standard rolled guard rail; the wheel block with corrugated surface for point or heel of frog and the wheel block for the toe of frog. The toe block and wing knees are provided with riser surfaces, special hardened, to raise the wheels sufficiently to pass over the point of frog on its flanges, thus insuring long life to the vulnerable part of the piece. By the introduction of lugs on the crossing, all lugs and bolts have square bearings and the strains are direct. All castings are made of steel and are planed to fit the rail section. By comparison with

THE FALK CO. '04 FROG.

the old type of built-up frogs, it can be seen that the number of loose parts has been reduced to a minimum.

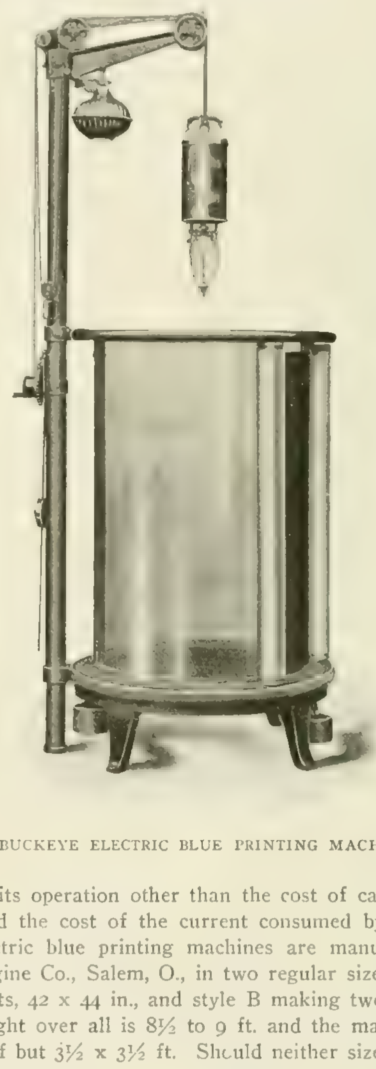
The Falk Co. has adopted the '04 frog for all its standard T-rail work, in cross-overs, diamonds and side turnouts. These frogs have been furnished to the Washington Water Power Co., of Spokane; Austin Electric Railway Co., Austin, Tex.; Lansing & Suburban Traction Co., Lansing, Mich.; Inter-State Traction Co., Duluth, Minn.; Fargo & Moorehead Street Railway Co., Fargo, N. D., and others.

The Buckeye Electric Blue Printing Machine.

The Buckeye electric blue printing machine has been designed to supply a growing demand for an efficient and economical apparatus for making blue prints by electric light at any time during the day or night, regardless of weather conditions. The machine consists of a glass cylinder set in a steel frame, two rods extending from top to bottom on the outside opposite each other. Two spring roller curtains are attached to these rods, the tracing and paper are then placed next to the glass and the curtains are extended and fastened to the opposite rods. Another rod extends from the floor to a point some distance above the frame, from which is supported the light.

To obtain the best results with these machines perfect contact must be secured between the tracing and the sensitized paper, which is obtained in the Buckeye machine by means of weights attached to small wire cables which engage both ends of the rollers. There are two rollers on each machine, one on either side, which operate independently of each other so that one side may be unloaded and reloaded while the other side is printing. The rollers will remain stationary at any point of the circle, the curtain back of the roller being in perfect contact with the glass, so that it is possible to load the machine with numerous small prints if desirable.

The lamp furnished with these machines which is specially constructed for photo-engraving and blue printing work, is of the long arc type, and transmits a light rich in actinic or violet rays. A rheostat is furnished with each lamp to adapt it to the current desired. The speed of the pendulum governing the drop of the lamp through the glass cylinder is easily regulated, thus removing the necessity of making more than one drop of the lamp at a printing. The construction of this machine is very simple, its operation requiring no special skill whatever. The machine is entirely self-contained, is fastened in no way to the wall, ceiling or floor, and can be moved from one place to another. There is no expense con-



BUCKEYE ELECTRIC BLUE PRINTING MACHINE

nected with its operation other than the cost of carbons for use in the lamp and the cost of the current consumed by this one lamp.

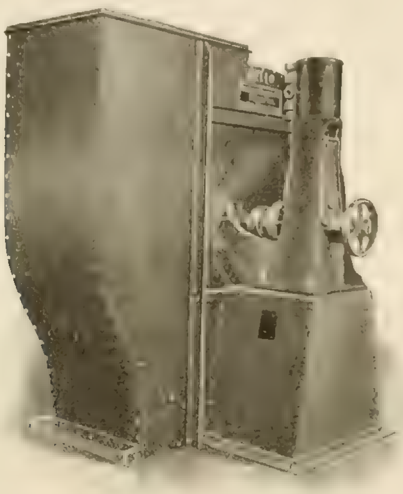
These electric blue printing machines are manufactured by the Buckeye Engine Co., Salem, O., in two regular sizes; style A making two prints, 42 x 44 in., and style B making two prints, 42 x 60 in. The height over all is 8½ to 9 ft. and the machine requires a floor space of but 3½ x 3½ ft. Should neither size fill the requirements to be met, the company is prepared to manufacture any other size desired.

The Spokane & Inland Railway Co., Spokane, Wash., has recently placed an order with the J. G. Brill Co. for 18 interurban passenger coaches and 2 large interurban express cars for use on its line between Spokane, Wash., and Lewiston, Idaho. A description of this line appeared in the "Review" for August, 1905, and a description of the electrical equipment appeared in the October "Review," page 770. Six of the passenger cars will be 53 ft. over the bodies and mounted on motor trucks, 12 will be 45 ft. over the bodies and will be operated as trailers. These cars are to be similar in design to those recently furnished by the Brill company to the Coeur d'Alene & Spokane Railway Co., and which were described and illustrated in the "Review" for June, 1905, page 390. The cars will have arched top twin windows, will be vestibuled at both ends, and in appointment and equipment will be thoroughly modern in every respect.

Three-Bearing Fan Engine.

In the handling of hot gases with a fan, as in a plant using induced draft for boilers, it has been found difficult to give the fan shaft a suitable bearing. A new method of construction, shown in the illustration, which has been very successful, is to be had in the use of three journal boxes cast in the engine frame. These can all be bored with the same boring bar and a perfect alignment maintained. In this construction the fan bearing is water-cooled and ring-oiled, and is supported by the engine bed and not by the housing of the fan as would otherwise be the case. This simplifies the construction by eliminating the additional bracing usually found on fan housings.

The wheel is varied somewhat from the ordinary construction. In place of the usual three spiders, is substituted a single heavier one, built of I-beams cast into the hub. By the use of a single spider the necessity for more than one hub on the shaft is obviated. In this manner the load of the wheel is concentrated upon a comparatively short length of shaft. Moreover, with the deep cone in the casing and the fan bearing as supported, the load of the fan is placed very near to the fan bearing. In fact, the bearing is included



AMERICAN BLOWER CO. FAN AND ENGINE.

within the width of the fan blades. This point is of great importance, since, were the fan of the ordinary three spindle design, the center of gravity would be some distance out from the bearing and there would be the tendency of the shaft to move on the fan bearing as a fulcrum and cause an upward thrust in the engine and on the engine journal caps. With the single spider this trouble is not encountered.

The engine is of the enclosed type, oiled by a recently devised pump which distributes oil to all of the reciprocating and revolving parts, even lubricating the eccentric outside of the frame. Tests in actual practice have proven that this fan will run several months without oiling or adjustment. This blower set is manufactured by the American Blower Co., of Detroit, Michigan.

Consolidated Car Fender Co.

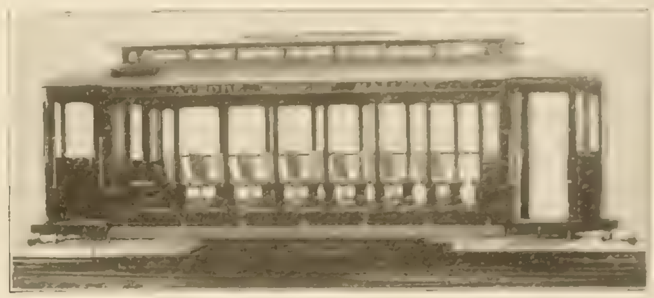
Owing to the death of Mr. A. C. Woodworth, who has been general manager of the company since its organization in 1895, the Consolidated Car Fender Co. has deemed it wise to move its main office from 39 Cortlandt St., New York City, to its factory at Providence, R. I., from where all correspondence and sales will be conducted hereafter. The company believes this move to be conductive to better, more prompt and more efficient service to its patrons. A branch office for the demonstration of fenders and the convenience of patrons will, until further notice, be continued at 39 Cortlandt St., New York City, but all communications should be addressed to the company at P. O. Box 228, Providence, R. I.

Mr. A. J. Thornley, who assumes the management of the company, has been identified with the manufacturing end of the business since its organization, and all patrons of the company may feel assured of prompt and courteous treatment at his hands.

"Grooveless-Post" Convertible Car for Latrobe, Pa.

The G. C. Kuhlman Car Co. has lately furnished to the Latrobe Street Railway Co. the convertible type of car built under the Brill patents, which is shown in the accompanying engraving. The method [illegible] as the "grooveless-post" system as the posts are not cut into as formerly for grooves for sliding either the sashes or the panels and therefore have the strength of their full thickness. A pair of guides in the roof pocket controls the movement of the sashes and steel guides or strips on the posts are straddled by the projecting edges of the two sheets of steel which compose the panels and by means of which they are conducted into the roof pockets.

As will be noticed in the illustration, there are no grab handles on the posts. An excellent substitute for grab handles consists of brackets between the backs of the seats and the posts. These brackets are arranged to swivel when the seat backs are stepped-over. As a passenger leaves the car he finds but one handle to take hold of, and that is on the side which prompts him to face toward the forward end of the car as he steps down upon the running board and so to the ground; thus a common source of danger is abolished. When the car is closed, the absence of grab handles on the posts of course adds to the appearance. Guard rails, one of which may be seen in the illustration in its lowered posi-



[illegible]

tion, slide into the post and when raised are just above the curtain box and appear to be part of the molding. The vestibule folding doors are controlled by a patent device which prevents the outer leaf of the door from swinging free and with liability to strike against passengers or to break the glass. It also enables the conductor or motorman to open the door rapidly and with the use of but one hand.

The length over the body is 20 ft. 7 in.; over the vestibules, 30 ft., and over the bumpers, 30 ft. 8 in.; width over sills, 7 ft. 2 in., and over posts at belt, 8 ft.; height from track to under side of sill, 2 ft. 4¾ in., and height from under side of sill over roof, 9 ft. 1⅛ in.; height of platform step from track, 15 in.; from step to platform, 12 in., and from platform to car floor, 6⅜ in.; height of running board from track, 18⅜ in., and from running board to car floor, 15¾ in.; from center to center of side posts, 2 ft. 7 in.; width of door opening, 40 in.; length of seats, 34 in., and width of aisle, 20½ in. The side sills are 5¼ x 6 in., with 6 x ⅝ in. sill plates on the outside. End sills are 4¼ x 6 in.; thickness of corner posts, 3¾ in., and of side posts, 3⅜ in.; sweep of posts, 5 in. The truck used is the Brill No. 21-E type. The weight of the car body is 10,300 lb., and weight of car body and trucks without motors, 15,-300 lbs.

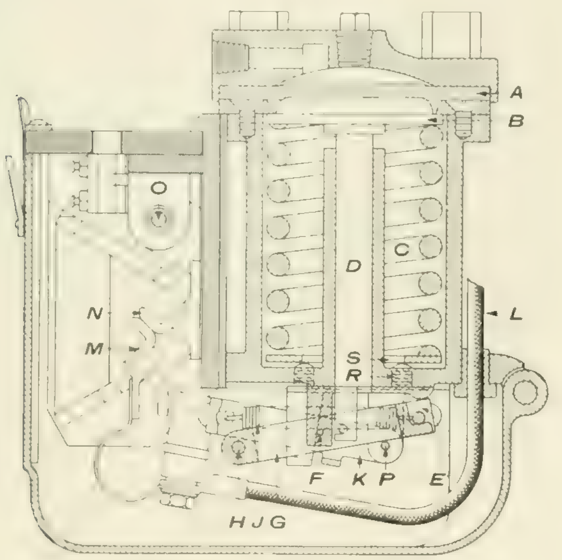
An important decision has just been rendered by the Supreme Court of Indiana as to the right of a municipality arbitrarily to dictate the style of the fender that shall be adopted for use on cars operated within the corporate limits. Recently the city council of Elkhart, Ind., passed an ordinance providing that it shall be unlawful to run any street car within the city limits without attaching thereto a certain form of automatic fender made by a certain company, or some fender equally as good, to be approved by the council. The court holds that the ordinance is void because it vests in certain public officers an arbitrary discretion in determining what fender shall be used.

A New Air Compressor Governor.

The independent motor-driven air compressor for the braking system of a car requires an automatic regulator or governor to control the air pressure. The reliability of the governor is an important factor in insuring continuity of service and a ready and positive operation of the airbrake system at all times. The General Electric Co. has developed the type MC governor, which is light, compact and simple in operation.

The limiting pressures at which the governor acts are usually such that a fall of 10 lb. in the operating pressure will start the compressor motor which will run until a rise of 10 lb. pressure is obtained. The varying pressure of the air against a diaphram actuates a set of operating levers, one of which carries the contact finger by means of which the motor compressor circuit is made and broken. The form of contact, arc chute, and magnetic blow-out is similar to that employed in the standard railway contactor, this construction having been found to be a satisfactory form of current interrupting device. A thick diaphram of pure rubber forms an hermetic seal and prevents any leakage of air through the governor, thus obviating all difficulties due to condensation and freezing of moisture. This construction, together with the absence of valves of any sort, assures the utmost reliability of operation.

The compact arrangement of the governor permits its installation in small space directly on the bottom of the car. It is 5¾ in. wide,



SECTION OF GOVERNOR.

9⅞ in. long and 10 3-16 in. deep. If installed for stationary use, it may be placed in any desired position. A tightly fitting cover protects the operating parts, contacts and adjustments from dust, dirt and mechanical injury. This cover also serves to exclude snow, brake-shoe dust and wheel wash, permitting the use of the governor without any enclosing box. Adjusting screws are provided for accurate adjustment for various maximum pressures.

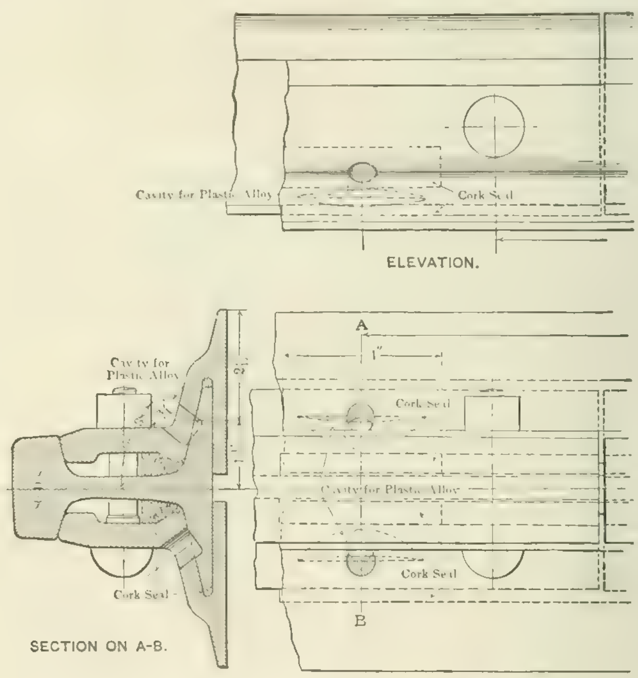
The action of this governor in opening and closing the motor circuit of the compressor may be followed by referring to the sectional view.

As the compressor continues to operate and the pressure of air in the reservoir is thereby increased, the pressure in the chamber above the diaphragm A rises; the piston rod D is forced downward against the action of the operating spring C, turning the lever E around its fulcrum. This brings the pivot H above the center line of the tension springs J, which connect the intermediate lever G with contact carrying lever K. The action of these springs then pulls the back end of the intermediate lever downward; this movement quickly carries the center line of the springs past the pivot P, thus reversing the action of these springs on the contact carrying lever K, which causes the free end of this lever to be drawn downward, separating the contacts M and N with a quick snap.

The object of this double system of levers is to maintain a constant pressure between the contacts until the tripping point is reached, and prevent the liability of burning at the contacts which would otherwise occur. As the pressure in the reservoir is reduced the piston rod D raises the back end of the lever E, a projection on which engages with the intermediate lever G. This carries the center line of the tension springs J above the pivot of the contact carrying lever K and thereby pulls the contact finger upward, quickly closing the circuit.

A Permanent Type of Plastic Rail Bond.

A new permanent type of plastic rail bond which can be applied to almost any rail section, and in the use of which the angle plates are made to carry the current, has recently been designed by Harold P. Brown, 120 Liberty St., New York City. When installing the bond, a hole is drilled through the angle plate on either side of the joint between the first and second bolt holes from the end of each rail. Under each of these holes a shallow cavity running lengthwise is milled in the top of the rail base. These holes in the angle plates and the cavities underneath in the rails are amalgamated by the Brown process, as is also the lower surface of the angle plate over the cavities, and both holes and cavities are filled with a new kind of plastic alloy, which does not harden nor permit the liquid mercury to run out. This material being inelastic does not jar out



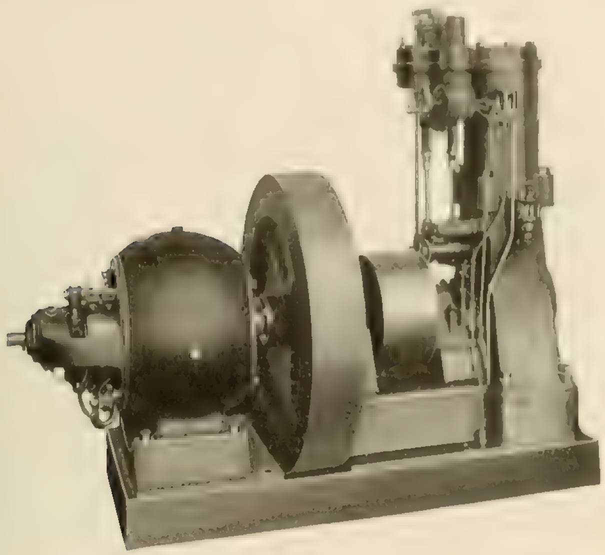
IMPROVED METHOD OF RAIL BONDING.

of the hole and in adhering to the amalgamated rail surfaces forms a flexible conductor of low resistance between the rails and the angle plates.

To exclude the dirt, the holes are sealed with weatherproof cork composition disks, and to prevent dirt from creeping into the holes or cavities a cork seal is placed between the web of the rail and the angle plate opposite the cavities. These disks can easily be removed thus leaving the bond free for inspection or repair without the necessity of removing the angle plates. Before placing the angle plates on the rails, the upper surface of the base of the rail around each cavity is coated with a non-hardening and weatherproof compound which seals the crack between the angle plate and the rail. The angle plates are drilled and amalgamated before being distributed along the road for making up the joints, the cavities being quickly milled by a portable hand-power milling machine. The conductivity of the joint, when the weight per yard of the two angle plates is equal to that of the rail and the rail joint is double bonded, is practically equal to that of an equal length of unbroken rail. It is claimed that the plastic alloy will always maintain contact between the rails and the angle plates and keep the conductivity of the joint unimpaired. These plastic bonds have been in service on the lines of the Denver City Tramway Co. and the Rochester Railway Co. for nine years, and it is stated tat they are in as good condition now as when first installed.

Automatic Oil-Electric Generators.

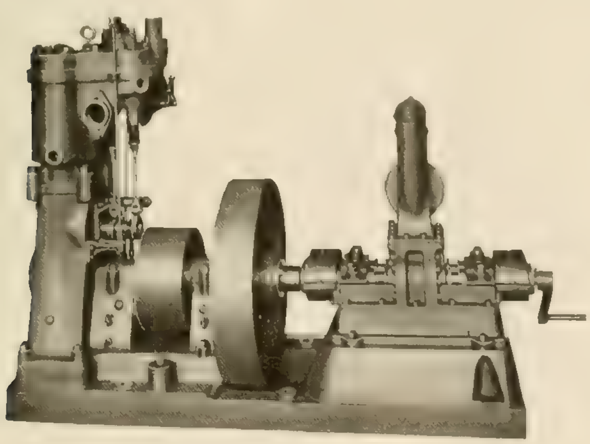
The Marine Engine & Machine Co., of New York City, has put upon the market a line of direct connected generating sets, consisting of Secor oil engines and electric generating units. These are known as Secor automatic oil-electric machines, and are said to be particularly advantageous for use in private residences, churches,



SECOR ENGINE AND GENERATOR.

public buildings, factories, boats, etc., where electric lighting, battery charging, or power is required. The Secor engine is operated with kerosene oil, which is absolutely safe from explosion, and an economical fuel. These engines start promptly, regulate closely, and are claimed to be very reliable and free from shut downs. As they are simple in construction and operate automatically, they can be cared for by unskilled help. The automatic control provides constant voltage and this is attained without any readjustment of fuel supply, governor or rheostat, and the current is supplied at a uniform voltage, irrespective of the load.

There are four types of these units made, each of which is especially adapted to a particular service. Type A is a constant potential generating set, comprising an engine and dynamo, solidly coupled and on a common base. This furnishes current of a uniform voltage for electric lighting, the voltage automatically remaining constant for all loads. Type B is designed for charging



SECOR KEROSENE OIL ENGINE.

automobile or other storage batteries, and its potential varies automatically as required for this class of work. Type C is a combination of types A and B. It can be operated at either constant or variable potential as desired, and may be used interchangeably for lighting or battery charging. Type D consists of a type C machine in connection with a special storage battery and automatic controlling device. The latter makes the current available either by day or by night. It is provided with interlocking arrangements which eliminate any complications, and which make it thoroughly reliable in charge of [illegible].

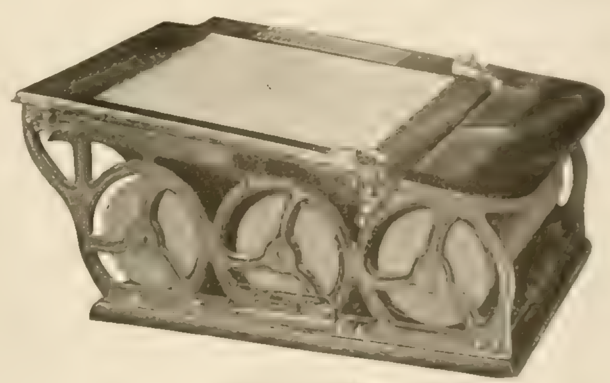
In addition to the [illegible] these units provide current at [illegible] flatirons, chafing dishes, heaters, cooking apparatus of all descriptions, organ motors and electric elevators.

These sets are also extensively used for pumping, and a fly wheel is provided between the engine and generator so that pumps may be belted to the set or can be driven by an electric motor at a distance, as the occasion requires. It is stated that one gallon of kerosene oil when used in a very small Secor engine will furnish sufficient power to lift 4,500 gallons of water 100 ft.; also one pint of oil is sufficient to operate ten incandescent lamps of 16-c. p. for one hour. The smallest of these machines has a capacity of 25 16-c. p. lamps, and weighs less than 600 lb.

A Practical Way Billing System.

The General Systems Co., of Dayton, O., formerly the railway division of the Egry Autographic Register Co., has devised a new and practical method for railway billing. The principal advantages claimed for this system are its saving of time, labor and expense, its elimination of unnecessary rewriting and its avoidance of errors and omissions.

By the use of this system there are issued at one writing three or more copies of each waybill, which copies may consist of a memorandum of shipment for the auditor, an original bill of lading, a receipt for consignee and, if desired, a duplicate bill of lading. These bills are automatically fed through the Egry manifolder, an instrument which is supplied with a solid writing surface so as to enable the operator to write clear, legible copies and to issue them



EGRY MANIFOLDER.

one after the other with the greatest amount of rapidity. Three or four rolls of paper are placed within the manifolder and so arranged that by turning a crank they are fed through to the writing surface, where bills of lading are issued as stated.

As the forwarding department is one of the busiest in the railway service, the value of this system can readily be appreciated, in that its installation provides a safeguard against errors and omissions, as well as an economical and rapid manner for billing freight. The bills of lading and way bills are consecutively numbered so that in filing on post binders any bill may be readily located. This feature will be found of particular value in tracing shipments, handling claims and similar matters, as the number that appears on the original bill of lading also appears on the waybill, so that instead of having only a car number or date of shipment for reference any one of the bills will give a reference that will enable the company to locate the auditor's slip or waybill at once. The economy obtained in issuing a bill of lading, waybill and auditor's slip at one writing is of considerable advantage, as by the old system a bill of lading is issued by the chief clerk, the shipment is billed by a bill clerk, an impression taken in the copy book, the original waybill forwarded with the shipment and a monthly report made to the auditor.

This system has been used by a number of interurban lines throughout the country, including the Indiana & Martinsville Rapid Transit Co.; the Interurban Railway Co., Des Moines, Ia.; Columbus, London & Springfield Railway Co.; the Evansville & Princeton Traction Co. and the interurban lines at Dayton, O.

New Equipment for the People's Railway Co.

The People's Railway Co., of Dayton, O., has recently added to its equipment six closed cars built by the John Stephenson Co. The cars measure 20 ft. 10¼ in. over the end panels and 31 ft. over the vestibules. The platforms are 5 ft. 6 in. long; width over sills, 6 ft. 4 in., and over posts at belt, 7 ft. 7 in.; sweep of posts, 8 in.; height of car from track over trolley board, 11 ft. 3 in.; centers of posts, 3 ft. 3⅛ in.; corner posts, 3⅝ in. thick and side posts, 1¾ in. thick. The side sills are 3¾ x 6½ in., and the end sills, 5¾ x 4½ in. The sill plates are 6 x ½ in.

The unusually long platforms are intended to provide extra standing space. The entrance is at one side of the platform only, and the doors in the ends of the cars are of the Brownell "semi-accelerator"

SINGLE TRUCK CAR FOR DAYTON, O.

type, which by being set to one side and close to the vestibule entrance, enables passengers to pass in and out of the car without the way being obstructed. The cars are intended for city service, and with the long platforms and wide space between the longitudinal seats a carrying capacity is obtained which is equal to a much longer car with transverse seats and the ordinary type of platform. Where the majority of passengers carried make short trips this type of car has many points in its favor, among which is its lightness; the car weighs 10,500 lb. without motors, and therefore during such hours when traffic is light a number of units may be employed without undue waste of current.

Dayton is the terminus of a number of interurban lines running in every direction. The cars of the People's Railway Co. connect with a number of these systems and the company has several lines which run well into the suburbs, one of which terminates at Fairview Park, a popular amusement resort of the people of Dayton, owned and controlled by the railway company.

Union Traction Co. of Kansas.

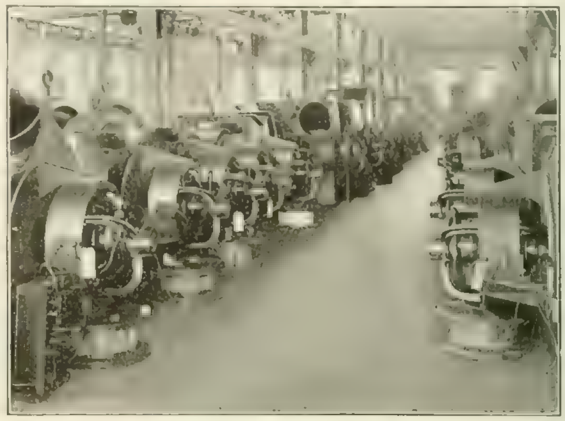
The Union Traction Co. of Kansas now has completed its grade from Independence to Coffeyville and is building the grade from Independence to Neodesha. The material for the track construction on the finished grade has been delivered and work is progressing rapidly.

The design and plans for the power equipment have been completed and the engines are now being built. There will be two main units, one of 600 kw. capacity and one of 300 kw. capacity. The generators of these units will be driven by Westinghouse horizontal tandem double-acting gas engines operating on natural gas, which at Independence, the location of the power house, costs 3 cents per thousand cubic feet. W. K. Palmer, Kansas City, Mo., is engineer in charge of the construction of this new line.

Service on the Tuscarawas traction lines between New Philadelphia and Uhrichsville was recently temporarily discontinued until attorneys for the traction company and the county commissioners arrived at some settlement regarding fares. The fare has been 10 cents, but conductors commenced charging a 20-cent rate and special officers ejected from the cars people who refused to pay the increase. A mob of several hundred people gathered at New Philadelphia Monday afternoon, October 23d, and threatened violence to the men operating the cars. The management decided to discontinue the serivce until the matter could be adjusted.

The New Plant of the B. F. Sturtevant Co.

As the growth and development of the B. F. Sturtevant Co. continued in its plant at Jamaica Plain, Mass., the accommodations for a thoroughly up-to-date manufacturing establishment became too restricted. While negotiations were in progress for the purchase of a new location near Boston, the works at Jamaica Plain were visited by a serious fire which destroyed a large amount of valuable machinery and threatened to severely cripple the business. With true American enterprise the business was practically placed in running order again within 30 days,

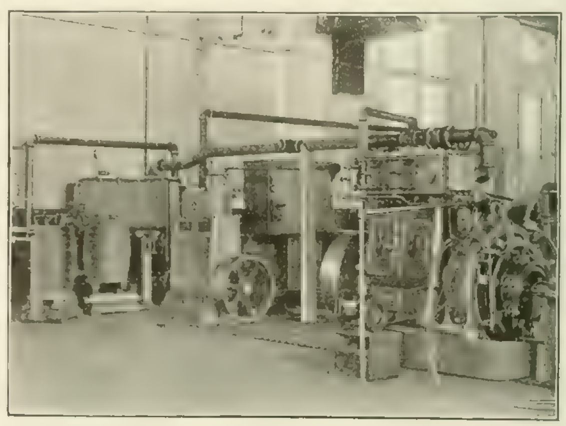


TESTING ELECTRIC FANS IN ELECTRICAL DEPARTMENT.

even though a nearly complete equipment of new machine tools had to be secured and put in operation in place of those destroyed. This disaster naturally hastened the final acquirement and development of a site for the new plant.

The most satisfactory site available was a lot of 20 acres in the town of Hyde Park, Mass., the new location being only six miles from the old plant. The lot has a frontage of about 1,300 feet upon the freight yard of the New York, New Haven & Hartford R. R. at Readville Station. Here new buildings were erected of about double the capacity of the old plant. The aggregate floor area of the new buildings is more than nine acres or nearly two and one-half times that of the Jamaica Plain plant. Employment is already given to about 1,300 hands although the plant will accommodate nearly 2,000.

The arrangement of buildings provides for a group parallel to the railroad tracks with accommodations for spur tracks between



ENGINES ON TESTING PLATE.

buildings, and an opportunity for growth of all important structures by extension in length. The type of construction is somewhat composite in its character consisting of steel interior columns and steel main girders, with heavy brick walls, wood timbered floors and plank roofs. In the case of the one story foundry, the roof is supported by steel trusses, in the other buildings open timbering with wooden columns in the upper floor is used. The main floors in the machine, fan and erecting shops are of tar concrete, upon which 3-in. hemlock planking is bedded in

liquid pitch and toe nailed together. The upper floors are carried upon hard pine beams. Maple top flooring is used in all cases. All roofs are of 3-in. plank with tar and gravel top.

The entire plant is electrically driven and lighted at 220 volts from a central power house containing at present one 100 kw. and one 250 kw. Sturtevant generating set; the power plant engines run condensing, the exhaust steam derived from engines under test upon the plate in the testing building is utilized for heating. The boilers are equipped with Sturtevant fuel economizers and the power house is placed sufficiently far from the ends of the buildings to permit of ample extension of each, and near to the water supply. Steam, electricity and compressed air are transmitted to the individual buildings through a concrete tunnel and a supplementary system of covered trenches.

NEW PLANT OF THE B. F. STURTEVANT CO., HYDE PARK, MASS.

Foundations for many of the buildings were put in during the late fall of 1901. Actual work of construction upon the foundry and pattern buildings began in July, 1902, and the first heat was poured six months from that time.

The pattern building provides at one end a two story portion 80 ft. square for carpenters on the first floor, and for pattern makers upon the second floor. The other portion of the building which is devoted to pattern storage is of about the same ground area and is provided with intermediate floors making four in all separated from the shop by double fire walls and automatic fire closing doors. This building is close to the foundry.

The foundry 170 x 350 ft. in dimensions is designed for the distribution of molten iron upon a floor track system, and is equipped with tracks of 24-in. gage bedded in concrete which form runways between the moulding floors. Two craneways run lengthwise of the buildings, and tracks extend beneath the crosswise travelling crane in the cleaning room at the end of the building. The brass foundry is located in one corner, a wash and locker room in the adjacent corner and the core room between the two. Storage for supplies is provided upon one side adjacent to the railroad switch. From the bins thus provided, the iron and fuel charges already weighed are carried directly to the charging floor.

From the foundry the castings pass to the rear of either the machine shop or the fan shop. The former is of the familiar gallery type, 500 ft. long, with wings 40 ft. wide, and central craneway of the same width designed for crane of 20 tons capacity. The lighting is secured principally by a series of sawtooth skylights running crosswise of the roof with glass facing due north. The present crane of only 10 tons capacity serves the entire floor and finally deposits the substantially complete engine or generator upon a transfer car which passes through to the testing building where a 15-ton crane picks up the machine, drops it upon the testing plate and subsequently carries it forward to the steam railway track which passes through the end of the building and provides space for the loading of two cars at a time. The upper floor of this building, together with portions of the adjoining buildings are devoted to the electrical department.

Both steam and industrial railway tracks enter the machine shop at the end farthest removed from the erecting shop. Industrial tracks cross the building at the center and both ends. The center cross track is in the direct line of transit from foundry to forge and fan shops. [illegible] the corner nearest the erecting shop is located the general store room and the office of the store keeper. The tools in the machine shop are arranged for the progress of the work from the open end toward the finished stores and erecting shop. The second floor of the machine shop is served by four elevators and an equal number of stairways. The galleries are connected at the ends by bridges. M[illegible] possible arranged for progressive operations. Space is left for additions in supplementary parallel rows. Large machines are direct driven by Sturtevant motors. Small tools in groups are motor driven through individual lengths of line shaft.

The building devoted to the manufacture of fans, heaters, etc., is 80 ft. in width, of the same length as the machine shop and three stories in height, of typical mill construction, provided with all conveniences for handling material. One-half of the length of the fan shop is served by a 5-ton travelling crane. Here are built steel plate fans for ventilation, mechanical draft and the like. Midlength of the first floor is the packing and shipping department, near the large 5-ton elevator which serves all floors. The other end of this floor is devoted solely to the manufacturing of heater sections for the Sturtevant steam hot blast apparatus.

Immediately above, upon the second floor, the cast iron fans are built. Nearly one-half of the third floor is devoted to galvanized iron work. Upon the same floor are set up the fan wheels ranging all the way from 6 in. to 20 ft. in diameter. The balance of this floor is devoted to the punching and commutator division of the electrical department, which is located upon the adjoining third floor of the erecting building.

At the other end of the building is the special store room for electrical supplies. The balance of this floor and of the intermediate floor below is devoted to winding, assembling, testing, etc. The balance of the first floor is given to the assembling of engines and to the packing, storage and shipment of these machines. The testing plate measuring about 30 x 60 ft. is completely equipped with steam and electrical connection; engines may be run condensing or non-condensing and efficiency tests conducted.

The smith shop 40 x 100 ft. in size is equipped with a full outfit of Sturtevant forges with blower for blast and exhaust for removing smoke. The equipment also includes power and steam hammers, together with heavy shears for cutting angles and tees.

The standard first floor height in the main buildings is 17 ft., that of the second and third stories is 15 ft. The windows are large and numerous. Ribbed glass is used in all but the lower sashes. All structural steel, window frames, racks, and bins and the walls up to a height of five feet are painted a rich green. The other portions of the walls and ceilings is covered with white cold water paint. The entire industrial equipment was designed and constructed by the B. F. Sturtevant Co.

All of the buildings are heated and ventilated by the Sturtevant system. The office is a model structure of its kind and serves as headquarters for the entire business. It contains the correspondence, accounting, designing and drafting offices, the production department, the advertising bureau, and a printing office and lunch room in the basement. It is four stories in height and was designed to suit the particular wants of the business as determined from experience at the earlier plant.

Personal.

MR. E. C. FOLSOM, formerly general superintendent of the Ft. Wayne & Wabash Valley Traction Co., has been appointed general manager and purchasing agent of the Atlantic City & Suburban Traction Co., with headquarters at Pleasantville, N. J.

MR. P. D. KLINE, who has been associated with the Sheboygan Light, Power & Railway Co., Sheboygan, Wis., for the past nine years, during the last six of which he has been superintendent, has resigned to become superintendent for the Coal Belt Electric Railway Co. at Marion, Ill.

MR. T. K. WELLS has been appointed superintendent of transportation of the Manila Electric Railway & Lighting Co., of Manila, P. I. Mr. Wells has had a wide experience in railroad work, having been with the Wabash R. R. and the St. Louis, Iron Mountain & Southern R. R. for 14 years, and with the Syracuse Rapid Transit Co. for eight years.

MR. RICHARD D. BEATTY, formerly with the Westinghouse company at Pittsburg, Pa., has been appointed general manager of the Eastern Ohio Traction Co., Cleveland, O. Mr. George T. Bishop, receiver of the property, and who has acted in the capacity of general manager since its receivership, will devote a greater portion of his time to the development of the Washington, Baltimore & Annapolis road, of which he is president.

MR. THOMAS DAVIS, who has been in the employ of the Boston Elevated Railway Co. for some time, has been appointed superintendent of power stations, a position recently created. The duties of the superintendent of power stations will be the proper care, maintenance and operation of all generating plants and equipment connected therewith, including storage batteries, and he will report direct to the superintendent of motive power and machinery.

MR. A. B. CONOVER, who has been associated with the John A. Roebling's Sons Co., since 1888, has succeeded Mr. George C. Bailey as general manager of the company at Chicago. Prior to entering the service of the Roebling company Mr. Conover was sales agent for the Buckthorn Fence Co., Trenton, N. J., resigning in 1888 to become associated with the Roebling company in the Chicago office, since which time he has been closely identified with Mr. Bailey.

MR. JOHN LINDALL, general foreman of shops, Elevated Division, Boston Elevated Railway Co., has succeeded Mr. C. F. Baker as superintendent of motive power and machinery. Mr. Lindall is well known to readers of the "Review" and electric railway men throughout the country, having read a paper on "Maintenance and Inspection of Electrical Equipment," before the American Railway Mechanical & Electrical Association at St. Louis, Oct. 11, 1904.

MR. C. O. SIMPSON, who has recently resigned as auditor and treasurer of the Birmingham Railway, Light & Power Co., to become general manager and treasurer of the Little Rock (Ark.) Railway & Electric Co., was born in Troy, N. Y., Aug. 20, 1865. At the age of 16 years Mr. Simpson was cashier of the leading dry goods store in that city, which position he held for four years, resigning on account of ill health to go west in the spring of 1885. In the fall of the same year he went to Kansas City, where he engaged in the lumber business as representative of a southern mill owner. March 2, 1888, he was offered a position in the auditing department of the Metropolitan Street Railway Co., where promotions to responsible positions followed, and he became assistant auditor. In October, 1898, Mr. Simpson left the service of the Metropolitan Street Railway Co. to take charge of the auditing department of the Augusta Railway & Electric Co., Augusta, Ga., and become secretary of the Augusta Gas Co. While connected with these companies Mr. Simpson read a paper before the Kansas City convention of the Street Railway Accountants' Association on "The Routine of a Street Railway, Electric and Gas Lighting Company." While in the employ of the Augusta companies he organized an employes' benefit association, which is still in existence and of great benefit to the company and employes. In September, 1901, he accepted the position of auditor and treasurer of the Birmingham Railway, Light & Power Co., which position he retained to his present appointment with the Little Rock system. In October, 1887, Mr. Simpson married a Kansas City young lady, and his wife and four children will shortly join him in Little Rock. While in Birmingham Mr. Simpson took an active part in local affairs, was director in the Y. M. C. A. and chairman of its educational committee, and is a stockholder and director in the Citizens' Savings Bank. Mr. Simpson has always taken an active interest in the work of the Accountants' Association, being a member of the executive committee in 1900 and second vice-president in 1904.

MR. HOWARD B. ARNOLD has resigned his position as auditor of the Dayton & Northern Traction Co. to enter the supply business, and is now sales agent for Shelby trolley poles, Barrett jacks, Lyon sheet steel gear cases and other electric railway supplies, with headquarters at Dayton, O.

MR. F. A. DEVERELL, formerly auditor of disbursements of the Pere Marquette System, has been elected secretary and treasurer of the Columbus, Buckeye Lake & Newark Traction Co. and the Columbus, Newark & Zanesville Electric Railway Co. These properties were recently purchased by a syndicate of which Mr. W. Kelsay Schoepf is the head. Mr. Deverell has established his offices in the Traction Building, Cincinnati, O.

MR. ISAAC McQUILKIN, for the past two years comptroller of the Indiana Union Traction Co. at Anderson, Ind., has resigned to become comptroller of the Bristol Belt Line Railway Co. with offices at Bristol, Tenn. Mr. McQuilkin is an active member of the Street Railway Accountants' Association and last year was its second vice-president. Mr. W. H. Forse, who has been in the auditing department of the company for the past two years, has been appointed auditor to succeed Mr. McQuilkin.

MR. W. S. MENDEN, general superintendent of the Metropolitan West Side Elevated Railway Co., Chicago, has resigned to become chief engineer of the Brooklyn Rapid Transit Co., and the position of general superintendent has been abolished. Mr. Benjamin H. Glover, formerly with the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., has been appointed superintendent of motive power and way, and Mr. M. J. Feron has been appointed superintendent in charge of train and station service.

MR. WARREN BICKNELL, president of the Lake Shore Electric Co., Cleveland, O., expects to leave the service of the company some time during January, 1906, as his tenure of office expires at that time. Mr. Bicknell will become president of the Cleveland Construction Co., and will devote his entire attention to its business of promoting and developing several traction properties. Mr. Bicknell has been appointed as one of a committee of five to manage the affairs of the Missouri Valley Electric Railway Co. during its construction. This road, as described on another page of this issue, will be built between Kansas City and St. Joseph, Mo., with branch lines to Leavenworth and Atchison, Kas., making a total mileage of 58 miles. It is also understood that he will have charge of the building of the Youngstown & Ohio River Ry., which will connect Youngstown and East Liverpool, O.

GEORGE S. HASTINGS, Cleveland, O., general sales agent of the street railway department of the Germer Stove Co., Erie, Pa., has recently completed arrangements for representing other manufacturers of electric railway supplies in the middle states. The National Electric Co's. complete line of electrical machinery, including Christensen air brakes, will be handled by Mr. Hastings throughout Ohio, Indiana, Michigan, West Virginia and New York as far east as Schenectady, and electrical machinery only in Pennsylvania as far east as Johnstown. He will also handle in this same territory the products of the Blake Signal & Manufacturing Co., of Boston, Mass., manufacturer of the well-known Blake electric railway signals and telephones.

Mr. Hastings enjoys a wide acquaintance in the electric railway field, and the arrangements he has made for handling these supplies will be mutually pleasant and profitable to all concerned.

MR. C. F. BAKER, superintendent of motive power and machinery of the Boston Elevated Railway Co., has resigned to become associated with the Brooklyn Rapid Transit Co. in a similar capacity. Mr. Baker has had charge of the power and rolling stock for the West End and Elevated companies since 1893. For many years he was master mechanic, but his title changed when the Boston Elevated Railway Co. was organized. Previous to his coming to Boston, Mr. Baker was chief engineer of the Pillsbury-Washburn Flour Mill Co., at Minneapolis, for several years. Before he went to Minneapolis he was with the Edward P. Allis Co., in Milwaukee. On Friday evening, October 27th, a reception was tendered Mr. Baker by the officers and employes of the Boston Elevated Railway

Co. at the American House, Boston. As a testimonial of esteem he was presented a handsome diamond ring, the presentation speech being made by Mr. John Lindall, his successor at Boston.

Mr. A. P. PECK, who is well known in the middle west as a successful salesman of electrical machinery, has joined the Allis-Chalmers Co. and will hereafter be connected with the New York office of that company. Mr. Peck is an associate member of the American Institute of Electrical Engineers. He is a native of Chicago, and was graduated from Purdue University in 1892 with the degree of B. M. E. and E. E. He then secured a place with the World's Columbian Exposition Co., and was identified with the Electrical Engineering Department of the Chicago World's Fair until January, 1894, as assistant engineer of arc lighting. From 1894 to 1896 he was with the Westinghouse Electric & Manufacturing Co. It was under his supervision during this time that the motors and wiring were installed in the cars of the Chicago City Railway Co.

A. P. PECK

Mr. Peck began his career as a salesman in 1896, and in 1898 became identified with the manufacture of electric signs, and was engaged in that business for three years thereafter. His next connection was with the engineering department of the Chicago Edison Co., resigning about three years ago to join the National Electric Co. as electrical sales agent. Mr. Peck's connection with the Allis-Chalmers Co. began in the early part of October.

Obituary.

MR. GEORGE C. BAILEY, general manager and secretary and treasurer of the John A. Roebling's Sons Co. in Illinois, died at his home, 5224 Jefferson Ave., Chicago, Friday, October 27th. Mr. Bailey was born in Lambertville, N. J., March 14, 1843, and at the age of 14 began work in Princeton, N. J. Two years later he moved to Trenton, N. J., where he entered the employ of Titus Bros., woolen manufacturers. Later Mr. Bailey became associated with the John A. Roebling's Sons Co. as western traveling representative, and at the time of the opening of its western branch at Chicago in 1886 was appointed general western manager. It is interesting to note in this connection that the western business of the company was developed by Mr. Bailey and the confidence that was placed in him by his employer was shown in the selection of him to purchase the site of the present location of the company's Chicago office and to open it. At the time of the incorporation of the Roebling company of Illinois he was appointed secretary and treasurer of the company.

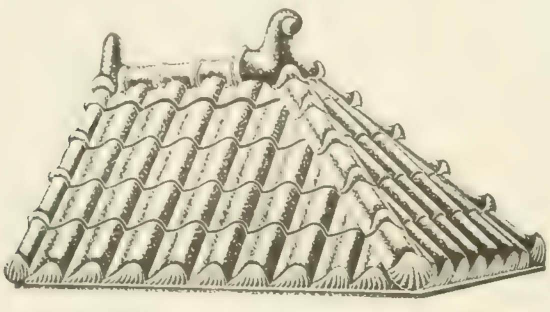
GEORGE C. BAILEY.

Mr. Bailey was connected with the Roebling company in Trenton five years prior to the opening of the Chicago office, and has since been associated with the company. His long service in the supply business made for him innumerable acquaintances, and his integrity, capability and strength of character have endeared him particularly to a large circle of friends in the electric railway field with whom he had been associated since the industry was begun. Mr. Bailey was an active member of the Chicago Electric Club during its existence and a prominent member of the Union League Club of Chicago. The funeral services were held October 30th at the Hyde Park Presbyterian Church, Dr. Joseph A. Vance officiating, and the body was conveyed to the receiving vault at Oakwoods Cemetery. He is survived by his wife and two children.

Metal Tile Roofing for Power Houses.

Among the many features incorporated in the manufacture of metal roofing, the Berger Manufacturing Co., Canton, O., claims for its products the following noteworthy and vital advantages: A thoroughly scientific construction yielding the highest efficiency; ease of application and wide adaptability to varying conditions and requirements; and remarkable durability and low cost, in connection with artistic features that blend harmoniously with any style of architecture.

The style of roofing shown in the accompanying illustration is known as the "Spanish" tile roofing. This illustration is of a complete roof, showing the tile with ridge moulding, gable moulding, hip mouldings and terminals. In the construction of this roofing expansion and contraction are fully provided for, and a water-tight roof is furnished, when the material has been properly applied. The tile roofing plates are large and the roofer is thereby enabled to apply them rapidly and economically. One of the many advantages in using the metal tile roofing is that no special roof framing is necessary, nor must the framing be unusually strong.



COMPLETE SPANISH TILE ROOF.

This tile roofing is manufactured in four different styles of copper, zinc, galvanized steel and terne tin plates. Of these the "Spanish" tile is considered more adaptable to public buildings, such as hospitals, hotels, railway stations, power houses, etc. The Berger company also manufactures an extensive line of metal ceiling, sheet metal roofing and siding, eave troughs, cornices and architectural sheet-metal work.

Warren & Jamestown Street Ry.

The Warren & Jamestown alternating-current railway system operating between Warren, Pa., and Jamestown, Pa., recently began operation. The electrical equipment has had several weeks' preliminary run from a small gas engine-driven unit temporarily installed in the power house at Stoneham. On October 19th the large gas engines were placed in service for the first time and a permanent operating schedule was inaugurated.

Probably the most interesting feature of this system is the exclusive employment of horizontal double-acting gas engines of the heavy-duty type for the generation of power to operate the road. Two of these engines are now installed, the first of which is already operating. The second will be placed in service in a short time. These two engines will be called upon to operate in parallel on the electrical end. As it is not possible to utilize storage batteries to absorb the load fluctuations, the engines are called upon to sustain them and are thus put to severe test.

The two units installed are each of approximately 500 brake h. p. capacity direct connected to 260-kw. revolving-field engine-type single-phase generators. Each has two cylinders arranged in tandem fashion with a single crank. They will operate entirely upon natural gas distributed by a local company. A 55-h. p. vertical Westinghouse engine of the single-acting type is also in operation driving the air compressor and exciting unit for the main equipment. Current is generated directly at a voltage suitable for transmission without the use of transformers. Transformer sub-stations are located along the right of way. These reduce the line voltage to 3,300 volts for the trolley at which pressure it is collected by the cars.

Cincinnati, Toledo & Detroit Short Line.

The final location and engineering work for the line of the Cincinnati, Toledo & Detroit Short Line Railway Co. has been completed between Toledo and Defiance, O., and construction work has begun. The Gardner Co., of Toledo and New York City, has the contract to build and equip the entire line of 220 miles between Toledo and Cincinnati, passing through the counties of Lucas, Henry, Defiance, Paulding, Van Wert, Mercer, Drake, Preble, Butler and Hamilton. As now planned the line will intersect all east and west steam railroad trunk lines between Lake Erie and the Ohio River, 29 in all, and in crossing the state will connect with the lines of seven interurban railway companies, as well as 14 other interurban lines and systems in the terminal cities.

The roadbed will be constructed after standard steam road specifications, using 70-lb. rails. A private right of way will be used except through towns and cities. The proposed location parallels the public highways for a large part of the distance. The line will be built for a high-speed service. There will be few curves, and those of large radius, which with easy grade will permit of high speed service. Mr. W. A. Calhoun, consulting engineer of the Gardner Co., is in charge of the work.

New Fast Trains in Indiana.

When the Indiana Union Traction Co. started two new high-speed trains, known as the Marion Flyer, October 22d, steam railway men were interested in the running of the trains because of the reduction of time from one hour and 40 minutes to one hour and 15 minutes for the 34 miles between Anderson and Marion. The first train left Marion at 8 a. m., and plunged into a rainstorm, arriving at Anderson at 9:16. The second made the run in the schedule time of 75 minutes, and showed that the new schedule can be maintained.

It was regarded as the fastest time ever attempted on an Indiana electric line, for between Anderson and Marion there are 14 railway crossings of main lines and switches, where full stops must be made and the car must be signaled ahead by the conductor. Two stops are made in Alexandria, and 15 miles of the right-of-way between Anderson and Marion is within the corporate limits of cities and towns, where speed must be reduced. A speed of 30 to 35 miles an hour was maintained between some of the stations. From Anderson to Indianapolis the Marion Flyers went as first sections of the regular limited trains, but reduced the running time five minutes, covering the 39 miles of electric line to the Indianapolis terminal station in 85 minutes. Returning, the new trains were on the limited car time of 95 minutes to Anderson, and then 75 minutes to Marion.

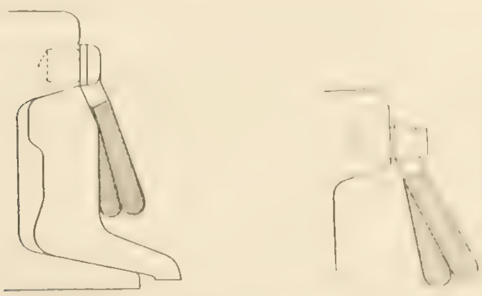
Central Railway of Missouri.

A complete engineering location party is now in the field determining the route of the Central Ry. of Missouri. It is proposed to first build this line from Sedalia north through Marshall to the town of Miami on the Missouri River. This general route is about 45 miles long and will furnish transportation facilities both for passengers and freight to a territory which at present has no railroad running north and south. The existing steam lines which the new electric line will intersect are the Chicago & Alton R. R., Missouri Pacific Ry. and Wabash R. R.

The ruling gradient of this line will be one per cent with a limiting rate of curvature of four degrees. The roadbed and track will be thoroughly built to steam railroad standards, using 75-lb. rails and rock ballast. Power for the operation of the trains and for lighting purposes will be generated in one central power house, located at the point where the track crosses the Blackwater River. The financial interests, which will build the proposed road, own a coal mine at the proposed power house location so that as coal and water are easily available the location seems an excellent one. It is proposed to carry on a general freight and passenger business similar to that of steam roads of like size. The engineering work for the Central Ry. of Missouri is being conducted by W. K. Palmer, 718 Dwight Building, Kansas City, Mo.

Twin Terminal Rail Bonds.

A new form of rail bond that gives promise of supplying an exceptionally perfect electrical connection for all track work is being introduced by the American Steel & Wire Co. The new bond is of the type which is applied to the back of the ball of the running rail. It consists of a short flexible body made up of two pieces of cable with each end provided with terminals having two small



END VIEW OF BOND AS APPLIED

solid exterior-hardened copper bosses. The bosses are driven rigidly into holes drilled in the outer side of the ball of the rail, as shown in the illustrations.

When installing a bond, the hole centers are first marked with the aid of a template, then are drilled in the usual manner. The holes are small and being bored in the ball of the rail, the strength of the rail is not impaired. When the four holes have been made ready for the reception of the terminals the hardened copper bosses are inserted and compressed in the usual way, either with hydraulic compressors or screw compressors. Just before the terminals are inserted recesses are made with a chisel in the sides of the holes so that when compressed the copper is solidly anchored in the hole.

Some of the advantages which are apparent in the use of this new type of bond are large terminal capacity with double bosses at each end, low price and expense of installation; it can be attached with- [illegible] tact is obtained. The body of the band is short. The duplex cable of horse shoe shape makes the bond especially free from trouble caused by movement of the rail, and as the holes are sealed from air and moisture by the expanding of the copper, the contact sur-

TWIN TERMINAL BOND IN PLACE

faces remain clean and of low resistance. Due to its exposed position on the outside of the ball of the rail, it is easily inspected. The small amount of copper in the entire bond does not induce theft and if properly installed no copper can be removed except by breaking.

The American Steel & Wire Co. keeps in stock hydraulic tools, hydraulic compressors or punches, grinding motors, etc., for installing any of its many forms of bonds. The bonds manufactured include the "Crown" and "United States" bonds of the well-known under-fish plate type, several types of soldered bonds, and the new twin terminal bonds.

Advertising Literature.

THE MINNESOTA SCHOOL OF MINES has recently published No. 11, Vol. 8, of the University Bulletin, which is issued every six weeks during the university year. This issue contains a general statement regarding the university calendar, program of the examinations, etc., a list of the faculty, and information regarding admission, fees, courses of study, courses of instruction, and a register of students.

THE AMERICAN STEEL & WIRE CO. has recently issued an attractive pamphlet descriptive of its rail bonds and equipment for installing them. These products include "Crown" and "United States" terminal stud rail bonds, several types of soldered rail bonds and the company's well-known twin terminal rail bonds. The equipment for installing these bonds includes double-burner brazer, clamps, hydraulic compressors, motors and grinding machines.

THE NOVEMBER NUMBER OF THE PUBLICITY MAGAZINE, published by the Under-Feed Stoker Company of America, contains, as usual, many interesting features. This month, a tabulation of shipments and a list of recent sales is shown. Among others we note, as pertaining to the street railway field, shipments to the Hagerstown Railway Co., Hagerstown, Md., four stokers; Georgia Railways & Electric Co., Atlanta, Ga., eight stokers, being a second order; and four stokers to the Winnebago Traction Co., Oshkosh, Wis.

THE C. LEE MANUFACTURING CO., of Louisville, Ky., has published an interesting catalog and description of Cook's metallic packing, for use with steam and air, and for reciprocating and turbine engines. Some of the users of this well-known packing in the electric railway field are the Brooklyn Heights Railroad Co., Chicago & Milwaukee Electric Railway Co., Cleveland Electric Railway Co., Detroit United Ry., Indianapolis Traction & Terminal Co., Interborough Rapid Transit Co., Milwaukee Electric Railway & Light Co., Philadelphia Rapid Transit Co., Public Service Corporation and the Twin City Rapid Transit Co.

THE NATIONAL ELECTRIC CO. has recently published a very complete description of its belt-driven alternating-current generators in Bulletin No. 358. A large number of valuable improvements which represent the latest development of engineering design have been incorporated in the construction of these machines. The belted-type alternators are manufactured by this company in two types, which it has termed the "R B" type and the "R C" type. In the former type the bearings are supported on a cast sub-base, while in the latter the bearings are supported from the stationary armature frame. In addition to a description of these machines considerable valuable data regarding their operation is included in the bulletin.

THE ARNOLD CO., engineer and contractor, Chicago, Ill., is now distributing Bulletin No. 13, descriptive of the hydro-electric plant of the Spring River Power Co., Joplin, Mo. The bulletin, profusely illustrated by a large number of half-tone engravings and zinc tracings, shows the construction of the dam and power house, details of transposition, transmission lines, sub-station and transformer house equipment. The style of the publication is similar to that of former bulletins issued by the company, with which our readers are familiar. The Spring River Power Co. has been organized and built for the purpose of developing the water power along Spring River for utilization throughout the rich mining district in the vicinity of Joplin, Mo.

THE KEYSTONE ELECTRICAL INSTRUMENT CO., of Philadelphia, Pa., has recently published its catalog No. 13, which is a supplement to catalog No. 12, and does not supercede the latter. This publication describes and illustrates the electrical measuring instruments manufactured by this company, and will be found of particular interest to engineers and central station operators. The company is also distributing a circular which, in its nature, is supplementary to catalog No. 13, in which the patent situation and its relation to Keystone instruments is very clearly set forth. The company has recently established sales offices in the following cities: Boston, F. B. Smith, 170 Summer St.; New York, Arthur Organ, 114 Liberty St.; Philadelphia, Louis J. Costa, 1229 Real Estate Trust Building; Pittsburg, J. L. Merrill, 1526 Park Building; Chicago, Wm. P. Crockett, 165 South Canal St.; St. Louis, St. Louis Electrical Manufacturing Co., Seventh and Hickory Sts.

THE ELECTRICAL TESTING LABORATORIES, 80th St. and East End Ave., New York City, has recently published in pamphlet form a description of its plant, which is a reprint of an article by Clayton H. Sharp, Ph. D., that appeared in the columns of the Electrical World and Engineer.

TWO RECENT PAMPHLETS published by the American Spiral Pipe Works, Chicago, describe and illustrate the products of the company in a very interesting manner. These include the "Swartwout" exhaust head, forged steel pipe flanges and Taylor's spiral rivited pipe for all purposes.

THE LOCKE INSULATOR MANUFACTURING CO., Victor, N. Y., has published supplement No. 1 to catalog No. 8, the Insulator Book, to keep all interested informed of revisions and additions to its products. The items covered in this supplement include bushings, crates for shipping insulators, various types of insulators, panels and pins.

THE OCTOBER NUMBER of the Monthly Bulletin, published by the Ohio Brass Co., Mansfield, O., has a number of articles of interest to street railway men. Under the head of Practical Suggestions is an article entitled "The Selection of Overhead Material," by F. S. Denneen, this being of a series of articles on subjects of interest to railway men, each article being complete in itself.

THE FIDELITY & CASUALTY CO., 97 Cedar St., New York City, is distributing a supplement to its Monthly Bulletin, entitled "Fly Wheel Explosions." This is a reprint of an article by William H. Boehm, which appeared in the June, 1905, number of "Insurance Engineering." The Fidelity & Casualty Co. is offering a flywheel policy to the public and this article was written by the superintendent of the flywheel department.

THE UNDER-FEED STOKER CO. OF AMERICA, 837-847 Marquette Building, Chicago, has recently issued a pocket edition of its catalog descriptive of the Jones under-feed mechanical stoker. The publication includes a very complete description of this stoker. Some sixty engravings and drawings are used to illustrate the installation and operation of the device, as well as valuable efficiency tables and a table on height of chimneys.

THE AMERICAN BLOWER CO., Detroit, Mich., has recently published three interesting pamphlets relative to its products. These include its illustrated sectional catalog No. 186, "ABC" heating apparatus for the heating and ventilating of factory and public buildings and the drying of materials of all kinds; sample specifications for vertical, enclosed, self-oiling, high speed, automatic engines manufactured by the company; and a statement of the relative cost of fuel, depreciation, lubrication, attendance and water consumption of the "ABC" engines as compared with other engines.

IT IS WITH REGRET that we note that the Rand Drill Co., 11 Broadway, New York City, has discontinued the publication of its house organ, "Air Power." This publication has given to its readers many valuable and interesting articles regarding the application of compressed air in various kinds of work, and in the October number (which is the last issue) are included articles on the application of compressed air in railroad work, in mining and rock-drilling, and city water supply; also data on proportioning air receivers and the amount of air required to operate rock drills.

THE DEMING CO., SALEM, O., is distributing its catalog G, in which are described and illustrated the many types of pumping machinery manufactured by the company for operation with any power. The appartus includes single and double-acting triplex pumps for various services, power deep-well working heads, artesian well cylinders, rotary and centrifugal pumps. The publication also includes a telegraph cipher code, directions for setting up and operating pumps, rules for determining the size and speed of pulleys or gears, and various tables of capacity of pumps, etc.

THE WESTINGHOUSE MACHINE CO. announces with a recent pamphlet a new branch of business which it is just entering, the manufacture of storage batteries for railway signal service. The advantages claimed for these batteries are exceedingly long life, absolute freedom from injurious sulphation, maximum efficiency and ability to operate with greatest efficiency under high rates of charge and discharge. Signal engineers will find this little pamphlet interesting. Circular No. 1119, of the Westinghouse Electric & Manufacturing Co., illustrates and describes the various types and sizes of motor-generators manufactured by the company.

STREET RAILWAY REVIEW

Vol. XV DECEMBER 15, 1905 No. 12

The Detroit, Flint & Saginaw Railway Co.

Being a Description of the Territory Served, Roadway Construction, New Power House and Equipment.

BY EDWARD [illegible]

The Detroit, Flint & Saginaw Railway Co. was organized Nov. 5, 1903, with a capital stock of $1,000,000, for the purpose of constructing and operating an electric line from Detroit to Saginaw, Mich. The preliminary plans were laid out so that the line would afford rapid and frequent service between intermediate points and offer the farmers along the route a means for marketing their products.

The community through which the line passes is thickly settled, and as the towns which it connects are thriving industrial centers it is believed a good healthy passenger and freight traffic can be built up. Saginaw, the northern terminus, is surrounded by rich salt quarries and coal mines and is the center of the beet sugar industry of the state. As soon as the system of freight carrying cars can be equipped it is anticipated that the road will have all it can do to handle the freight offered for transportation.

The work of grading the line was begun at the Saginaw end, soon after the company was organized. Franchises had already been obtained from the township boards for constructing the electric roadbed along the sides of the public highways. The first car was run over the tracks from Holland Ave., Saginaw, to Bridgeport, a distance of six miles, on May 1, 1904. Later in the year the line was completed to Frankenmuth, 6½ miles from Bridgeport, and an hourly schedule has since been maintained between that point and Saginaw.

The plan of the company as originally drawn was to follow the highway east from the present Frankenmuth terminal to Tuscola village, thence south through Arbela and Thetford townships to Clio, thence parallel to the Pere Marquette R. R. to Mt. Morris and Flint. During the past few months, however, the plans have been changed and it is now proposed to turn southeast on a private right of way at Cook's Corners and follow along near the old state plank road, which runs nearly parallel to the Pere Marquette, to Flint, tapping a rich and thickly populated farming community enroute.

From the present Frankenmuth terminal the management expects to continue the line to Tuscola and Vassar, making this a spur of the main line. The Detroit-Flint part of the project has been abandoned for the present.

On the line between Saginaw and Frankenmuth, other than the usual swings in the highways, there are only two curves. One of these turns an angle of 20 degrees with a curve of 240 ft. radius, and the other turns an angle of 7 degrees with a curve of 819 ft. radius. The line is located in a comparatively level country so that with a very few exceptions little work was required to keep the grades below one per cent. As a rule the track follows the natural contour of the country through which it passes. Coal shale from the mines in the vicinity of the line was used as the preliminary ballast and up to this time no additional dressing has been applied. As soon as connection with the Tuscola gravel pits can be made gravel ballast will be distributed the entire length of the line.

VIADUCT OF DETROIT, FLINT & SAGINAW RAILWAY CO. OVER THE [illegible]

At the city limits of Saginaw the company's tracks connect with the Genesee St. lines of the Saginaw Valley Traction Co., over which they are allowed to run. The company has a running contract with the traction company by which it is not only allowed to carry its own passengers but is allowed to pick up and carry passengers inside of the city limits. In order that an accounting may be made two registers, one for the city and the other for the suburban traffic are used. By this method patrons from the outside districts going into the city are required to pay two fares, one to the city limits and a 5-cent fare inside of the city.

Track and Overhead

The tracks are laid with T rails, 80 and 75 lb. per yard, mounted on hewn 6x8-in. x 8-ft. cedar ties with 2-ft. centers. The joints of the rails are broken and suspended. They are connected by the Illinois Steel Co's. standard six-hole angle bars and the Ohio Brass Co's. 10-in. figure-8 copper bonds with 7/8-in. terminals.

The trolley and feed wire poles are 30 and 35 ft. in length and

[illegible] HIGHWAY

have as a minimum size 8-in. tops. They are set 5½ ft. in the ground. The 35-foot poles are used where it will be necessary, when the road is extended, to string extra feed wires. The Ohio Brass Co's. tubular iron trolley arms and hangers are used the entire length of the line, except in the village of Bridgeport, where span wires, with fittings the same as on the balance of the line, are used. On the overhead crossing as illustrated the trolley supports are of special design. They are made of 2½-in. pipe, 21 feet high, with 12-ft. 8-in. arch. Angle iron braces are used to make the supports stiff at the top. The bases of the supports rest on the bent caps to which they are fastened by 5/8 x 6-in, lag screws. The trolley is round copper No. 00 wire and is suspended 17 ft. above the rails.

Viaduct.

One of the interesting features of the road is the viaduct constructed in order to avoid a grade crossing with the Pere Mar-

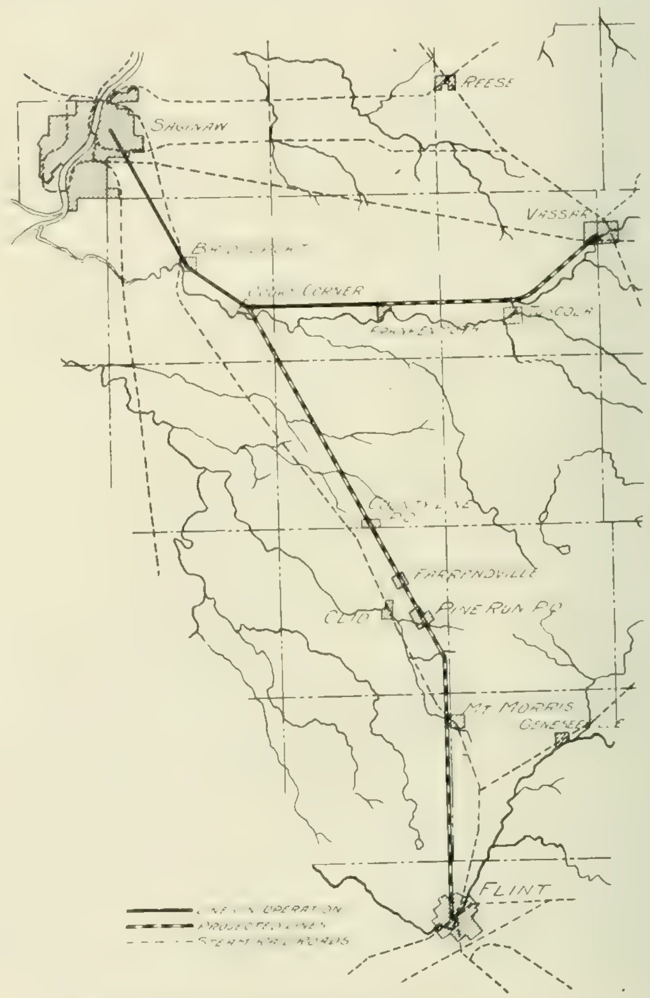
[illegible] LOCOMOTIVE CAR

quette R. R. The bridge proper and the approaches have a combined length of 1,488 ft. The steel span is 168 ft. long. On either side of the center span is a trestle incline 460 ft. long and a fill for 200 ft. The span rests on concrete abutments with 22 x 4-ft. faces, giving a clearance of 18 ft. 6 in. above the rails of the steam road. The foundations of the abutments are 6 ft. 6 in. below the level of the ground. The concrete work is a 1-3-5 mixture. Four-pile bents, spaced 14 ft. apart and cross-sway braced in two directions, are used. The braces are fastened at the ends with ¾-in. bolts. The piles are white oak and Norway pine. Twelve by fourteen-inch caps and 8 x 16-in. double stringers are used. Coal shale and earth are used in the approach fills. The approaches have a grade of three per cent.

Power House.

The power plant of the Detroit, Flint & Saginaw Railway Co., located at Bridgeport, was completed in October and was turned over to the railway company by the contractor, the Prather Engineering Co., Nov. 10, 1905. Since the plant was started no time has been lost because of lack of power and the plans, as laid down by the company several months ago, have been executed smoothly.

By the completion of the new power house the company can better handle its cars and expects soon to give a much faster schedule than has heretofore been possible. Previous to October 4th the



MAP, SHOWING ROUTES OF DETROIT, FLINT & SAGINAW RY.

power for operating the line was supplied by the Saginaw Valley Traction Co. from its city line feeders.

The new power house is of sufficient capacity to supply the road with the power needed for the entire system when completed. The building is 64 x 100 x 25 ft. in size. It is constructed entirely of sand-lime brick. The boiler and engine rooms are large enough for the installation of another boiler and engine.

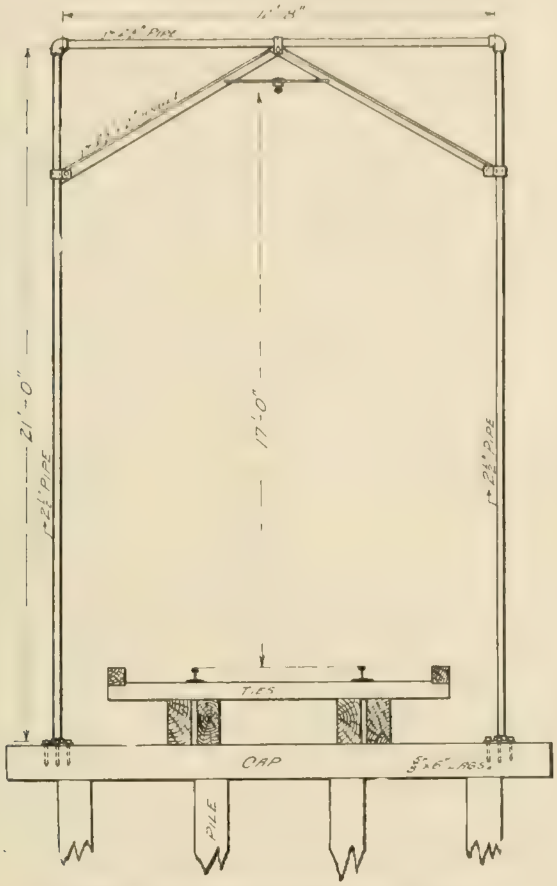
Two engines of 375 h. p. capacity each, one right and one left hand, are directly connected to two National Electric Co. 550-volt, railway type generators of 250 kw. capacity. The engines have cylinders 15 and 30 x 20 in. and are of the Fleming side crank, tandem compound type, manufactured by the Harrisburg Foundry & Machine Co., Harrisburg, Pa. They have a speed of 175 r. p. m. and operate on 150 lb. steam pressure at the throttle. The main shafts are 11 in. in diameter and the fly wheels have a diameter of 90 in. with a 22-in. face and 3-in. rim. Only one of the engines is run at a time, and at present only one-third of the capacity of either engine is needed.

Steam is generated in a battery of two 250 h. p. Cahall horizontal water tube boilers fitted with superheaters. The furnaces are equipped with McClave rocking grates. A steel smoke stack 8 ft. in diameter and 150 ft. high provides draft for the fire.

Six-inch pipes lead from the boilers to a 9-in. main header. The engine connections are also 6-in. piping. The pipe, valves and specialties were supplied by the American Foundry & Construction Co.

There are two boiler feed pumps with cylinders 7½ and 4½ x 6 in. in size and one general service pump 10 and 6 x 10 in. in size which supply the water from the intake well to feed the water heater, fire plugs and furnish the supply for general usage. A 6-in. pipe leads from the well to the boiler feed. The feed water pumps are so arranged that if the service pump fails taps can be made and water for general use can be furnished by them.

The arrangement of the condenser is one of the unique features of the plant. A 12 x 18 x 24 in. air pump and jet condenser is located in a pit 11 ft. deep with a long diameter of 17 ft. and a short



SKETCH OF TROLLEY SUPPORT ON VIADUCT.

diameter of 11 ft. The top of this pit is flush with the basement floor immediately under the engine room. From the pit to the intake well a tunnel 3 ft. high and 2½ ft. wide is so constructed that the pipes leading to and from the pit can be repaired, in case of accident, without delay. The walls of the tunnel are brick and the floor cement. Three pipes, the boiler feed, the condenser injection pipe and the condenser discharge, are laid in this tunnel.

The pit itself is built of cement and is so arranged that when the water gets too high it can be drawn out by means of a suction pipe. The condenser is regulated by hand-wheels from the engine room.

Provision for free exhaust is made by means of a 12-in. atmospheric exhaust pipe with an automatic valve.

A Cochrane feed-water heater and purifier is used. This has a 9-in. exhaust inlet and outlet, 2-in. feed-water supply connection and a 4-in. feed-water suction. A large Bundy steam trap takes care of the condensation from the steam separators and from the main steam headers, returning the condensation to the feed-water heaters. Two small traps of the same make care for the condensation from the engine receivers.

[illegible]

[illegible]

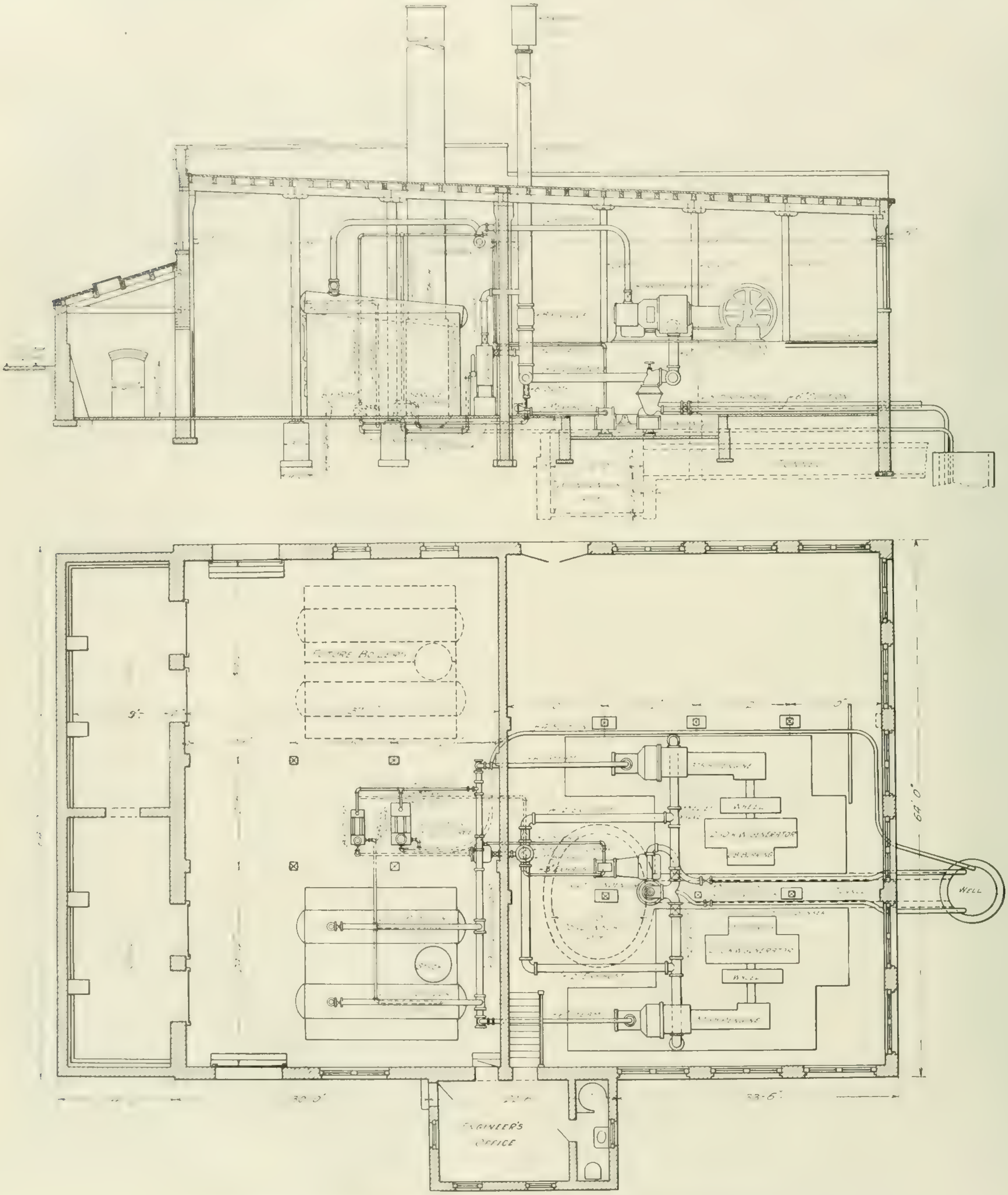
traffic demands it another will be strung. Provision has been made for two separate lighting circuits for the villages of Bridgeport and Frankenmuth.

One of the [illegible] tion in respect to the Pere Marquette R. R. and the Cass River. The plant is served by a switch from the main line, thus having its coal and maintenance supplies delivered at the doors of the building. A [illegible] its own line into Mine No. 2 of the Consolidated Coal Co. This

[illegible]

mine, [illegible] 700 ft. from the electric line, produces coal of a superior quality. As soon as this spur can be built the coal will be hauled from the mine in the electric company's cars and used as fuel for the power house. The officers of the company anticipate that by this means [illegible] the year.

The location of the power house on the bank of the Cass river assures an abundance of feed water at all times of the year. Just outside the power house and on the level of the river an intake well 30 ft. deep has been constructed. The water is unusually clear for river water and does not carry much lime or other ingredients.



PLAN AND VERTICAL SECTION OF NEW POWER HOUSE, DETROIT, FLINT & SAGINAW RAILWAY CO.

Barns and Shops

The car barns, machine and repair shops occupy a space of ground 90 x 60 ft. and are located only a short distance from the power house. Although they are of a temporary construction they have been carefully planned so that all cars can be repaired without delay. An overhead crane is used for transferring armatures from the repair pit to the winding room and to the lathes. The repair pit is 72 ft. long and 5 ft. deep. The track over the pit is supported by 8 x 8-in. timbers laid on concrete foundations. On the second floor of the shop building an office room, sleeping quarters for the trainmen who live in Saginaw and a store room have been provided.

The cars for the line as shown in the illustration have a length over all of 52 ft. and a 42-ft. body. The width over all is 9½ ft. They have three compartments with a total seating capacity of 52 people. The general and smoking compartment seat 40 and [illegible] longitudinal seats in the baggage section accommodate the remainder. The baggage room is located between the other two compartments and is separated from them by solid walls with a single sliding door. In one corner of the baggage room a William C. Baker car heater stove is located so that the entire car is warmed by it. The platforms have double folding doors on each side. The cars were made by the Laclede Car Co. and are finished with reversible seats upholstered in rattan. Four No. 38-B, 50-h. p. Westinghouse motors are used with Westinghouse type K-14 controllers and the Westinghouse air brakes.

The cars are despatched by telephone, two pairs of wires having been installed for this purpose. One of these, the company's own private system, is connected with booths built at the switches and turn-outs, and the other, maintained by the Bell Telephone Co., enables the employes to connect with the city office in case of accident to the railway wires. Two of the wires are strung on a 40-in. cross arm near the top of the pole and the others are supported by pins on the opposite side and two feet below the point where the trolley arms are fastened to the poles.

One of the most serious operation problems the company has had to contend with has been the keeping of its tracks clear of snow in the winter. The accompanying illustration was taken last spring, at a point near the Saginaw city limits, just after the company's snow plow, which is also illustrated, had worked its way through a huge snow bank. The plow, which has proven quite effective, is attached to the front end of a locomotive car. The blades of the plow are 7 ft. long and 3 ft. wide. The car is driven by two 50-h. p. motors. During the summer months the car is used for repair and maintenance purposes. It is operated from a small cab built near the front end.

Personnel.

The officers of the Detroit, Flint & Saginaw Railway Co. are: Timothy E. Tarsney, president, Detroit; Thomas G. Sullivan, vice-

PLATFORM LOCOMOTIVE CAR.

president, Detroit; James B. Peter, treasurer, Saginaw; Charles P. Anderson, secretary and assistant treasurer, Saginaw; Timothy B. Tarsney, superintendent.

The board of directors is composed of the president, vice-president and secretary of the company, together with Timothy Nester, Saginaw, and John M. Duffy, Chicago.

The Fire Hazard in Car Barns.

[illegible]

It [illegible] [illegible] ditions that are to a greater or less degree unavoidable. But besides these necessary conditions, which are due principally to the large areas, the inflammable nature of the contents of a car barn, and the large values subject to destruction in one fire, there are in the great majority of car barns features which have most serious effects in

STANDARD PASSENGER CAR [illegible]

the way of causing fires, but which with proper methods of construction and proper management may readily be removed, or at any rate so modified, that the danger from them becomes inconsiderable. With regard to those features of car barns which are susceptible to improvement from a fire protection standpoint it is natural first of all to deal with the construction of the barns themselves, then with the ordinary hazards found in such barns; for instance, repair work, heating and lighting, use of oils and grease, lamp filling, sand drying and defective wiring. Finally we may consider the hazard that is more serious than all others; that is, the hazard due to the cars stored in the barn.

It has been claimed that one of the features mentioned as being unavoidable, the large areas, may be obviated by suitable division walls. Many insurance boards recommend that the total area of any one subdivision of a car barn shall not exceed 10,000 sq. ft. While such a division into fire sections separated by brick walls is unquestionably desirable, still, even when this method is carried out the number of cars which can be placed in each fire section will be twenty or more, and the aggregate values thus exposed to destruction by one and the same fire are enormous. Each car representing as it does an expenditure of from \$3,000 to \$15,000 or more, the average value of a car will usually be greater than that of an ordinary dwelling.

Considering this aspect of the matter, it has been proposed to subdivide each barn into numerous fire sections, each being wide enough for only one track, and to subdivide these long narrow sections by means of rolling iron shutters so spaced as to accommodate two or three cars between successive shutters. While such a method of construction would be excellent from a fire protection standpoint, it would be inconvenient and annoying in the ordinary everyday operation of the road and it seems rather improbable that such extensive subdivision will be found desirable. The advocates of this plan further suggest that it may be made possible to remove the cars from each section in case of fire by constructing the tracks with a slight incline toward the doorways, so that in case of fire

[illegible] objections to this. Ordinarily there would not be sufficient track room outside of the barn to accommodate all the cars, and the chance of injury to employes would be increased many fold by any plan by which a 20 or 30-ton car might become free to run down its inclined track at unforseen times.

[illegible]

[illegible]

posed to one fire as being necessary conditions for the operation of the road, we may by a proper attention to the construction of the car barn obtain a greater degree of security from fire than is usually the case. The height should be one story, without a basement. Walks should be of brick, 16 in. thick. Brick fire walls should divide the building into sections whose area should in most cases be about 10,000 sq. ft., and in no case exceed 20,000 sq. ft. All division walls should have parapets at least 36 in. high. If the front doors of the barn are of wood, the division walls should extend beyond the front wall line in order to prevent the communicating of fire from one section to the next around the end of the division wall. The floor should be of brick, concrete, stone, or earth. Particular attention should be paid to the construction of the pits. Ordinarily, pits should be near the rear of the barn, but in

[illegible]

double-ended barns they should be near the center. This is for the reason that cars over the pits are frequently jacked up and rendered immovable, and in this condition they would block the cars behind them in an emergency. When it is possible, the pits should be in only one section of the barn, so that the hazard which they introduce may involve as small a part of the car barn as possible. It is extremely bad practice to construct the pits so that they extend sideways under several tracks, and adjacent pits should be separated by substantial brick walls. The roof of the barn should be of mill construction, built with heavy planks supported on widely spaced single-stick roof beams which are carried by wooden posts. A roof of this kind is substantial and will withstand the action of fire for a long time before yielding. It is common to find car barns with roof supported on steel beams or on light steel trusses. This type of construction is unsatisfactory since the steel members when exposed to fire will bend and twist and allow the roof to collapse.

This point was well illustrated by a fire in a car barn of the Lewiston, Brunswick & Bath Street Railway Co., at Lewiston, Me., Dec. 19, 1903. The ruins of this building are shown in the accompanying illustration. The roof of the car barn was of 3-in. planks carried on light steel trusses and purlins. About seven minutes after the fire was discovered, the roof fell, crushing in the roofs of some of the cars and shielding the fire from the water thrown by the firemen.

The weakness of a steel trussed roof was further illustrated by a fire at the Forest Hills Station of the Boston Elevated Railway Co., at West Roxbury, Mass. This fire occurred Oct. 25, 1904. The two illustrations tell very forcibly the story of the rapid destruction of the steel-trussed roof. A part of the roof fell in within 15 minutes after the outbreak of the fire. The area of this barn was about 22,000 sq. ft., and there were 47 cars in the barn at the time of the fire. These cars were practically a total loss, there being a slight salvage on the trucks.

Two illustrations are shown of the ruins of a car barn at Manchester, N. H., which was burned March 4, 1905, with a loss of about $110,000. The building was one-story, frame, metal clad, with joisted roof supported on posts. The area was 19,200 sq. ft.

The practice of carrying on extensive repair work in car barns introduces a distinct hazard which should be eliminated by transferring cars in need of any considerable amount of repairing to regular repair shops. Woodworking, painting, and varnishing materially increase the danger of fire in a barn where they are carried on, and it would seem that in many cases this additional hazard is avoidable.

Any defective system of heating or lighting car barns is a matter of moment, as it is in the case of any risk holding combustible contents. The heating should be by steam or hot water, with all pipes

ROOF OF WEST ROXBURY BARN AFTER FIRE

properly supported out of contact with woodwork and with boiler properly cut off from the main building. Lighting should be by electricity, except that gas may be used for lighting offices and waiting rooms if the arrangement of pipes and jets is properly attended to.

Any stock of oils on the premises should be stored in a fireproof room, with walls of brick, terra-cotta, or wire lath and plaster on metal studding. If possible the walls should extend above the roof, but if this cannot be arranged the ceiling should be made fireproof. The floor should be of incombustible material, as brick or cement.

All openings communicating with the main buildings should be protected in an approved manner by standard fire doors or fire shutters. The filling of lamps and lanterns should always be done in a room of this kind, unless it is possible to have a small detached building that may be used for this purpose. If an ordinary wooden room be used for oil storage or for filling lamps its walls, floors and benches quickly become oil soaked and readily inflammable. Usually it is best entirely to exclude gasoline, benzine, lacquer or similar inflammable liquids from a car barn, but if such materials are used or stored on the property they should be safeguarded in the way described above, that is, by keeping them in a detached building or in a fireproof room.

Care should be taken in the disposal of oily waste and greasy rags. They must not be allowed to accumulate and the small amount that may be present should be kept in standard [illegible] cans reserved for that purpose.

Sand drying becomes a dangerous process as it is carried on in some car barns. The hazard of the process may, however, be made inconsiderable if proper attention is paid to the installation of such apparatus. Driers of the stove type must be kept at a safe distance from woodwork and their flues must be similarly safeguarded. If steam pipe driers are used, the pipe must be kept free from contact with wood, and no wooden partitions or hoppers should be allowed to form a part of the device. The hot sand issuing from the drier should be stored in a bin made of incombustible material since the sand is frequently hot enough to char wood.

The wiring of car barns should conform in all respects to rules of the National Electric Code. The trolley cut-out and the main switch controlling the power and lighting circuits should be outside the building at such a distance that they can be reached even though the car barn be burning.

The hazard due to the cars is perhaps more important than any other hazardous feature of a car barn. The ordinary car contains a large amount of combustible material so arranged as to give every opportunity for the spread of fire once started. In the case of ordinary street cars having longitudinal seats, the space beneath the seats becomes the receptacle for dirt and refuse, particularly if there are openings at the base of the windows which communicate with this space and offer an inviting channel for the disposal of waste paper and miscellaneous rubbish.

Besides affording plenty of fuel to encourage a fire once started, in the great majority of cases the cars have such an electrical equipment that there is grave danger of starting a fire. The National

EFFECT OF FIRE ON WOODEN POSTS, MANCHESTER BARN.

Electric Code (edition of 1905) prescribes proper methods for the wiring and equipment of cars, and an observance of the rules there laid down will do much to diminish the number of fires. The electrical equipment of a street railway car is subject to the hardest kind of usage, and extraordinary care should be given to the installation, but this is far from being the case in practice. In most cases, car wiring is notably bad. It is usual to find undersized wires, poor insulation, stapled work, unsoldered and untaped joints, crossed wires, work exposed to the weather, lack of bushings and defective or poorly [illegible] which the code requires improvements over existing conditions are that [illegible] and [illegible] lined with fire resisting insulating material; that conductors be [illegible]

[illegible]

conductors carrying more than 25 amperes, be provided with soldered lugs for fastening the fittings; that all wiring and conduit work be installed with the greatest care and attention to detail.

Particular attention should be given to the installation of heaters and they should be treated as one would treat stoves. Panel heaters are to be located at least four inches from the woodwork. Heaters for cross-seats should be so arranged that current carrying parts shall be not less than six inches below the underside of the seats, unless the underside of the seats be protected by not less than one quarter-inch of fire resisting insulating material or .04-in. sheet metal with 1-in. air space above, in which case the distance may be reduced to three inches. Defective heating devices have been a prolific source of fires.

In considering the question of loss by fire in car barns we naturally think of the possibility of removing cars from a building that has begun to burn. One method of accomplishing this purpose has already been mentioned, that is, an arrangement whereby all tracks should have an incline toward the doors, so that by unbraking or unblocking the car nearest the door on each track all the cars will move out of the barn. Another somewhat similar plan contemplates the use of two trolley wires for each track. One of these wires is ordinarily dead, and on this wire the trolleys are placed when the cars are housed; the controller on each car is thrown over one notch; in case of fire the trolley wire is thrown into circuit, and the cars are supposed to move slowly out of the barn. It is sufficient simply to mention these devices; their impracticability is immediately apparent. It is possible, however, to so arrange the door and tracks that the removal of cars will be facilitated. Tracks should run clear from the barn without transfer tables, and special track work in front of the barn should be provided with guard rails where necessary. Track doors should be built in pairs, so hung as to swing outward, and should be provided with stops to prevent their swinging by their proper position when either closed or open.

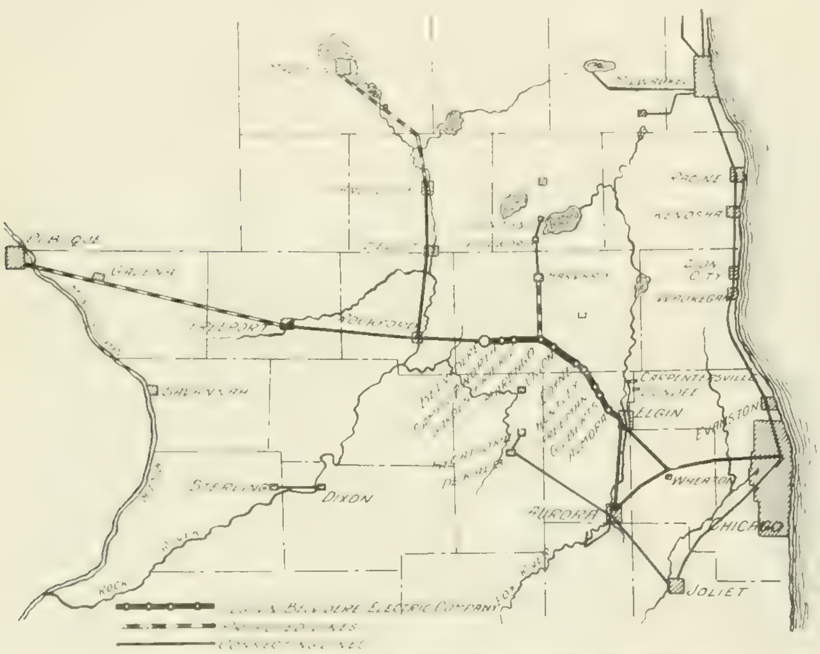
The present article makes no attempt to discuss fire protective devices, but it must be said that properly installed sprinkler systems, standpipes, fire hose, sand or water pails and casks, automatic alarms and private fire departments have a recognized and unquestioned value in property of this class. Whether these protective devices are used or not, the fact must not be lost sight of that safety from destruction by fire is not altogether a question of construction or of protective devices, but is largely dependent upon careful management and constant and competent supervision. The most costly and elaborate installation becomes practically worthless unless maintained at the high standard that is justified by the importance of the issues at stake.

Elgin & Belvidere Electric Co.

[illegible] on the roadway of the Elgin & Belvidere [illegible] progressing rapidly during the [illegible] weeks, and it is expected that the grading for this line between Elgin and Belvidere will be completed the latter part of December. If at the time the grading is completed, weather conditions are favorable, the construction of track work and overhead equipment will be continued and the line will probably be ready for operation early in the spring. Otherwise it is not expected to complete the work before the early summer.

The Elgin & Belvidere Electric Co. is an Illinois corporation authorized to construct an electric railway between Elgin and Belvidere, Ill., a distance of 36½ miles. The intermediate points served by this line are Almora, Gilberts, Freeman, Huntley, Coyne, Union, Marengo, Garden Prairie and Camp Elworth, located in one of the most prosperous sections of Northern Illinois. The line will also ultimately form the connecting link of an electric railway system between Chicago, Elgin, Belvidere, Rockford and Freeport, Ill., and Beloit, Janesville, Madison and the famous summer resorts, Lake Geneva and Delavan Lake, Wis. The cars of the Elgin & Belvidere company will enter Elgin over the tracks of the Elgin, Aurora & Southern Traction Co. to the Union terminal in the city of Elgin, at which point connection will be made with the Aurora, Elgin & Chicago Railway Co. and the Elgin, Aurora & Southern Traction Co. for interchange of business. At Belvidere the line will connect with the lines of the Rockford & Interurban Railway Co., which will provide interchange of business with the points served by that line, as well as the Rockford, Beloit & Janesville Ry. With the completion of a proposed line between Freeport and Dubuque and between Janesville and Madison, the territory along the Mississippi River in Northern Illinois and the lake district in Southern Wisconsin will also be reached. Arrangements have been made for the through handling of both passenger and freight business between Chicago and the various points served by these lines.

The roadway of the Elgin & Belvidere Electric Co. will be built on private right of way of sufficient width for eventually double tracking the line. It will be built with a view to high speed service with maximum grades of two per cent. There will be few curves. The rails will be 70-lb. A. S. C. E. section laid to standard gage and double bonded at each joint. The ties will be 6 x 8 in. x 8 ft. laid 2,800 to the mile. The roadbed will be gravel ballasted.



MAP OF ELGIN & BELVIDERE ELECTRIC CO. AND CONNECTIONS.

The transmission line will be carried on 35-ft. poles set 100 ft. center to center, and will transmit three-phase alternating current at 25,000 volts pressure. Three sub-stations will be constructed at suitable points on the line. Each will be equipped with two rotary converters with transformers, switchboard and accessories, and provision will be made for additional installation should it become necessary. These sub-stations will be constructed of brick with slate roofs and will also include passenger, baggage and freight rooms.

The location of the machine and repair shops and car barns has not yet been decided. Power for the operation of the line will be obtained from the Batavia power house of the Aurora, Elgin & Chicago Railway Co. The rolling stock will be of the latest design, equipped with four motors of sufficient capacity to maintain a maximum speed of 60 miles per hour. All through cars will be equipped with multiple-unit control for operation in trains.

The officers of the Elgin & Belvidere Electric Co. are: President, Hamilton Browne; secretary and treasurer, J. Joseph Wright. Others interested in the project are Bion J. Arnold, John M. Roach and Granger, Farwell & Co. The Arnold Co., Chicago, has charge of the engineering features of the line and the Main Construction Co. is doing the construction work. Mr. Arthur T. Browne is president of the latter company, and R. G. Arnold, secretary and treasurer. The offices of the Elgin & Belvidere Electric Co. are at 1114 Unity Building, 79 Dearborn St., Chicago.

Annual Report of the Montreal Street Railway Co.

The annual report of the president and directors of the Montreal Street Railway Co., for the year ended Sept. 30, 1905, was submitted at the 45th annual meeting of shareholders, held on Nov. 2, 1905. The comparative statement of the company for this period and the same period 1904 is as follows:

	1905.	1904
Gross receipts	$2,707,474.11	$2,463,824.70
Operating expenses	1,650,565.99	1,510,997.90
Expenses, per cent of car earnings....	61.88	62.37
Net earnings	1,056,908.12	952,826.80
Net income per cent of capital........	11.25	11.10

The number of passengers carried in 1905 was 66,631,206 as compared with 60,281,834 in 1904. The number of transfers issued in 1905 was 19,801,893 as compared with 17,915,242 in 1904. The total number of passengers carried, including transfers, was 86,433,099 in 1905 as compared with 78,197,076 in 1904. The car earnings per passenger were the same for both years, being 4 cents, while the car earnings per total passenger carried were 3.09 cents for both years.

Several new extensions to the tracks of the company have been constructed and the rolling stock and equipment have been increased as the requirements of traffic necessitated. A large block of land was purchased in order to permit of the construction of car sheds, substations and other necessary buildings to accommodate the increasing business. Contract was entered into with the Montreal Light, Heat & Power Co., for the supply of 3,000-h. p. alternating current to be delivered at substations at outlying points in the city. An extension of the company's franchise for the construction and operation of its system in the town of Maisonneuve has also been secured. The Mutual Benefit Association established by the company's employes has continued to be successful and a majority of the employes are now members of the association. During its fiscal year ended April 30, 1905, the sum of $12,021.66 was contributed to this association by the company.

Technical Publicity Association.

At a meeting and banquet of the Technical Publicity Association, held at the Aldine Club, New York, Friday evening, November 3rd, the following officers were elected: President, C. B. Morse, Ingersoll-Rand Drill Co.; 1st vice-president, H. M. Cleaver, Niles-Bement-Pond Co.; 2nd vice-president, Frank H. Gale, General Electric Co.; secretary, Rodman Gilder, Crocker-Wheeler Co.; treasurer, H. M. Davis, Sprague Electric Co.; members of executive committee, Graham Smith, Westinghouse Companies and Charles M. Manfred, H. W. Johns-Manville Co.

Superheated Steam and the Construction of Superheaters as Used in Power Plants.

[illegible]

The production of superheated steam can be secured only by adding heat to dry saturated steam, to do which two pieces of apparatus are required: First, the boiler to produce the dry saturated steam from water at a temperature corresponding to the exhausting pressure; and second, the superheater to produce the required extra

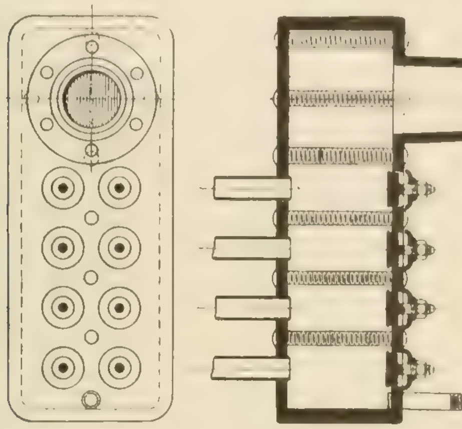


FIG. 1.

temperature. Superheated steam is a more perfect gas at a higher temperature and contains a greater amount of heat than dry saturated steam; also its volume is increased per unit of weight. Although it must be noted that, other things being equal, a cubic foot of superheated steam contains fewer heat units than the same quantity of dry saturated steam. In conveying superheated steam from the superheating apparatus to the prime mover, it will remain superheated till the surplus heat is withdrawn and the temperature reduced to that corresponding to the pressure. A further drop in temperature would be accompanied with decrease in pressure. It will be seen that the benefit of superheating is first noticed in the steam mains, where it will prevent or reduce the condensation. If the steam is still superheated on entering the prime mover, it cannot be said that no condensation has taken place in the steam pipes, which is contrary to many statements. Condensation may take place, and it is even possible to draw condensed steam from

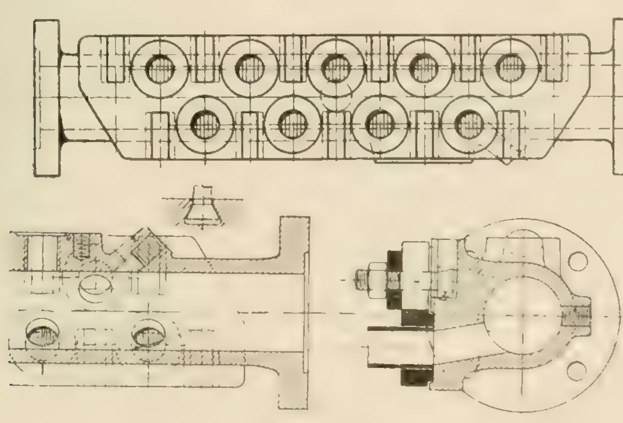


FIG. 2.

the main after the steam has traveled a certain distance and is still superheated.

It is often stated that steam in the presence of water is always saturated. This, however, is not always true. Wet saturated steam will be superheated by adding sufficient heat, which is easily done by dividing it and passing it through say a number of small [illegible] the inside of the tube is enormous, as will be easily understood when [illegible] be only moderately superheated. Should the tubes of the superheater be excessively large, it will easily be seen that all parts of the steam, especially the inner part, cannot as soon be affected by the heat of the gases as with smaller tubes. This is especially due to the very low conductivity of superheated steam. This is also the reason why, especially in Germany, so many narrow tube types of

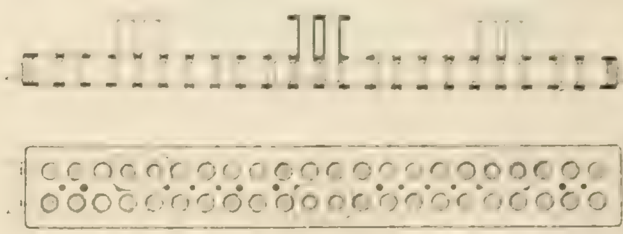


FIG. 3.

superheaters are on the market, or where larger tubes are used ribs are placed laterally on the inside, or flat boxes with staggered rows of short pipe sections inserted. All of which indicates the intention of the designer to have all parts of the steam come into contact with the highly heated surface of the superheater.

If the superheated steam is conducted through a long run of pipe

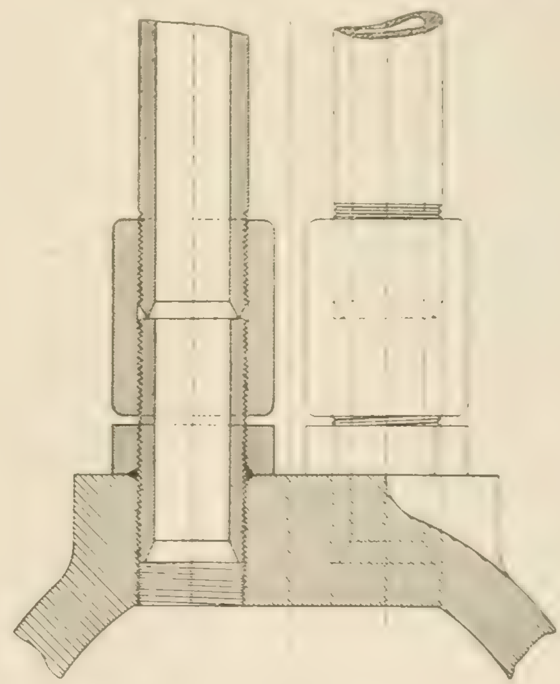


FIG. 4.

to the prime movers, traveling at or near the pipe surface, usually it will remain there during the entire run, and will sooner or later lose a certain amount of heat, becoming saturated, while the steam nearer the center will not be so easily affected, owing to the low conductivity of the steam. One may therefore conduct in the same pipe superheated, dry saturated steam and water. Thus the

temperature of superheated steam must always be measured at the center of the pipe.

The presence of such water in the steam mains necessitates the installation of a "water catcher" near the prime mover, even with the use of highly superheated steam. In order to reduce the decrease in temperature of the steam to a minimum, the practice on

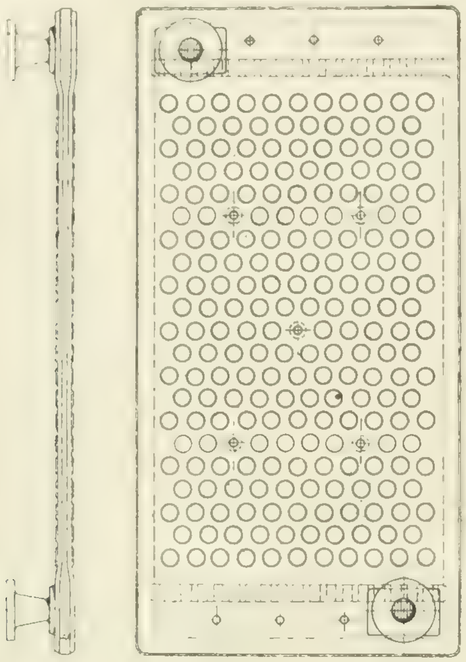


FIG. 5

the continent of Europe is to give the steam a velocity of some 12,000 feet per minute, and even higher, while in America and Great Britain a velocity of only 6,000 feet is ordinarily used. This saving of heat in the steam is of greater benefit in the prime mover than the few pounds which the pressure may be reduced due to friction. It must, however, be stated that superheated steam is not as easily affected as saturated steam, due to the character of a more perfect gas, while the latter has a greater specific gravity.

Superheated steam being a more perfect gas, will readily escape through a leak where saturated steam will not, such as at pistons, flanges or cracks. Condensed steam will, however, escape even more readily than superheated steam, and as saturated steam contains far more water than superheated steam, it will easily be seen that with the latter there is a greater liability of leakage of water. Again, in the form of steam only the leakage is greater with superheated than with saturated steam, although the total loss due to leakage is far greater with saturated steam. The radiation all through the steam pipes is much greater with saturated than with superheated steam, due to the very low conductivity of the latter. Superheated steam is of much more importance in the prime mover itself, either engine or turbine.

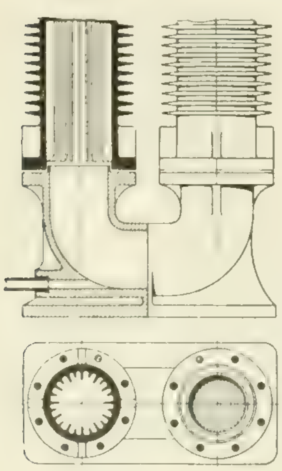


FIG. 6.

The initial condensation in the cylinder of an engine in the case of saturated steam may be from 20 to 40 per cent of the total steam supplied to the cylinder, depending upon the type of construction, so that there is left only the remaining percentage of steam for the performing of useful work. This initial condensation may be partly or totally eliminated by the introduction of superheated steam into the cylinder.

As previously pointed out, superheated steam after a run through a certain length of pipe contains a very small percentage of condensed steam which may enter the cylinder, but due to the expansion of steam in the cylinder after cut off, this small amount will easily be re-evaporated. The cylinder walls, similar to the pipe walls only in greater proportion, absorb a certain amount of heat. Taking this loss of heat, and also that required for the re-evaporation of water after cut off, in order to obtain good economy the degree of superheat on entering the cylinder should not be less than that required to still maintain superheated or at least dry saturated steam.

Not seldom steam enters the cylinder at a temperature of some 550° F. and even higher. This, of course, must lead to a special design of engine suited to this high temperature. Common practice has shown that engines designed for the use of saturated steam may also be used with superheated steam and excellent results obtained, yet it is difficult to compare the percentage of saving due to the use of superheated steam in two engines, where one may have been constructed nearer to the ideal for the use of superheated steam than the other. Tests have frequently illustrated that the economy of engines may be increased 1 per cent for each 8 to 10° F. increase in the steam temperature, up to a reasonable limit. This, of course, cannot be applied to every manufacturer's product. Knowing by practice the character of the engine, the type of boilers and the size and run of the steam mains, one may easily judge the possible saving due to the use of superheated steam.

The more wasteful the engine in the use of saturated steam, due to initial condensation, the greater the possible economy to be effected with the use of superheated steam, although the temperature of the superheated steam is limited and cannot be as high as if the engine were especially designed for it. A superheated-steam engine is of different construction from that of the ordinary engine. This is true regarding the size, number and ratio of the cylinders,

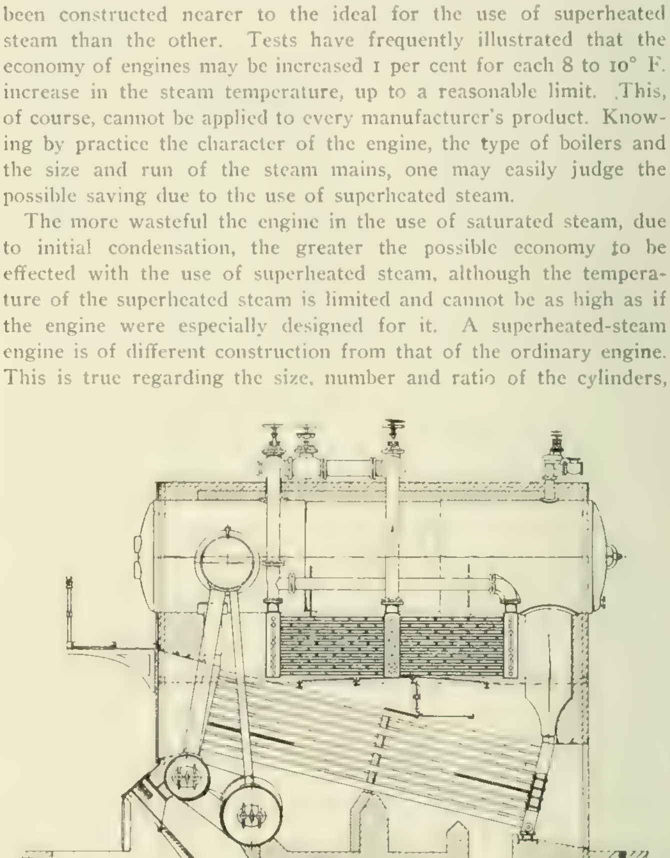


FIG. 7.

to condensing and non-condensing, cylinder-jacketing, steam pressure, cut off, etc. All of these, as well as numerous other items, have to be considered in classifying a modern, up-to-date engine with respect to its adaptability for use with superheated steam, as all add appreciably to the economy.

It may be of interest to give a few examples of the steam consumption in tests made with so-called "superheated-steam" engines. These engines are of different manufacture, and the tests were made in the different power plants, not in the testing departments, and reported in the "Zeitschrift des Vereines Deutscher Ingenieure":

Location of Plant.	No. of Cylinders.	No. of Expansions.	Type of Valves.	Steam consumption, lb. per i. h. p per hr.
Krupp Steel Works, Annen.	2	2	Slide	9.52
Luisenstrasse, Berlin	4	3	Poppet	9.49
Moabit, Berlin	4	3	Poppet	9.04
Municipal, Vienna	4	3	Poppet	9.31
Oberspree, Berlin	4	3		8.91
Ghent, Holland	2	2	Piston	8.86*

*Steam at throttle. Pressure, 151.1 lb. per sq. in. Temperature, 605 deg. F.

All of these tests were made with superheated steam at a temperature of not less than 570° F. at the engine. It should be stated that this low steam consumption is due not only to the employment of superheated steam, but, as already pointed out, to the engine manufacturer, the power plant designer and the management.

The economy due to the relative degree of superheat in a properly designed engine in which the steam consumption is remarkably low with dry saturated steam will be noted from the following figures. The previously mentioned engine at the plant "Luisenstrasse," Berlin, is of the four-cylinder triple-expansion type, the cylinder ratio being 1:2.1:6.4, and is rated at 3,000 h. p. At a temperature of 590° F. and 210 lb. steam pressure, the consumption was 9.41 lb., while at 580° F. this was 9.49 lb., and at 360° F., corresponding to dry saturated steam, this was increased to 10.1 lb. per i. h. p. hour.

The greater advantage of superheat with the steam turbine is well recognized, and steam consumptions of from 9 to 10 lb. are frequently obtained on the Continent. The results of tests, several of which the writer has at hand, show that the records were made under actual operating conditions in the power plants, some of which being made under a pressure of 175 lb. and a superheat of 620° F. at the trottle.

The amount of heat necessary to produce a given temperature of superheat is not uniform with different types of superheater, but the size or heating surface of the apparatus to produce a given temperature of superheated steam varies with the type of superheater. Furthermore, in a dependently fired superheater the character of the boiler to which the superheater is connected plays an important part. Some boilers may produce dry saturated steam while others would deliver wet steam. The longer the pipe line between boiler

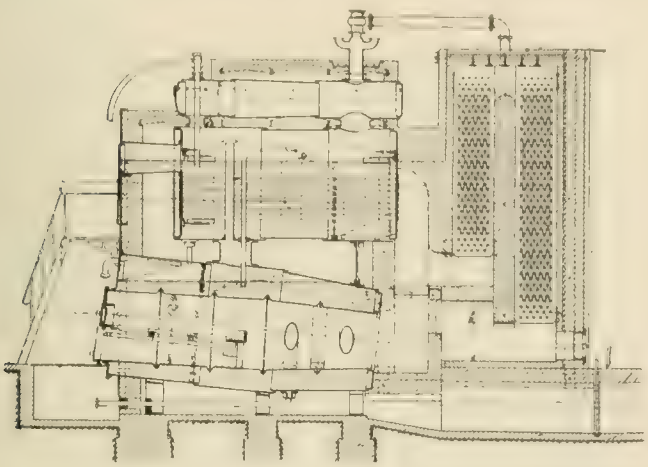


FIG. 8.

and superheater, the more saturated will be the steam reaching the superheater apparatus. Of still greater importance is the location of the superheater with regard to the flue gases, and the velocity of the steam with regard to the type of construction. A further important item which must be taken into consideration with regard to the amount of heat to be supplied and the size of apparatus, is the direction of the flow of steam with respect to that of the furnace gases. This may be parallel or counter current, or a combination of both.

The counter current is considered more efficient. In this type the gases at the lowest temperature come in contact with that part of the superheater apparatus carrying the steam at the lowest temperature, and vice versa. This system has the great advantage of not requiring the heat per unit of heating surface that the parallel current type does, and therefore for the same results the heating surface may be reduced. Herr Berner, probably the most competent authority on superheated steam, states in "Zeitschrift des Vereines Deutscher Ingenieure" that the ratio of these superheaters is 1:1.158; in other words, the parallel-current type requires a heating surface 15.8 per cent greater than the counter-current type. This, of course, cannot be applied to two different designs. Here one finds an explanation for the fact that one type of superheater, although the same amount of heat is applied to the same surface, does not always produce the same degree of superheat.

In the case of the [illegible] type [illegible] more [illegible] is required [illegible] type, may be [illegible] ap-

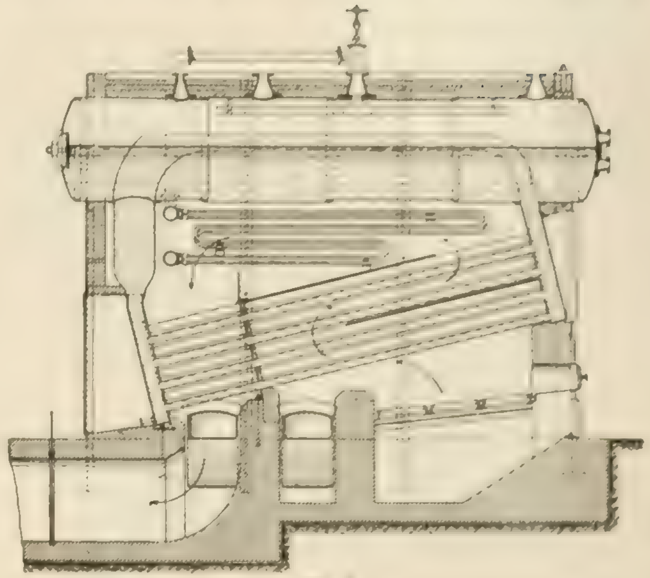


FIG. 9.

paratus of a size between that of the parallel and that of the counter-current types.

The superheater itself may be located directly in the boiler setting, in which instance the furnace or flue gases give the necessary heat to the superheater. This is the dependently-fired type. In giving the superheater its own setting and furnace, the independently-fired type is obtained. Which is the more advantageous type can only be determined after studying the exact local conditions. The dependently-fired type is the more common, although the independently-fired has many advantages, which, however, do not generally outweigh the disadvantages. For instance, in power plants having long steam pipe runs between the boiler and prime mover the superheater may advantageously be located near the prime mover, and may thus supply superheat of the highest degree to the prime mover without the loss of heat in the pipe runs.

It must be remembered that the location of the superheater near the prime mover's foundation will generally mean difficulty in handling coal and ashes. The independently-fired type will produce a higher degree of superheat than the dependently-fired one, and the degree of superheat may more easily be controlled by regulating the furnace. On the other hand, the temperature of superheat produced by the dependently-fired type is usually considered sufficiently high for ordinary practice. The first cost of the dependently-fired superheater is very much lower, no additional floor space is required, and it does away with [illegible]

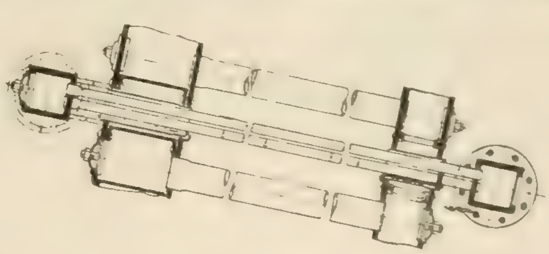


FIG. 10.

tended by the boiler operator. To decide which of these two types is to be chosen for a given power plant, many questions must be considered: the location of prime movers with respect to the boiler, the character and type of the boiler as well as the superheater to which the latter should be attached, the length and size of steam mains and other items.

It may be of interest to give here some data as to which of the two types are most commonly employed, as reported by Herr Ernst before the "Engineering Congress of the International Society of Boiler Inspection" at Zurich, Switzerland, 1902. Mr. Ernst states

that, in the district of the "Vienna Boiler Inspection and Insurance Society" which includes [illegible] power plants, 14 per cent are equipped with the independently-fired type; 86 per cent with the dependently-fired type, 10 per cent of the latter being located in the second and third passes of the boiler furnace gases, while all others are located in the first and second passes.

By arranging the types of superheater according to construction, three classes are obtained:

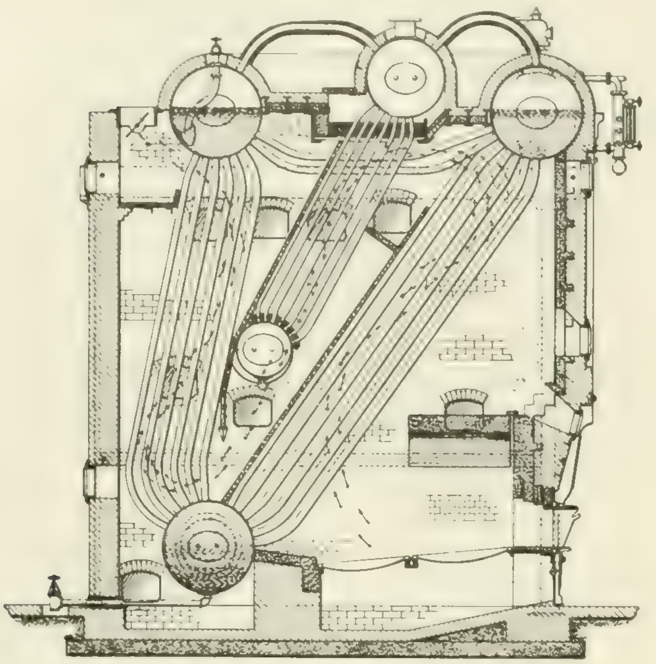


FIG. 11.

1.—The small tube system, where the steam passes through these tubes surrounded by the hot gases.

2.—The tube system, where hot gases are conducted through the tubes and the steam travels around the same in a chamber.

3.—The system of comparatively large size tubes.

A few types of this latter system exist where there is an additional tube system through which boiler feed water or air is conducted, surrounded by the steam in the large pipe which is heated by the hot gases.

The first of these systems is the most common, and one will therefore find a great variation in the forms of construction, all, however, being made of seamless, drawn, wrought iron or steel tubes, either straight or of return bend forms or coils, the ends being held in headers. These headers are of welded steel or wrought iron, as illustrated in Fig. 1, or of cast iron, a type of which is shown in Fig. 2. In certain instances these headers consist of wrought iron plates riveted together, as seen in Fig. 3. The tubes or return bends are either bolted or expanded into the headers, as will be observed in the illustrations. The latter system is also used in the well-known systems of the Babcock & Wilcox Co. and the Sterling Consolidated Boiler Co. An illustration of a screw joint is given in Fig. 4, representing the Buettner (Uerdingen) system. All of these superheaters are of the narrow-tube type. The system in which the hot gases pass through the tubes is shown in Fig. 5. This type of construction is a very new one, although its principle rests upon one of the earlier superheater systems, namely, a long cylindrical chamber in which were inserted tubes conveying the steam, while hot gases surround them in the chamber. This newer system of Heizmann's, as will be seen, is a flat box, of only one-half inch thickness over all, through which 2-in. tubes are passed in staggered rows, expanded into the sides. While the hot furnace gases pass through these tubes, the steam in passing through the box is deflected at as many points as there are tubes, thus thoroughly mixing it and producing a uniformly high temperature.

A similar system is that of Prégardieu. In this system instead of having the box riveted together and the pipes inserted, the entire apparatus is welded together as if made of a single piece.

A third system has large sized tubes, which may be provided with inwardly-projecting laterally-running ribs, as in the Schwoerer system, the construction of which is shown in Fig. 6. It will be noticed that these tubes are also provided with outside circular ribs. Other types of this system are provided with a single or cross straight diaphragm or even with a twisted diaphragm, forcing the steam to take a spiral course through the superheater. With the exception of the latter system, which uses seamless drawn steel tubes with the twisted diaphragm rolled in, these types are of cast iron only.

Another type of this same system is that of Cruse (Manchester), consisting of 6-in. cast iron tubes in which 2-in. steel tubes are inserted, steam traveling around the latter, while through them boiler feed water is conducted. This system furnishes boiler feed water at an extremely high temperature, the amount of boiler feed water as well as the steam to be superheated being easily controlled.

Still another type, similar to the Cruse, is the Adorjan system, in which air takes the place of the boiler feed water.

In order to determine the velocity of steam in the superheater, the character and the construction must be known. The greater the clear cross-section the lower must be the velocity of the steam. This is necessary in order to superheat the steam which does not come into direct contact with the superheater surface. Whatever the type of superheater may be, the velocity of the steam is closely related to the desired degree of superheat and the location of the apparatus with respect to the flue gases, this latter depending upon the type of the boiler. Fig. 7 represents a Goehrig-Leuchs (Darmstadt) superheater located in the first and second passes of the furnace gases. It is a narrow tube type, and it will be noticed that the flow of steam is combined parallel and counter current. The steam enters at the outside ends and leaves at the middle, a damper being so arranged that the passage of furnace gas may be controlled. The superheater, as illustrated in this boiler, has a heating surface equal to one-half that of the boiler itself, and will therefore assure the highest superheat which can be used only in a first class prime mover.

Another practice is illustrated in Fig. 8, representing a Hering superheater located practically in an additional compartment attached to the setting of a tubular boiler. It will be noticed that the gas leaves the boiler setting, passes through the superheater and returns to the boiler and escapes below the superheater setting. This is a parallel-current superheater. In both of the mentioned types the travel of the gas is at right angles to the flow of steam.

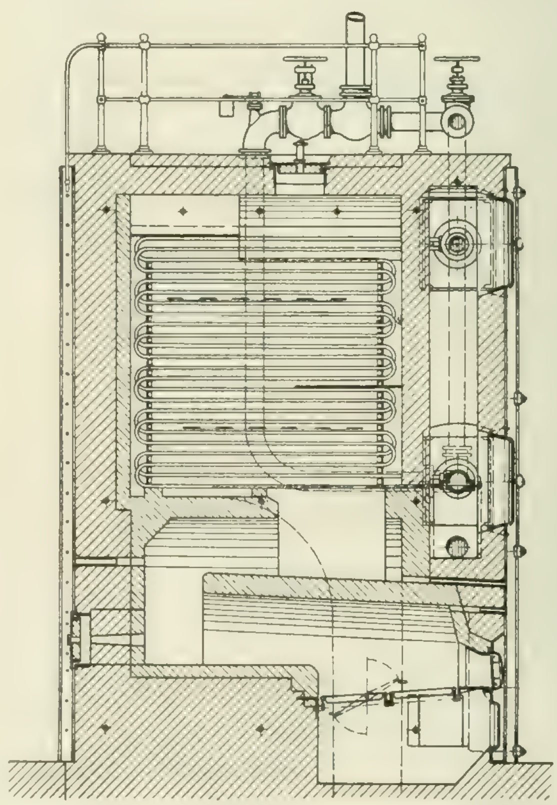


FIG. 12

A system frequently used, in which the steam runs with the same axis as the flow of gas and, which at the same time is a parallel and

counter current Boettner type, as shown in Fig. 9. The tubes of this system, it is claimed, are of such strong and durable material that the necessity for a regulating damper is eliminated.

A different type of superheater has its detail of construction shown in Fig. 10. The tubes of the superheater take the place of a horizontal row of water tubes of a boiler, and the superheater may occupy a lower or higher position according to the amount of superheat required. Three superheater tubes, 1¼ in. in diameter, occupy a space of one 4-in. water tube.

An application of the superheater to a semi-vertical water-tube boiler is given in Fig. 11, representing a Stirling boiler with the same makers' superheater located in the second pass. If a lower degree of superheat is sufficient the apparatus may be located in the third or last pass of the boiler. Similar arrangement is made for this type as an independently-fired one having its own setting, but in this event it is preferable to locate a boiler feed water heater of similar construction in front of the superheater, protecting the tubes of the latter against the enormously high temperature of the furnace gases.

Space cannot be taken here to illustrate more types of superheaters, as there is such a great variety on the market today; but attention should be called to a Dingler (Zweibruecken), independently fired system, inasmuch as this apparatus is constructed in such a manner as to [illegible] tubes connected to the header (see Fig. 12) are inserted steam-tight small tubes which are closed at one end while the other end enters a separate small header. These tubes are filled with air, which, with an increased temperature, operate upon a cylinder filled with glycerine provided with a float, which in turn operates the well-balanced throttling damper, thus regulating the amount of air under the furnace grates and changing the character of the furnace gas. The massiveness of this superheater setting will also be noticed, which prevents undesirable radiation. For the same purpose both headers of this superheater are kept in a chamber apart from that conducting the furnace gas.

Nearly all superheaters, dependently or independently fired, are provided with small pipe connections for drainage which does not necessarily take place during operation. The regulation of the amount of superheat in the different types may be effected by determining the location of the superheater, by the velocity of the steam in the apparatus, by dampers controlling the amount of gas or by the mixing of saturated with the superheated steam.

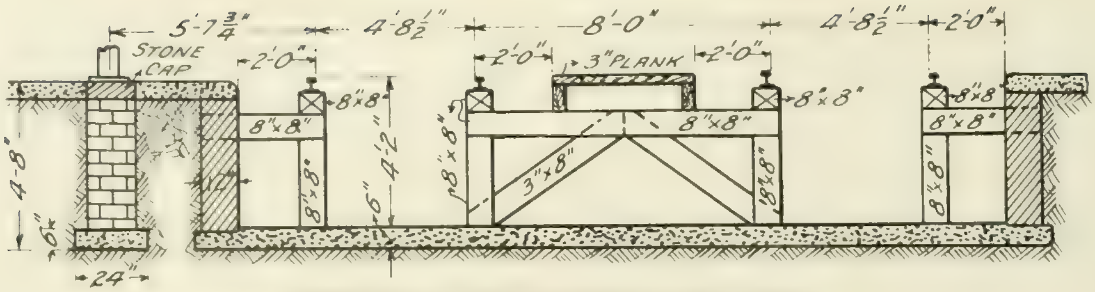
New Car Barns and Shops of the Saginaw Valley Traction Co.

The railway properties of the Saginaw-Bay City Railway & Light Co., which controls the Saginaw Valley Traction Co., were described in the "Review" for June, 1905. Since that time the new storage barns and shops of the Saginaw Valley Traction Co., at Saginaw, Mich., have been completed and are equipped with many interesting details for facilitating work and for the convenience of employes. The new buildings are adjacent to the old car barns at the corner of Washington Ave. and Astor St. They have a frontage of 170 ft., and a depth of 170 ft. on the north and 230 ft. on the south side. That part of the old building which is still standing has a frontage of 122 ft. The front part of this old building is two stories high and is now being used for the offices of the superintendent of transportation, his assistants and employes' rooms, the remaining portion being used for car storage.

SAGINAW VALLEY TRACTION CO. NEW SHOP AND BARN BUILDING, WITH [illegible]

In the new building, the main storage room for the accommodation of operating cars of both city and interurban lines occupies a space 92 ft. wide and the entire length of the building, while the remaining frontage of 78 ft. extending the depth of the building is occupied by the machine shops, winding room, carpenter shops, etc. The building is built of sand-lime brick with an asphalt composition roof. Wood trusses are used throughout the barns for supporting the roof, while in the shops, where heavy lifting is necessary, heavy steel girders and steel framework are used. The floors of the shop are of concrete and those of the storage barns are of gravel and cinders. Care has been taken in the arrangement of the side windows and skylights to provide sufficient light at all time so that employes are not hampered in their work on this account. The front of the new structure is enclosed by nine 16 x 16-ft. Kinnear rolling steel doors with vertical center posts hinged at the top, so that when the doors are open these intervening posts may be drawn up against the ceiling and added clearance given for handling long interurban cars around the special work at the entrance of the barn. In the building are 19 parallel tracks, aggregating 3,800 ft. of trackage, [illegible] the street to the building.

The arrangement of the tracks entering the barn and shops may be seen in the accompanying plan. One track, resembling a common stub-end spur, is led from the double track main line on Washington Ave. to the curb line of the company's property. From this spur are led all tracks serving the buildings. The advantages of this system are readily apparent, as it prevents congestion of city lines at the car barns, allows all transfer work to be done within the



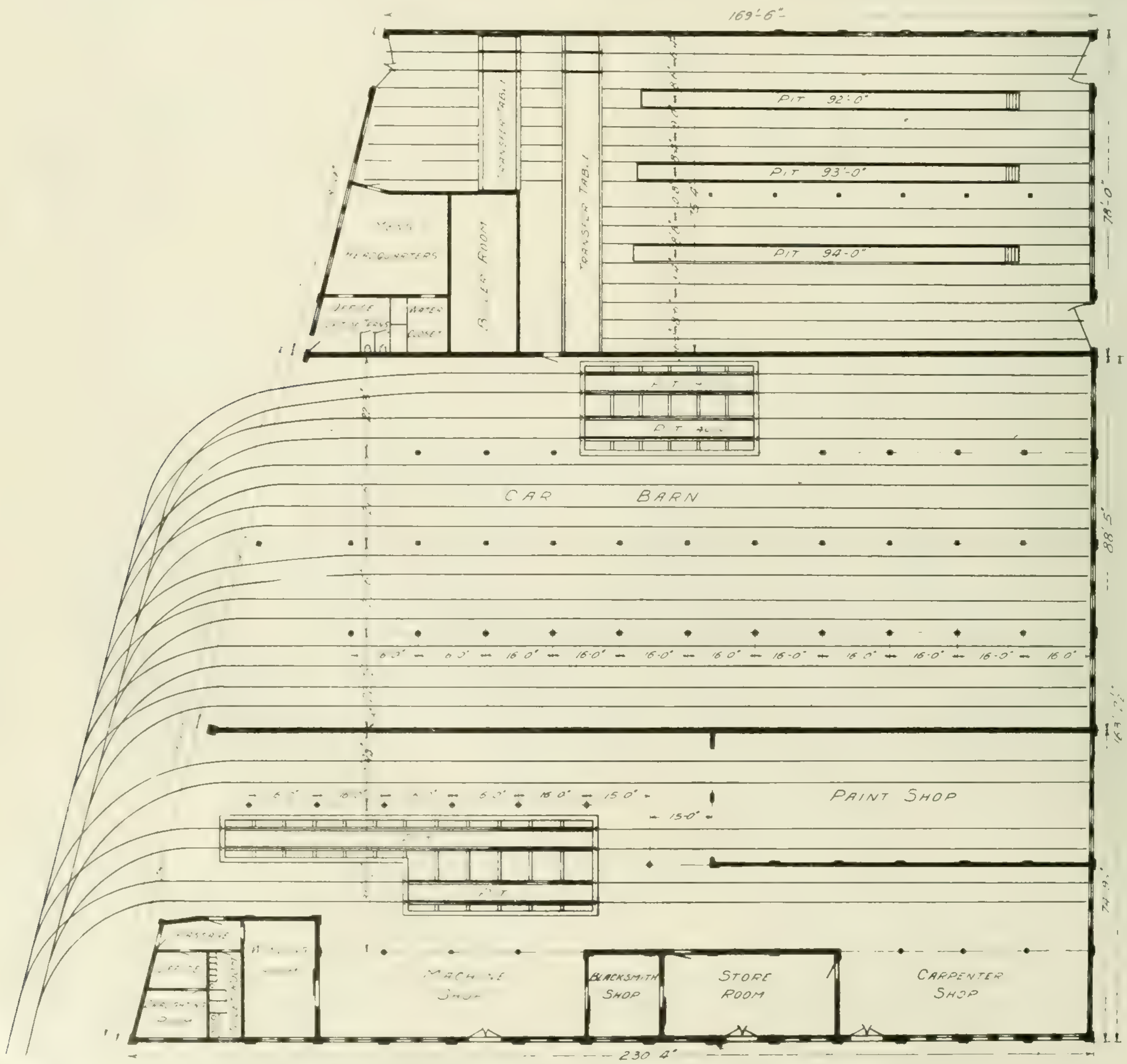
CONSTRUCTION OF WIDE PITS SERVING TWO SHOP TRACKS

curb line and eliminates the wear on special work that would otherwise occur should these tracks be led from the main line.

Seven pits serve the tracks in various portions of the buildings, the construction of four of which is unique and interesting. Four pits serve two tracks in the new car barn and two tracks in the machine shop. The pits are 8 ft. wide by 4 ft. 2 in. deep and extend not only under the tracks, but two feet outside of the rails, giving free access to the trucks and bodies of the cars and enabling the workmen to stand in the pits outside the rails. The rails are laid on 8 x 8-in. oak stringers, supported by timbers of the same size, which are braced by 3 x 12-in. stays and secured by ⅝-in. bolts. A bed of concrete six inches deep forms the floors of these pits. The side walls are of brick, 12 in. thick. A flight of brick stairs of five steps is built at either end of the pits.

A fireproof wall separates the storage barns from the machine shop. This shop is served by three tracks, with the two pits which extend through the central portion of the room. Two of these tracks extend through the paint shop, which is located at the rear of the machine shop. The paint shop is separated from the other parts of the building by a brick partition and the openings over the two tracks are closed by steel doors. The floor of the paint shop is of concrete, sloped for proper drainage, so that cars may be washed before being painted.

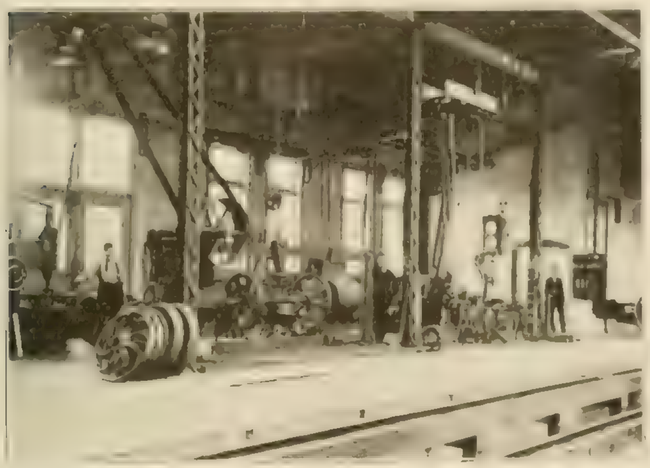
The south bay of the building comprises the several small shops



PLAN OF BOTH OLD AND NEW CAR BARNS AND SHOPS OF THE SAGINAW VALLEY TRACTION CO.

and that portion of the machine shop containing the repair [illegible]. The front end of the [illegible] is divided into [illegible] adjacent to which is the armature room. Beyond the portion of the shop using machine tools is located the blacksmith shop, the stock room and the carpenter shop.

The machine shop is equipped for handling repair work with an overhead pneumatic hoist system. Over each of the two tracks having wide pits is hung an I-beam, the lower flanges of which support the carriages of the pneumatic hoists. An I-beam [illegible] built in the shape of a circle, 32 ft. in diameter, is located near the rear of this shop adjacent to the machine tools, so that trucks, motors, etc., which are to be repaired may be handled by these hoists and deposited near the machine tools. [illegible]



[illegible]

10-in. and two 8-in. hoists, manufactured by the Northern Engineering Works, of Detroit, Mich., are used. The air for operating these is furnished by a horizontal compressor built by the Franklin Air Compressor Works, Franklin, Pa., driven by a G. E. 20-h. p. 500-volt motor.

The equipment of the machine shop and its arrangement is such that repair work may be handled with economy and efficiency. Among the tools installed are a wheel press of 200 tons capacity

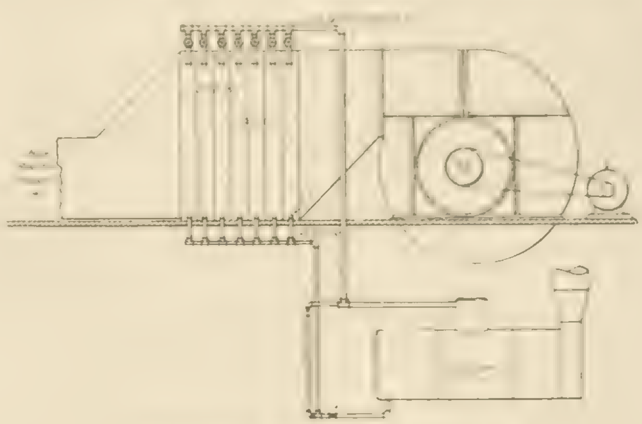
[illegible]

made by the Niles Tool Works; a 36-in. wheel boring machine of the same make; planer, with 5-ft. bed, manufactured by the Ames Manufacturing Co.; 16-in. shaper manufactured by the Smith & Niles Co. and furnished by the C. C. Warner Machinery Co., of Detroit, Mich.; drill press with 16-in. table, made by Prentice Bros., Worcester, Mass.; lathe with 5½-ft. bed and 21½-in. swing, made by the Lodge & Davis Machine & Tool Co.; and a 3½-ft. lathe with 14-in. swing, manufactured by the Porter Machine Works. Power [illegible] motor driving two line shafts supported from the ceiling.

[illegible]

[illegible]

[illegible]ists of a steel-plate blower in connection with the Green patent heating coils and a system of galvanized iron ducts running near the ceiling and discharging the air into the various rooms. The air is discharged in the pit of the wash-room. In the paint-shop it is discharged near the ceiling so as to avoid stirring up the dust which would otherwise be distributed were this air discharged into the room through the pits. In the machine shop and other shops the air is discharged about 12 feet from the floor line through suitable openings, each opening being provided with a damper. The openings leading into the offices are provided with registers and means for shutting them off. The coils and fans are located directly above the boiler. The steam is taken from the dome, carried to the top of the coils, the water condensations being led from the bottom



[illegible]

of these coils directly back to the boiler below the water line. This return connection is provided with a Daniells' section tee for equalizing the pressure between the coils and the boiler. The system is designed for using any pressure up to 100 lb. No pumps are necessary for returning the water to the boiler, and after the motor is started the system will require no more attention than that of a common house heating system.

The Green Bay Traction Co. has recently shortened the running time of its cars between Kaukauna and Green Bay, Wis. The distance between these two cities is 23 miles and the running time 55 minutes, which allows an hourly schedule with a five-minute layover. In this distance of 23 miles there are 10 steam road crossings at which the electric cars must be stopped and flagged ahead, and there is also a trackage of 5 miles in city streets, and a swinging draw bridge at which a stop must always be made. The usual number of stops, other that the 11 mentioned stops, which must always be made, averages about [illegible]

Fall Meeting, New England Street Railway Club.

The second Fall meeting of the New England Street Railway Club was held in Boston at the American House on the evening of November 23rd, President Potter being in the chair. The speaker of the occasion was Mr. W. S. Bartholomew, western manager of the Westinghouse Air Brake Co., Chicago, his subject being "Air Brakes for Electric Cars." The paper constituted an exhaustive summary of the present status of air brakes in electric traction service. Some of the more important features follow:

There are several very important reasons why air brakes are now considered to be an essential part of the equipment of an electric car. Among these are: economy of operation, saving in time of operation and safety. First cost is no longer as influential a factor as it was in the days when the street railways were changing from other powers to electricity. The increase in car weights from 7 and 10 tons upward and the gain in speeds which accompanied this, soon demonstrated that hand brakes were inadequate to cope with the situation. The difference between the cost of operation of an electric car equipped with air brakes and one equipped with hand brakes is over 10 per cent in favor of the former, for the reason that it is necessary for the purpose of safety to operate through the streets in congested districts with the shoes close to the wheels on hand-braked cars in order to prevent accidents, whereas with air brakes the shoes can be left free from the wheels, as an emergency application can be made without the time element necessary with the hand-braked car. The saving of time in operation is well shown in the recent case of a steam passenger train which was operated 200 miles by hand brakes on account of a failure of the air brake equipment, and was two hours behind time for no other reason than that extra caution was necessary and that the stopping of the train required an abnormally long time with the hand equipment. This feature will from now on be of great importance in the operation of electric cars and trains, especially in connection with electrified steam railroads, where the higher acceleration of the electric motor demands improved deceleration as well.

The accident account is a heavy strain upon electric railway finances, and it would seem desirable for the American Street & Interurban Railway Association proper, and also the Mechanical Association, to recommend a standardization of practice in regard to draw bar strains and foundation brake rigging, and the compulsory application of power brakes to cars of a given weight and for speeds in excess of some stated normal speed. Although the use of the air brake to improve the factor of safety was long ago practiced in electric car work, the conditions are at present changing so rapidly that what was necessary three or four years ago to simply improve on hand brakes does not meet the present conditions any better than the hand brakes did at that time. Unless proper consideration is given to the extreme maximum speed at which the cars are likely to run to make up lost time after a delay, serious accidents are liable to occur. It is just as essential that the appliances on the car should be such as to make a stop possible in the same number of feet at 60 miles per hour as has heretofore been possible at 30 miles per hour.

Until quite recently the tendency of electric roads has been to increase the size of each individual vehicle until we now have interurban cars weighing 98,000 lb. complete, without live load. Certain disadvantages are now becoming apparent in the operation of single heavy vehicles in interurban service. It is necessary to operate the heavy vehicle at all times during light and heavy traffic; large motors require high floors, which are inconvenient for passengers; the broader wheel treads and deeper flanges make trouble with the ordinary city special work; the cars are too long for satisfactory operation around 35 to 40-ft. radius street corner curves; and finally, the difficulty of handling the heavy currents required by platform controllers has led to the use of multiple unit control, where the contacts are made and broken beneath the car floor instead of on the platform and the vehicles may readily be operated in trains. The tendency is therefore toward modified weights, with trains of from two to five cars, the length of train being adapted to the traffic.

Mr. Bartholomew then emphasized a number of different methods of combining motor cars and trailers in trains, specifying the fields of usefulness of single car, locomotive and motor-trailer operation. He made it clear that one standard air brake equipment could not be used for all these several and separate conditions.

Although the automatic air brakes now in use on steam railroads will doubtless serve in their present form to meet steam railroad conditions for some years to come, such equipment was not originally designed for the widely varying conditions of operation pertaining to electric roads. There are several reasons for this. The applications of the brakes on electric cars are likely to follow each other in such quick succession that there is not enough time for the proper recharging of the auxiliary or braking reservoirs, a graduated release of the brakes is necessary to make smooth stops with due regard to the standing load, and with the standard automatic equipment the release of pressure from the brake cylinders is complete when once started; a prompt response of the brakes after an application has been made and released is very essential; the small brake pipe volume found in the equipment of motor cars with automatic brakes prevented flexibility in the release graduations; and, finally, the standard automatic equipment was designed for use with an air supply on the head end of the train only. Individual compressors have now come into pretty general use, and changes made in the standard equipment to secure an equal division of pump labor.

For single car work "straight air" brakes serve the purpose well, and provide sufficient flexibility to meet the most varying conditions of car weight and speed. They will probably continue to be used as in the past, but with very large cars and very high speeds, say from 50 to 65 miles per hour, an additional braking effort must be provided to bring the car to rest within comparatively short distances. The rotation of the armatures at these high speeds is a matter of considerable moment. Two separate conditions must be met by the brake valve—in an emergency the maximum pressure should be instantly applied to the wheels, which ordinarily will not skid at high speeds, and at the lower speeds the braking effort must not be great enough to cause sliding. With the lighter cars and slower speeds previously found no special necessity existed for such an arrangement. Straight air brakes have too many shortcomings, particularly in the factor of safety, to be satisfactory to train service.

Considering automatic air brakes, the speaker then stated that when a motor car is to be operated alone most of the time, with a non-motor trailer attached in rush hours, on Sundays, holidays, etc., a combination braking equipment is furnished, in which the straight air feature is the most prominent, with an additional small triple valve and second hose connection which will apply the brakes automatically in the event of a rupture in the hose connections or piping, or in the event of the emergency position of the brake valve being used. This arrangement prevents the use of an excessive amount of air by the motorman and tends to check the too free use of the emergency position in stopping.

When a motor car and a non-motor trailer are operated together continually it is unnecessary to have a straight air brake pure and simple for handling the motor car singly, and if a straight air release of the brakes from the brake cylinder of the head car be added to the automatic equipment, together with an arrangement to enable the brake applications to follow each other immediately without danger of depleting the auxiliary reservoir pressure, the conditions can be better met with automatic brakes than with straight air. This type of equipment requires but a single hose line and a simple brake valve, which is a great advantage in surface car work, and the brakes are applied practically simultaneously on both front and rear cars. One application after another can be made in quick succession, and any rupture of the piping or breaking apart of the train will at once apply the brakes on both vehicles. By the use of the straight air motor release, the train can be handled with great smoothness. In practice the braking effort on the motor car is slightly in excess of that on the trailer. This equipment is the automatic brake in its simplest form, but it is designed to meet the

[illegible] lighter car is hauled behind a heavier motor car.

Mr. Bartholomew then described in detail a new automatic air brake equipment specially suited to the operation of two and three car trains, composed of all motor cars or motor and trailers in multiple unit control trains. This equipment is designed to prevent the overcharging of the train line and consequently the overcharging of all the auxiliary reservoirs on the front cars of the train, which is a very important point in the handling of short trains, and especially single cars with automatic air brakes, as it is essential to [illegible] ment short trains can be handled with a flexibility and safety not previously attained, and the triple valve is arranged to graduate the release of the brakes. The applications are also graduated and the brake valve is regularly furnished with a straight air release position which can be used or not as the circumstances warrant. Modifications of this equipment can readily be made to meet conditions which Mr. Bartholomew described in detail. It is furnished with a single pipe system for ordinary motor trains, but a double pipe line is desirable for trains equipped with pneumatically operated doors or other devices, to provide an alternative method of operating these [illegible] apply this equipment to a larger train than three cars regularly, or possibly four cars in exceptional cases, as the triple valves have no quick action features sufficient to eliminate the time element in long trains. The advantages which lie in this equipment are the quick recharge feature of the triple valve, together with the graduated release at the triple valve and the use of the straight air release at the motorman's brake valve. All the parts are designed to secure the lowest possible cost of maintenance and repairs, and the triple valves are of the new pipeless design, so that they can be readily removed for inspection and cleaning without the necessity of breaking any pipe connections whatever.

For electric trains of four cars or more, all motor cars or motors and trailers with multiple unit control, the conditions of having each unit self-accelerating and each motor car equipped complete with compressors, brake valves, etc., make it necessary to provide for the division of pump labor and also make it possible to secure with an independent air supply on each of the motor cars refinements impossible in steam railroad service. In describing two practically similar equipments which secure these refinements Mr. Bartholomew stated that it was a very important engineering accomplishment to secure in a single schedule graduated release, quick recharge of auxiliary reservoirs, quick serial service application, no overcharging of brake pipe, prompt response of triple valves after full release, independent operation of all compressors in a train, and a single hose pipe. The most prominent installations of these equipments (Westinghouse Air Brake Co's. A M Q and A M R schedules) are 418 cars on the Metropolitan West Side Elevated Ry. of Chicago, 175 cars on the Long Island railroad's electrically operated division, besides trains on the Boston Elevated and Manhattan Elevated.

For service with locomotives and trailers, either steam or electric, a schedule "E T" is now available, the particular features being independent control of the brakes on the locomotives, a holding position to retain the locomotive brakes when releasing train brakes and maintained pressure in the brake cylinder on the locomotive at whatever point desired. All the features of quick charge and graduated release apply to this equipment, together with the regular Westinghouse quick-action features in the triple valves and a new departure in the way of a quick service feature in the triple valves. Five-pound graduations of the release can readily be secured. The quick service feature is an arrangement of parts in the triple valve to secure the use of brake pipe pressure to aid in raising the brake cylinder pressure in service applications and reduce the time of serial action through the train, whereas heretofore this feature has been confined to emergency applications only. The time of serial action has now been reduced one-half, at least, so that larger trains can be handled with greater smoothness and facility than with the former schedules. With this equipment on a locomotive the highest speed passenger trains can be handled as well as freight trains, or even switching can be satisfactorily done.

The latest development in air brakes is the electric-pneumatic system "No. 3." The apparatus is not strictly an air brake schedule, but consists of additional devices to be used in connection with any of the preceding schedules. These devices consist of electric tops [illegible] line electric circuit through the train, a special bracket, on which are [illegible] the application and production of the release of the brakes and at [illegible]

[illegible] and in reserve at all times for immediate use. When the electric [illegible] the triples are in release position also, and the auxiliary reservoir [illegible] slight movement to the right energizes the application magnet, which permits auxiliary reservoir pressure to flow into the brake cylinder through the triple valve exhaust, as long as the handle is kept in the electric application position, but if the hand is brought back to the lap position the brake cylinder pressure is held on all cars, as the atmospheric exhaust is still held electrically closed. The release graduations are then made by moving the handle still further to the left, breaking the circuit and exhausting the brake cylinder pressure into the atmosphere. These graduations of application and release can be made with any degree of fineness desired. These operations take place without the movement of the triple valve proper, and applications can be made as rapidly as desired, especially with the new quick recharging equipment, and this without the discharge of air beyond the ability of the equipment to immediately replenish. This new electrical apparatus gives practically straight air on each car with a uniform braking head of 70 lb., or whatever the feed valve pressure is arranged for. The system goes far beyond anything previously possible with straight air, as there is absolutely no time element whatever in serial action from car to car, as the same results take place at each brake cylinder in the train simultaneously. The base of the deceleration curve is as short, if not shorter, than with automatic brakes, and by the use of the refinement of graduation above mentioned it is possible to secure a deceleration curve that is practically a straight line, as the brake cylinder pressure can be kept in the exact ratio of the negative deceleration and the use in the curve of the coefficient of friction. An important commercial advantage of the equipment occurs in the fact that it uses very much less air than any other equipment, even with straight air. No train pipe reduction or other waste of air is required to secure a brake application, and as the electric valves are [illegible] of at least 50 per cent of the air used can be made. As the time for permitting the brake handle to remain in one position is the same for any length of train, the element of judgment necessary for the motorman to use with other equipments is almost entirely eliminated by the use of electrically operated brakes. Mr. Bartholomew stated that it is his belief that the electro-pneumatic brakes have come to stay, especially with electric roads operating trains of vary- [illegible] these results does not stand in the way of the adoption of this equipment with electrically operated roads, as the officials are familiar [illegible] improvement in this equipment will be the operating of brakes on trains with motor cars entirely electrically, with no hose connections [illegible] brake will be retained as a reserve for some time to come. It is only necessary to move the brake valve handle further to the right, to the regular automatic service and emergency positions, to operate the brakes in the ordinary manner.

[illegible] Mr. Bartholomew.

THE
STREET RAILWAY
REVIEW
AN INTERNATIONAL JOURNAL OF STREET AND ELECTRIC RAILWAYS

PUBLISHED MONTHLY BY THE
KENFIELD PUBLISHING CO.,
45-47 PLYMOUTH PLACE, CHICAGO, ILL.

Cable Address: "Winfield." Long Distance Telephone, Harrison 754.

BRANCH OFFICES:
New York—39 Cortlandt Street. Cleveland—302 Electric Building.
London—Byron House, 82 Fleet St.

SUBSCRIPTION AGENCIES:
Austria, Vienna—Lehmann & Wentzel, Karntnerstrasse.
France, Paris—Boyveau & Chevillet, Librairie Etrangere, Rue de la Banque.
Italy, Milan—Ulrico Hoepli, Libraria Della Real Casa.
New South Wales, Sydney—Turner & Henderson, 16 and 18 Hunter Street.
Queensland (South), Brisbane—Gordon & Cotch.
Victoria, Melbourne—Gordon & Cotch, Limited, Queen Street.

Address all Communications and Remittances to Kenfield Publishing Co., Chicago, Ill.

CORRESPONDENCE.

We cordially invite correspondence on all subjects of interest to those engaged in any branch of street railway work, and will gratefully appreciate any marked copies of papers or news items our street railway friends may send us, pertaining either to companies or officers.

DOES THE MANAGER WANT ANYTHING?

If you contemplate the purchase of any supplies or material, we can save you much time and trouble. Drop a line to THE REVIEW, stating what you are in the market for, and you will promptly receive bids and estimates from all the best dealers in that line. We make no charge for publishing such notices in our Bulletin of Advance News, which is sent to all manufacturers.

This paper is a member of the Chicago Trade Press Association.

Entered at the Post Office at Chicago as Second Class Matter.

Vol. XV DECEMBER 15, 1905 No. 12

CONTENTS OF THIS NUMBER.

COURTESY.

Rules regarding courtesy were recently issued by T. E. Mitten, president of the Chicago City Railway Co., and at that time received considerable attention from the daily press in the way of editorial comment and cartoons. Courtesy is one of the most valuable assets of either an individual or a corporation, and especially is this true of an electric or steam railway company and its employes. The personnel of a railway company is an important factor in the solicitation and retention of traffic and on competitive business the company that has the reputation of treating its patrons with courtesy and respect is the one which will secure the larger share of the business. A large increase in traffic on a well known western line was attributed to the fact that the passenger department saw that its employes were courteous and also that the company had the foresight to advise the public of this important and much appreciated characteristic.

The development of courtesy in employes is a comparatively slow process and if the environment of a man has not been good, it is with some difficulty that he cultivates courtesy. Perhaps the most effective cure for lack of courtesy is to be treated with courtesy. Superior officers and patrons of the electric railway companies can do much to develop and command this characteristic in employes by treating them in the way that the employes should treat the road's patrons. In other words—"Do unto others as ye would that they should do unto you."

PORTABLE SUB-STATIONS AND FIRE HAZARDS.

The usefulness of portable sub-stations in taking care of concentrated loads, varying largely in amount and location at different seasons of the year, has long been appreciated in electric railway circles. Until quite recently the ordinary wooden box or flat car used on steam roads has been the housing for the transformers and rotaries or motor-generators comprising the portable equipment. In many cases, absolutely no provision has been made in the way of fire protection or extinguishment. High potential circuits have been introduced through suitable glass or porcelain bushings and the interior wiring has generally been carefully installed, but the hazard of housing from $20,000 to $40,000 worth of electrical equipment in a wooden housing costing less than $500 has often been overlooked. Even the installation of sand buckets, asbestos blankets and chemical extinguishers has not served to make the box car sub-station any too safe.

New portable sub-stations recently equipped for the Long Island R. R. represent a praiseworthy advance in design. They are constructed on steel cars which are ordinarily housed in concrete-steel sheds. As each of these sub-stations has a rated capacity of 1,000 kw., it is evident that the cost of using fireproof instead of wooden cars can be but a small percentage of the total investment—little more in fact than the insurance premium which should be eliminated by the steel construction. The Long Island practice also illustrates once more the importance of preventing shut-downs and consequent loss of traffic by employing a far-sighted design in an essential department of its motive power supply

SUBURBAN FARES IN MASSACHUSETTS.

An important decision recently made public by the Railroad Commission of Massachusetts arouses new interest in the suburban fare problem, with particular reference to the reduction of transfer privileges. In approving the petition of the Boston & Northern Street Railway Co., for consent to withdraw certain transfer privileges in Reading, Wakefield, Melrose, Stoneham and Sangers, the Board sanctions the cutting down of transfers to a point which makes possible for one fare a ride between adjacent town centers, or between any part of one town and the center of the next, but not between any part of one town and any part of the next. The company's petition also recited that the fares were to be raised in some instances. The Board does not pass upon the reasonableness of this course, but suggests that possibly a less radical change than a doubling of rates would be a wise policy. The intimation of a compromise between 5 and 10 cents opens a wide field of speculation as to the future of street railway fares in suburban municipalities.

A very casual analysis of the financial operations of the suburban lines in Massachusetts shows beyond the shadow of a doubt that the present density of traffic is inadequate in most cases to pay a

reasonable profit upon the improved service given in comparison with that of a few years ago, unless a readjustment of fares be effected. One need not pose as an alarmist to hold this view; the fact simply remains that the lavish provision of quicker, more comfortable and larger service, with connecting lines and through cars which the companies have made, has outstripped the increase in gross earnings which is needed to make good the extra expense and to provide a just return upon the invested capital. Last year, for example, the Boston & Northern earned less than 2.5 per cent upon its capital stock, while the Old Colony Street Railway Co., covering the distinctly suburban field to the south of Boston, earned less than 1.6 per cent. On the west of Boston, the Boston Suburban Electric Cos. centering in the Newtons made an even poorer showing. In the case of the Newton & Boston Street Railway Co., a heavy annual loss in operation has been met since 1899, which has impaired the assets to the extent of over $150,000. Recognizing the impossibility of permanently continuing such conditions, the Board authorized this company in May, 1904, to discontinue transfers for 16 months as an experimental measure, and at this writing the question of further extending the time in which transfers may be partially withdrawn is before the Commission. The reduction of transfers to zero increased the receipts per passenger from 3.69 cents in 1903 to 4.67 cents in 1904. In the year ending Sept. 30, 1904, the Newton roads lost the sum of $23,700; to September, 1905, they gained $9,000. The transfers have now been in part restored, and it is hoped that the extreme expedient of cutting them out altogether will be unnecessary in the future.

The soundness of the suburban electric railway business is in no sense imperiled by the necessity of raising fares, or, what is the same thing, reducing the transfer privilege. The suburban territory constituting Greater Boston now has a population of 1,300,000 within the ten-mile radius, and although the steam railroad service in this district is frequent and commutation rates not much in excess of one cent per mile, the electric railways, with their still more frequent service and ability to deliver passengers almost at their very door, are certain to secure more and more traffic as these communities develop. The Boston & Northern and the Old Colony Street Railway companies' passenger department is doing splendid work in the direction of traffic encouragement, and the more general use of progressive advertising methods on suburban lines will do much to increase the total volume of travel. The point is simply that facilities have been extended more rapidly than the traffic has oftentimes justified, and the public must be made to realize the legitimacy of an advance in the tariffs.

The issue of free transfers has been overdone in many instances to the extent of quite losing sight of the original purpose of supplying them, which was to place travel upon connecting lines upon the same footing as travel over direct lines. Transfers have often been issued simply to extend the distance of travel upon a single fare. Every electric railway manager knows the objections to the use and abuse of transfers and there is no need of summing these up at this time. There is no doubt that it is a very difficult matter to raise the fare upon any street railway system, regardless of legislative or judicial sanction, but sooner or later the public will be forced to recognize the justice of moderate advances, commensurate in suburban service at least with the greatly improved facilities offered. No immediate prospect is apparent on purely urban roads of any increase in fares, but it goes without saying that short interval service with comfortable cars operating at good speeds and furnishing liberal transfer privileges cannot in the nature of things be provided at the same rates in the suburbs as in the more densely populated city proper. The Massachusetts Railroad Commission seemed to appreciate this fact, judging by the Board's statement in the Boston & Northern case to the effect that if fares upon that railroad were for the first time to be established probably no criticism would be made against the proposed management, but as it is now intended to take back something once granted, there naturally follows the grievance which always accompanies any act of withdrawing privileges.

The raising of fares is naturally an unpopular measure, and it is often taken at the risk of lessening the volume of business. It is at times complicated by agreements made between companies and town officials when locations in the streets were granted. If fares are raised from 5 to 10 cents, seemingly arbitrary distinctions between long and short distance travel, which often provoke the through passengers [illegible]. In Massachusetts the zone system has never been [illegible], and the effort of interurban lines [illegible] and at the same time to establish a mileage basis for through travel has led to more or less complaint. The future of lines which do not give a reasonable return upon the investment involves either the abandonment of the railway, the acceptance of an unsatisfactory service as better than nothing, or the increase of fares, as was ably pointed out in the last report of the Board. The American characteristic of being willing to pay for the best service rather than to accept anything inferior at a lower cost will be of material help in solving the suburban problem, once the public appreciates the real situation. In any live American community the stopping of a street railway line is simply out of the question, and there is little prospect of the public's being satisfied with inadequate service. On steam railroads no one objects to the use of odd cents in buying transportation, and the success of coupon books in the middle west deserves the close study of eastern officials. The future development of suburban fares in the metropolitan district of Massachusetts promises some interesting results in the light of recent experience.

RECENT AIR BRAKE PROGRESS.

Mr. W. S. Bartholomew's [illegible] New England Street Railway Club paper on air brakes, abstracted in this issue, deserves the careful reading of every progressive railroad man, whether his lot be cast in the steam or electric field. Recent developments in air brakes have been proceeding at a pace little realized outside the immediate circles concerned, and the variety of new and effective equipment lately placed upon the market is little short of a revelation in the flood of light which Mr. Bartholomew has thrown upon the subject. It is interesting to reflect that a large part of this progress has been set in motion by the evolution of electric railway rolling stock, which introduces with heavier cars and higher speeds conditions of momentum much more exacting in range and flexibility than anything steam railroad practice is likely to produce for some years to come.

Touching upon the most salient features of the paper, it is noteworthy that the advantages of straight-air for single car operation are recognized even in the development of some of the latest schedules of automatic equipment. The field of straight air is undoubtedly the single car of moderate or slight weight running at speeds not much in excess of 50 miles per hour. With heavier cars and faster maximum speeds additional refinements in the brake system, capable of stopping the rotation of the armatures, applying the maximum pressure in the cylinders instantaneously in case of emergency and reducing the pressure to prevent skidding as the coefficient of friction rises become necessary. With these improvements, straight air will probably remain in favor for a long time to come, and with the addition of recently developed equipment which will apply the brakes automatically in the case of a broken hose connection or in the event of the emergency position of the brake valve being used, straight air is well suited to motor-trailer operation in situations where the trail car is operated only a small part of the time. In cases where the trailer is handled continually by the motor car the automatic system is well adapted to meet the conditions and in the latest apparatus described by Mr. Bartholomew there are added to the plain automatic equipment a straight air release of the brakes from the brake cylinder of the head car and the possibility of making repeated applications without depleting the pressure in the auxiliary reservoirs. Although at first glance it might seem that this method of making a stop would lead to unsatisfactory results, the arrangement of a slightly greater braking effort on the motor car permits the slack to run in when the application is made, and this condition of bunched slack is maintained until the stop is completed, which insures very smooth operation.

A notable improvement in automatic brakes for multiple unit trains is found in the arrangement of the triple valves to give a graduated release of the brakes. Great smoothness of operation results in this way, especially as regards standing passengers. In the most advanced pneumatic equipment mentioned for multiple unit service a veritable triumph of engineering has been consummated in the incorporation in a single schedule of the features of graduated release, quick recharge of auxiliary reservoirs, quick serial service application, no overcharging of the brake pipe, prompt response of

triple valves after full release, independent operation of all compressors in a single train, and all this with a single hose pipe. On the Metropolitan West Side Elevated railway, of Chicago, 418 cars are now equipped in this way, with 175 cars on the electrically operated division of the Long Island, besides elevated trains in New York and Boston. For locomotive service these features have all been retained, with the addition of a new quick service feature in the triple valve, which secures the use of brake pipe pressure to aid in raising the brake cylinder pressure in service applications and reduce the time of serial action throughout the train. Some of the worst accidents on elevated railroads have heretofore been due to the fact that one application after another of the brakes could not follow in quick enough succession with the standard automatic air brake equipment. The quick recharge of the auxiliary reservoirs is therefore a notable advance, and another feature of importance is found in the maintaining of a balance between the train pipe and the auxiliary reservoir pressure, which insures at all times a quick response of the brakes.

The climax of air brake development, however, seems to be reached in the new electro-pneumatic system, which points the way to the use of automatic multiple unit deceleration in the not distant future. The importance of automatic acceleration occurring simultaneously at all the motors in a given train has been realized since the first commercial experiments were made with multiple unit control, but it is only recently that the deceleration curve has been taken in hand as of equal importance with the acceleration line. The new electro-pneumatic brake system described by Mr. Bartholomew consists of a few comparatively simple electrically operated valves and contacts which can be applied to any one of the modern air brake equipments for the purpose of further refining the application and graduation of the release of the brakes; the connections are carried throughout the train in a two-wise jumper circuit, with the result that absolutely uniform and instantaneous brake performances are secured on each car, no matter how long the train may be. This is a notable advance, for the operations of the brakes in making service stops are practically equivalent to the use of straight air on each car; there is no loss of time in serial action, from car to car, and the advantages of quick recharge and ability to make repeated applications are prominent features of the equipment. The retardation curve becomes practically a straight line, and the consumption of air need not exceed 50 per cent of what is ordinarily required with automatic brakes. All this means that satisfactory operation can be secured even with motormen of small experience, while the emergency features of the automatic air brake system are available as well as the regulating features of the electric control. There is no doubt that the new system will prove extremely useful in circumstances where the train lengths vary considerably, particularly in heavy suburban rapid transit service and in branch and main line operation upon electrified steam railroads. In surface work the possibility of doing away with the troublesome air hose, which in summer is far too near the ground for satisfaction and in winter is often hampered by snow drifts and uncoupled by freezing and mechanical shock, is of great value, for the electric jumper lines can be carried between the cars at any convenient height. Surpassing results are being attained with this equipment on some of the elevated cars in Boston, and the extension of its use will be watched with interest. In the light of Mr. Bartholomew's paper it appears that the air brake engineer has left no stone unturned to meet every exigency of rapid transit service, and it would be difficult to specify a commercial electric or steam railway proposition which, from the braking standpoint, cannot today be treated with selective economy and assured success.

TIE POSSIBILITIES.

The annual demand for ties is rapidly diminishing the available supply of our forest lands. Various technical publications have devoted much space to the problem of perfecting a suitable substitute for the wooden tie and considerable experimentation has been conducted along this line, but so far no very satisfactory solution has been arrived at. Sooner or later the time will come when a substitute for the wooden tie must be found.

Metal and reinforced concrete ties have been experimented with and results, affording various degrees of satisfaction, obtained. In Europe the need of a substitute for wooden ties is more pressing than here and many more experiments have been made with the idea of introducing ties of iron and steel. While there is no doubt but that metal ties are the strongest and most durable of the substitute ties in use today, some objections have been found which restrict the general use of metal in tie construction.

The reinforced-concrete tie presents some favorable features but embodies many objectionable ones. A number of the railroads are experimenting with the concrete tie, both plain and reinforced, and there are many such ties in actual service today. Where a high grade of concrete was used they have been found fairly durable, but the percentage of failures has been large and must, of necessity, be so until some method is devised for making a thoroughly mixed and uniform concrete. When this has been accomplished the concrete tie will, no doubt, be turned out almost as cheaply as the wooden type.

As in the metal tie, the difficulty of permanently attaching the rail to the tie is encountered, so the jar of the rail upon the rigid concrete is objectionable, although the objectionable feature might be eliminated by the introduction of a cushion of lead, or other inelastic material, between the rail and the tie. It cannot be assumed that every method of reinforcing the concrete has been exhausted and a spirit seems to be prevalent to try the reinforced concrete to a conclusion.

There has recently come under our attention a tie made of reinforced vitrified clay or shale, a description of which appears elsewhere in this issue. It has a distinct advantage over concrete in being homogeneous. The molecular tension of clay and clay being manifestly much greater than that of cement, sand and broken stone. The fact that streets paved with bricks of vitrified clay have withstood, for long periods, the traffic of heavy trucks over them, presents a strong argument in favor of the idea.

But here again we encounter the difficulty of rail fastening and the jar upon the rolling stock. These seem to be crucial points in the tie problem and attention should be especially directed toward overcoming these difficulties.

Long before the railroads find themselves without a satisfactory timber supply, some suitable substitute for the wooden tie will no doubt be evolved. Preservatives for wooden ties are being more and more used and much effort is being directed toward prolonging the life of the wood. There is something to be said both for and against the use of timber preservatives. Creosote is today the preservative most generally used and experiments have been made with the creosoting process for about 40 years.

An examination of its cross-section, shows a piece of timber to be composed of a number of cells of varying sizes, firmly united. Decay is caused by the entrance of living organisms into these cells, and the treatment of timber consists in the introduction of substances which will kill these destroying agents. Whatever is to be used must penetrate all parts of the timber remaining there permanently. Creosote seems to fulfill these conditions in a satisfactory manner.

In the process of preparing the timber for impregnation an objectionable feature is brought to light. The preliminary process of steam seasoning which the timber undergoes in most of the treating plants in the United States, tends to weaken the cell walls and render the wood brittle. The U. S. Department of Agriculture has made tests upon treated and untreated wood, and in many instances the results turned out in favor of the untreated sticks. The tests of time and use, which are the most pertinent, seem to result in favor of the creosoted timber.

In a southern city there are creosoted sap pine ties that have been in service in street railway track for more than 15 years and are said to be good for nearly as much longer. Sap pine is the poorest and cheapest grade of lumber in the South, on account of its open and porous nature, yet it is the most successfully treated. These treated ties are said to cost about 40 cents apiece.

The London & Northwestern R. R., the greatest standard road in England, is now getting 21 years of life out of wooden ties by creosoting them at a cost of 15 cents per tie.

But at some future time the scarcity of available tie timber which can be treated with preservatives will necessitate the use of concrete, metal or tile, or perhaps some manufacturing by-product, as a foundation for railway track rails. Saw-dust, leather-scraps, chemical by-products or even paper might be used as the basis of a composite mass which would answer every requirement. At the proper time something of this nature will no doubt be brought to light.

Rochester, Syracuse & Eastern Railroad Co.

The work of construction of the first 37 miles of the Rochester, Syracuse & Eastern R. R., between Rochester and Lyons, N. Y., has been practically completed. The construction of the remaining 45 miles of this 82 mile, double track road, between Lyons and Syracuse, will soon be commenced, and it is expected that the entire line will be finished late in 1907. From Rochester the road takes an easterly direction through the counties of Monroe, Wayne, Cayuga and Onondaga to Syracuse. Between Rochester and Lyons the portion of the road now completed passes through the towns of Brighton, Despatch, Fairport, Egypt, Macedon, Palmyra, Port Gibson and Newark.

Outside of the village streets the track is constructed with 70-lb. T-rail in 60 ft. lengths, and a 90-lb. T-rail is used through the villages. There are at least six inches of gravel ballast under the ties, and this is brought up level with the top of the ties. The ties are 6 x 8 in. x 8 ft., long leaf southern pine and spaced 32 to the rail. In the villages plug bonds are used, while outside the village limits the bonds are soldered to the head of the rail. The bonds are 300,000 c. m., and the four rails are cross bonded every 600 ft. The road is built entirely on private right of way except through the villages, and has 12-ft. track centers.

The overhead equipment is of span construction. The poles are 35 ft. long with 8-in. tops and 14-in. butts, set 6 ft. in the ground, the face of the pole being 8 ft. from the center of the nearest track. The poles are anchored at frequent intervals by Crouse-Hinds fluke anchors and 3/16-in. steel-strand guys. The trolley is No. 0000 grooved copper wire and the feeders are two 500,000-c. m. cables. A telephone line of No. 10 wire is installed. There are two circuits with additional circuits for signals, making in all six wires. There is also a duplicate high-tension line of No. 2 wire in triangles, 60 in. and 36 in. respectively, the 36 in. being used for emergency only.

The arches, viaducts and structures are of concrete and steel, and the live loads have been assumed as a train of cars, each car being 60 tons in weight, 60 ft. long, and 46 ft. center to center of trucks. There are several concrete arches, and the following important steel structures: A viaduct over the New York Central & Hudson River R. R. (Auburn Branch), at Brighton, consisting of a 100-ft. through plate girder span with a 400-ft. steel trestle approach on each side, with spans 32 ft. center to center. The total length of the bridge is 900 ft. A 55-ft. plate girder deck span has been constructed over Irondequoit Creek; a 60-ft. plate girder through span over Penfield Road and Thomas Creek; a 100-ft. through truss span over Ganargua Creek; a 240-ft. skew span, through pin connected trusses, over the Erie Canal at Fairport. A viaduct erected over the New York Central & Hudson River R. R., between Newark and Lyons, consists of one 254-ft. span, pin connected through truss, one 75-ft. plate girder deck span, and 10 spans of 30 ft. each, the latter being steel trestle approach; and a viaduct over the Ganargua Creek and Erie Canal at [illegible] steel trestle approach and a 170-ft. [illegible] pin connected trusses.

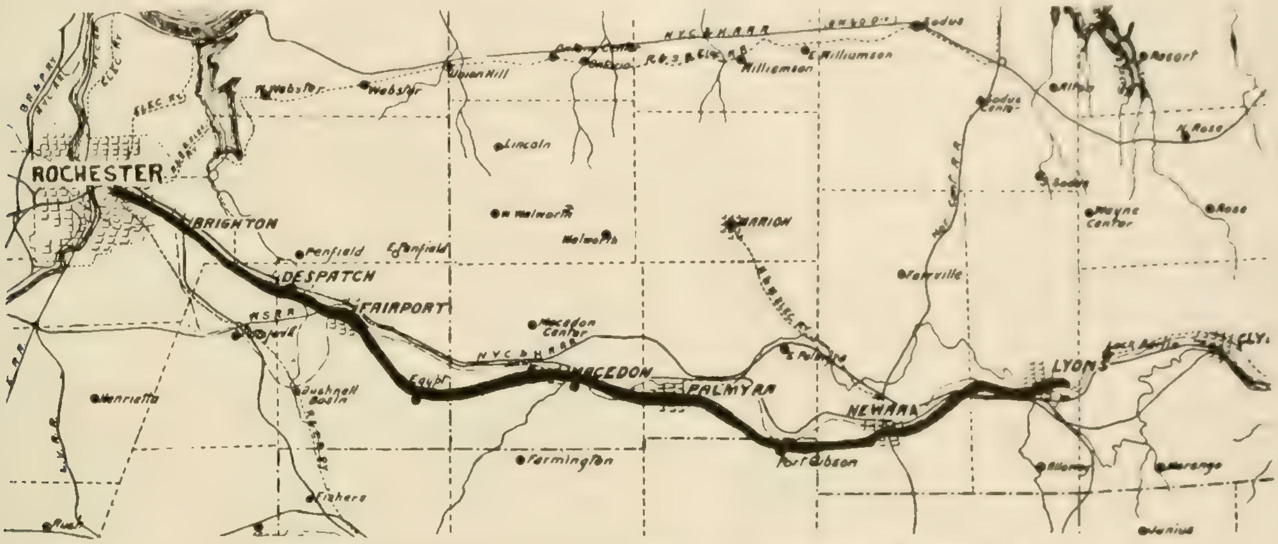
The car equipment [illegible] and will consist of 10 passenger cars [illegible] are being built by the Niles Car & Manufacturing Co., Niles, O., and two by the G. C. Kuhlman Car Co., Cleveland, O. The Niles company [illegible] car.

Two snow plows have been ordered by the company, one of these being a [illegible] Peckham Manufacturing Co., Kingston, N. Y., and the other a double-end Russell snow plow built by the Russell Car & Snow Plow Co., Ridgway, Pa. The latter [illegible] been constructed for electric railway service. The trucks are all of the M. C. B. type, of very heavy construction, with 6-in. axles and steel-tired wheels.

Westinghouse No. [illegible] h. p. motors will be used. All cars are to be equipped with four motors and nearly all of the cars will be provided with Westinghouse multiple unit switch type of control. The air brake equipment for all cars will be supplied by the Westinghouse Traction Brake Co., and will be its latest type A. M. T. gradual release automatic, so that the cars may be operated in trains, if desired. The snow plows will have Westinghouse straight air brake equipment.

Work on the power house at Lyons is being pushed forward as rapidly as possible. Most of the apparatus is now in place and the work of piping and wiring is well under way. The equipment will consist of two 1,500-kw., 3,300-volt Westinghouse-Parsons turbo-generator units, two 400-kw. rotary converters with the necessary switchboard panels and transformers for handling the transmission line current of 33,000 volts. The boiler plant consists of six 360-h. p. Heine boilers fitted with Heine superheaters for 150 degrees superheat. The condensing apparatus and air pumps are furnished by the Alberger Condensing Co., and are of the surface condensing type. The feed pumps are furnished by the Deane Steam Pump Co., Holyoke, Mass. An economizer of 400 pipes, which was built by the B. F. Sturtevant Co., Boston, Mass., is being installed. For this section of the road there will be three sub-stations located approximately 10 miles from the power house and 10 miles apart, in two or which there will be installed two 400-kw. rotaries and the necessary transformers and switchboards. The third one of these sub-stations will be fitted with 500-kw. rotaries. The sub-station buildings are now nearly completed, and it is expected that the power plant will be ready to operate early in the coming year.

The Syracuse Railroad Construction Co. has the contract for the entire work and the work was sublet to the following contractors: The engineering work was done by the Syracuse Construction company's own engineers. The contractors for the grading



MAP SHOWING COMPLETED PORTION OF ROCHESTER, SYRACUSE & EASTERN R. R.

[illegible] & Co., Springfield, Mass., the John Shields Construction Co., New York City; and J. G. White & Co., New York City. The latter contractor also had the contract for the track laying and overhead work. The Owego Bridge Co. constructed and erected three of the smaller bridges, and the American Bridge Co. supplied the others.

The officers of the Rochester, Syracuse & Eastern Railroad Co. are: President, L. C. Smith; secretary, C. A. Lux; treasurer, C. H. Hiscock; general manager, C. D. Bisbee; chief engineer, Thomas H. Mather; electrician, R. A. Dyer, jr.

November Meeting, Ohio Interurban Railway Association.

The November meeting of the Ohio Interurban Railway Association was held at the Tod House, Youngstown, November 23rd. The attendance was about forty, including a good number of railway men from the district around Youngstown.

It was announced by President Spring that the plan of the appointment of a permanent secretary and the formation of a publication and publicity bureau was meeting with considerable encouragement and that he hoped to interest the Indiana roads in the project but action could not be definitely taken until the other roads had been consulted. The next meeting of the association will be held at the Chittenden Hotel, Columbus, Dec. 21st, when it is hoped some definite action can be taken regarding the permanent secretaryship.

The annual meeting of the association will be held January 25th at the Algonquin Hotel, Dayton, and plans are being made for a large gathering and a magnificent banquet. A nominating committee, composed of Robert Dittenhaver, Toledo; F. G. Green, Springfield; F. D. Carpenter, Lima; J. O. Wilson, Cleveland and J. R. Harrigan, Newark, was appointed. This committee will select a slate of officers to be voted upon at the annual meeting.

The announcement was made by J. H. Merrill, chairman of the transportation committee, that since the last meeting of the association the Richmond Street & Interurban Ry., the Indianapolis, Columbus & Southern Ry., and the Kokomo, Marion & Western Ry. have adopted the interchangeable coupon book of the Ohio Interurban Railway Association. The committee had also received a communication from the Muncie, Hartford & Ft. Wayne Ry., indicating its intention of joining the agreement.

Interline Tickets.

The first subject under discussion was the revision of the present form of interline ticket. Theodore Stebbins, of the Appleyard system, who introduced the subject said that while the present form of interline ticket now sanctioned by the association is satisfactory under certain conditions, yet the work of the agents is increased and especially in large terminal cities is the work slow. He suggested a form of multiple destination ticket used by some steam roads, in which the agent folds the coupons and punches the routes and destinations with one operation.

F. J. J. Sloat, of the Cincinnati, Dayton & Toledo Traction Co. said that while the skeleton form of ticket at present in use was largely used by steam roads, he thought that operators of the interurban roads must work out some improvement. He thought interurban roads had too many varieties of tickets. He suggested the use of a so-called "Closed System" in which the receipt is issued in duplicate, the duplicate section remaining in a locked box so that the conductors cannot manipulate the receipts. The conductor settles on balances, deducting his change and turning in all other money to the auditor who compares it with the receipt stubs locked in the box. He felt that this scheme would be more satisfactory than the card tickets which are not issued in duplicate sets.

F. W. Coen, of the Lake Shore Electric Ry., believed that if the steam roads could have improved the present form of interline ticket they would have done so some time ago. He thought Mr. Sloat's scheme objectionable, in that it would necessitate the use of very thin paper, and that since the tickets would be handled so often that they should be on heavy paper.

A. L. Neereamer, of the Columbus, Delaware & Marion Ry., said that he had seen many experiments with so-called multiple-destination tickets and that since they were not used to advantage on steam roads that they were less liable to be on electric roads, where ticket agents and conductors are usually of an inferior class. He said that there was nothing on the coupons, advocated by Mr. Sloat, to indicate to what point the passenger might be going, and that he wanted to know, immediately, where a passenger came from and where he got off; he wanted full explanations from the other fellow and thought that the interline business on electric roads could be worked out so that everything would be above board.

After a general discussion the chair on motion appointed Messrs. Sloat, Stebbins and Merrill as a committee to suggest improvements in the present form of interline tickets.

Steel-Tired Wheels

The discussion of the subject of steel-tired wheels was opened by W. E. Rolston, master mechanic of the Dayton & Troy Electric Ry. He said that his road on which the service is quite severe had been using steel-tired wheels for four years, and he believes a chilled wheel unsafe for such hard service. On this road an average mileage of from 200,000 to 250,000 miles has been secured, with 2½-in. tires. They are now trying 39-in. wheels, with 3½-in. tires with which they expect to get 400,000 miles. When cars are first equipped, the wheels are allowed to run 97,500 miles and then a 7-16-in. turning is made. Mr. Rolston believes that it is better economy to make more turnings and take off less steel each time, but this plan has not been fully decided. He stated that the cost for turning the steel-tired wheels, had been reduced to $1.10, by using the best material and employing a 20-cent per hour man. He strongly recommended steel-tired wheels for city service, and said that his road was using them on some of its small city cars.

Mr. W. C. Elmersdorf, master mechanic of the Youngstown & Sharon Ry., said that the first steel-tired wheels his road used had cast-iron centers and that the tires came loose. They are now using a steel center with the steel tire, and it is giving good service. He stated that these wheels, some of which have been run 127,000 miles, have one-half inch turned off, when they are good for 60,000 miles more. He spoke of an advantage of steel-tired wheels, in that the flat spots roll out, and their low cost when the total mileage is considered.

W. H. Abbott, of Roberts & Abbott, Cleveland, said that there was a great difference in rolled-steel wheels. He had used some which were made from low carbon steel and which had soft spots and did not wear uniformly, while others were more satisfactory. Larger wheels seemed to stand up better than small ones. He stated that steel-tired wheels should not be run more than 50,000 miles without returning since there is danger that the flanges will become sharp and wear quickly. The rolled and forged steel wheel, made by the Schoen Steel Wheel Co., Pittsburg, Pa., was described and some of the good results found in its use were enumerated.

F. J. J. Sloat said that he had used steel-tired wheels, but still favored cast-iron wheels. He said he had to get four times the mileage to equalize the cost, and he could not do it.

J. A. Paul, superintendent of the Youngstown & Sharon Ry., said that he had fitted a car with steel-tired wheels on one truck and rolled-steel wheels on the other, and that the advantage was in favor of the rolled-steel wheel.

Theodore Stebbins, of the Appleyard system, had found steel-tired wheels much safer and in the end less expensive than cast iron.

J. D. Cunningham, of the National Car Wheel Co., said that out of 30 interurban roads in Ohio, 13 are using steel-tired wheels. He said the great trouble was that roads demanded cast-iron wheels at such a low figure that the proper material and care could not be used in their manufacture.

Further discussion brought out statements that proper care of trucks makes a great difference in the wear of wheels; cast-iron wheels are more economical, but steel-tired wheels are undoubtedly safer, and that by fitting a car with roller bearing center and side bearings the flange wear is reduced to a minimum.

Mr. Abbott made suggestions regarding the good results to be gained by the use of wheel truing brake-shoes instead of turning steel-tired wheels.

Recording and Other Instruments.

W. H. Abbott, of the Roberts & Abbott Co., Cleveland, gave an interesting talk on the use of "Recording and Other Instruments." He divided the subject into steam and electrical, and sub-divided the electrical into portable and stationary. The use of portable

instruments has been neglected in the past, but its importance is becoming recognized. A high tension voltmeter is an important instrument. No matter how carefully a system is designed there are liable to be accidents or changes in the system, which make it necessary to determine the voltage in any particular district. Every road should have portable wattmeters to test out cars. Car house men should also have ohmmeters to measure the resistances of field and armature coils. The majority of power station switchboards are too lavishly equipped with instruments, many of which are never used. Some of them ought to be taken down and given to the men on the road. Recording pressure gages are desirable for boiler rooms where only one or two men are employed. Thermometers are coming into use and are necessary where superheated steam is used. Water meters are desirable but it is hard to find an accurate one. A water meter is useless, unless a record is also kept of the coal used.

Mr. Rolston said that a number of portable instruments were used in the Dayton & Troy Electric Ry. shops for testing work. They use wattmeters in stations to get a record of the daily power consumption, car mileage, coal and water. Free use of meters in the station enables them to locate trouble promptly and keep a close check on expenses.

Mr. Sloat said that they had experimented with the wattmeter on their cars and take careful reading at set times. Regarding acceleration, he thought it necessary to accelerate rapidly in order to make time.

A general discussion of the use of automatic devices for preventing rapid acceleration followed. The general sentiment was against their use, several serious accidents being attributed to them.

Charges for Cars on Foreign Roads.

The question of charges for cars on foreign roads, discussed a year ago, but never satisfactorily settled, was again brought up. Mr. Sloat suggested a schedule of rates based upon the weight of the cars and the capacities of the motors. On the Cincinnati & Northern road it costs 13½ cents per car-mile to operate, which together with the interest charges makes a total cost of 17 cents per car-mile. His rule is to allow the foreign company 2½ to 3 cents per car-mile, according to the size of the car, while his road furnishes the pilot and pays the crew.

Mr. Stebbins said that the Appleyard properties allow the foreign company $5 for the use of the car while on their road. If this is not satisfactory they pro rate with the foreign road on the mileage basis.

Mr. Coen said that in the Cleveland district the roads have a flat rate of 30 cents per car-mile. In the cities of Toledo and Cleveland there is a terminal charge of $7.50. He thought this matter ought to be decided at once. Steam road managers knew what it would cost to run a car over the tracks of another company, but that electric road people were obliged to first find out the rate.

No definite action was taken about charges for cars on foreign roads.

Reasonable Tender for Fares.

Mr. Neecreamer wanted to know what constituted a reasonable payment in the tender of fare. A $20 bill is frequently tendered for a 10-cent haul. Some states have laws fixing the amount, but the Ohio statutes say nothing on the point.

Mr. Spring said one of his men had put a man off, using violence in so doing, because he had no change for the $20 bill tendered, and that the act cost the company $250. The court did not decide the debated point.

Mr. Sloat said he had a notice posted in cars, stating that no currency exceeding $2 in denomination would be changed. He said the courts of some states had decided that making change was a matter of accommodation and that the company was not obliged to make change.

Mr. Paul said that the courts of Illinois had so held, and that he thought that a person presenting an unreasonably large bill should be put off.

It was voted that this matter be brought to the attention of the legislature, and that it be asked that a suitable law be framed in Ohio.

The meeting adjourned at 5 p. m.

Secretary Rogers and Superintendent Paul, of the Youngstown & Sharon Ry. extended [illegible] of the members, to [illegible] town & Sharon Ry. The visitors were first shown the freight and passenger station and [illegible] Lane, where the car [illegible] made in a handsome new car recently furnished by the Niles Car & Manufacturing Co.

The Northern Texas Traction Co. Improvements and Changes.

The Northern Texas Traction Co., Ft. Worth, [illegible] recently completed an extension of its Hemphill St. line to the works of the Ft. Worth Iron & Steel Co., a distance of about 5,700 ft., and has replaced 4,200 ft. of [illegible] construction. The track construction for this extension consists of 60-lb. T-rail laid on [illegible] center to center. The overhead construction is of the usual span type, using "Burnettized" poles with 12-in. butt and 7-in. tops. The spans consist of a [illegible] span being insulated by cutting in a wooden strain insulator 12 in. from each pole. The trolley wire is No. 00 and the feeder No. 0000, both being furnished by the John A. Roebling's Sons Co., while the caps, cones and ears, and also the 10-in. concealed bonds used for bonding the track were furnished by the General Railway Supply Co., of Pittsburg, Pa.

The company has recently placed an order with the Cambria Steel Co., Johnstown, Pa., for 200 tons of 60-lb. T-rails and 30 tons of 70-lb. high T-rail, and with the Lorain Steel Co., Lorain, O., for 80 tons of 80-lb. 7-in. high T-rail. The 60-lb. T-rail and the 7-in. high section will be used by the company for extensions in the city of Ft. Worth into the populous Third Ward district. The 70-lb. rail is for improvements on the interurban line between Ft. Worth and Dallas. The overhead material for the extension will be practically the same as that of the Hemphill St. line and has been purchased from the supply companies named. On the interurban line the company is replacing the old 4-in. mechanical trolley clip, which has given trouble, with a 9-in. clinch ear.

The company has recently given a name to every station on the interurban line from Ft. Worth to Oak Cliff, 36 in number, and in the future the stations will be known and designated by their names and not by stop numbers, as heretofore. Neat station buildings have been built at nearly all of the stops. The names of the stations are printed in plain letters on sign boards about three feet in length which are erected near the track. Much of the track has been reballasted during the past year and new bridge work is now under construction. The company has under consideration the double-tracking of its line from Ft. Worth to Handley, in order to take care of the rapidly increasing traffic.

All of this work, together with other improvements, has been done under the supervision of Mr. Blake A. Mapledoram, manager of the company, who has recently resigned to become associated with Mr. George A. Bishop in the construction of the Baltimore, Washington & Annapolis Ry. His esteem for Mr. Mapledoram is shown in his asking the present owners of the Texas property for Mr. Mapledoram's release in order that he might assist in the construction of these new properties. As a token of kind esteem, the employes of the city and interurban lines of the Northern Texas Traction Co. gave a smoker and luncheon to Mr. Mapledoram, shortly before his departure, at which time they presented him a handsome silver loving cup and an elaborate solid silver electric light desk stand. Mr. H. T. Edgar, vice-president and manager of the El Paso Electric Railway Co., succeeded Mr. Mapledoram as manager of the Northern Texas Traction Co., December 1st.

The properties of the Northern Texas Traction Co., in which Mr. Bishop had a controlling interest, were recently purchased by Stone & Webster, and Mr. Bishop is devoting his entire time to the construction of his eastern properties.

It is said that the Louisville & Nashville R. R. will shortly inaugurate an interurban service of eight trains a day making seven stops along the gulf coast, between Bay Saint Louis and Ocean Springs, Miss. The service is expected to compete actively with a proposed parallel electric line.

A Desirable Car for Interurban Service.*

BY F. J. [illegible]

The economy of employing the largest car practicable is apparent because of its ability to transport the greatest number of passengers per conductor. Because of the necessity for entering cities, a car of more than 60 ft. over the buffers is not desirable. The overhang with cars of a greater length than this becomes dangerous to pedestrians on sidewalks, at curves, and hampers operation on account of fixed or practically immovable obstructions frequently encountered at curb intersections. To my mind, therefore, a desirable car for interurban service, should be 60 ft. over bumpers, 8 ft. 6 in. wide over side sills, 9 ft. 3 in. from floor to under side of ceiling, 10 ft. from under side of sill to top of roof, and should stand 3 ft. 6 in. from top of rail to under side of sill. In external appearance the car should resemble, as nearly as practicable, that of the standard Pullman car.

It has been demonstrated that if the front end of the car be wedge-shaped, the air resistance is most easily overcome, but, on account of the location of the motorman's cab, with its controlling apparatus, the wedge is practically impossible. The nearest feasible shape for the forward part of the front end of the car would be a cylindrical form, this form to be limited by an angle of about 85 degrees, on a radius of 3 ft. 6 in. The corners of car should be rounded off to meet the circle on an 18-in. radius. This has been demonstrated to be the most practical and economical design for the front end of a high speed car. To allow for egress from the front vestibule, it will be necessary to place a 26-in. door in the right-hand corner, which, allowing for sufficient room for motorman and apparatus, will make the vestibule four feet long from the extreme point to the sliding door into the main body of the car.

The rear end of the car should be built with the shape of a one-half oval, the platform five feet long, at the center point, the steps 40 in. wide, and of proper height to suit local conditions. The doors in both front and rear vestibules should be so hung as to prevent slamming. This may be accomplished by using a small track or rod, on which the edge of the door slides when folding; thus, when the door is open, the hinge between halves will be toward the platform, while the two outside edges will be toward the outside of the car.

The interior divisions should consist of smoker, passenger, toilet and heater compartments. The most desirable place for the smoking compartment is in the forward part of the car. This portion should include one-third of the seating capacity of the car. The smoking compartment seats should be longitudinal, heavily upholstered in leather, with ample springs to furnish a good, resilient cushion. The space beneath these seats may be used for storage of hand baggage. The floor of the smoker should be covered with inlay linoleum of small, neat design. A sufficient number of brass cuspidors of a low, flat design should be placed in this compartment. The partition between the smoking and passenger compartments should be constructed with plate glass windows and door, thus permitting an unobstructed view for the passengers. In the passenger compartment, the seats should be of the high, stationary-back type, upholstered in dark green figured plush with all metal parts perfectly plain. In this, as well as in the smoking compartment, parcel racks at least 14 in. wide should be placed, thus affording ample room for parcels and avoiding the danger of the larger pieces toppling over on the passengers.

There is much reasonable argument in favor of the various positions for the toilet and heating cabinets, yet to the writer the location at the rear end seems least objectionable. In consideration of the location of the heater and toilet cabinets, first, is it not universally acknowledged that they should occupy positions on directly opposite sides of the aisle? To facilitate firing and emptying ashes and to obviate any liability of dust flying about the interior of the car, the heater door should open directly onto the rear platform. The expansion chamber, pressure and water gage should be placed inside of the cabinet, the safety valve being so piped as to deliver expelled water below the body of the car, thus preventing damage to varnish, etc. By placing the toilet directly opposite the heater, as suggested, an objection is overcome which arises from the fact that many persons are embarrassed when entering the toilet in full view of the other passengers. The heater cabinet space should be relieved by an oval window on the outside of car, glazed with green, opalescent glass. This type of window should also be used in the toilet compartment, but should be arranged to swing open a short distance for ventilation. The toilet room door should be hung on spring hinges, and a sufficient number of coat hooks should be conveniently placed.

The interior finish throughout the car should be selected mahogany with very simple inlay. Care should be taken in designing this finish to eliminate all extravagant ornamentation and to present as flat a surface as possible, still retaining an artistic interior, thus facilitating cleaning and renovating. The ceiling, of full empire, should be painted a light green, with some neat gold striping. The deck sash should be made in the form of half ellipses and should be glazed with green, opalescent glass. Similar glass should also be placed in the upper half of the circle windows.

The window sash, following steam road practice, should lift in opening, and should be supplied with counter-weights or springs. All sash and sliding doors should be glazed with polished plate glass. In this climate it is advisable to use storm sash during the winter months. These may be constructed in one piece to cover double window and transom sash. With the present system of car ventilation, which is accomplished by opening deck sash, it is necessary to have the sash work freely, and considerable annoyance is caused by rain and snow blowing in through crevices. This system of ventilation is also very unsatisfactory, due to draughts, which almost invariably blow directly downward on the passengers. Some system of ventilation, other than the deck sash, should be employed, and these deck sash then be sealed.

The feaures mentioned have been carefully considered, but I am free to admit that there is much reasonable argument in favor of views opposite to those which I have presented.

*Read at the December meeting, Indiana Electric Railway Association, Indianapolis, December 14th.

Inspection Trip on the Indianapolis & Cincinnati Single-Phase Line.

Through the courtesy of the management of the Indianapolis & Cincinnati Traction Co. and the Westinghouse Electric & Manufacturing Co., a party of about 100 representative electric railway managers recently enjoyed the privilege of inspecting the new single-phase system now in operation between Indianapolis and Rushville. The party was organized by Mr. T. P. Gaylord, manager of the Chicago office of the Westinghouse Electric & Manufacturing Co., who, through the kindness of President Henry, of the new line, did everything possible to make the trip one of profit, as well as pleasure.

A party of 60 left Chicago in special cars, the evening of Friday, December 8th, reaching Indianapolis, Saturday morning, where they were met by others from Detroit, Cleveland, Pittsburg and Cincinnati. The guests were taken from Indianapolis to Rushville and return in a train for the first time on this road operated by single-phase, with multiple-unit control. No special attempts were made for high speeds, but some of the guests timed several consecutive miles which were made in 59 seconds each.

As was the purpose of the trip, every facility was given the guests for inspecting and learning both the good points and the problems yet to be solved in single-phase interurban construction. During the run commutator covers and the traps in the car floor above them were removed, so that the commutation of the single-phase motors might be watched. The party returned to Indianapolis late in the afternoon, and at the Claypool Hotel enjoyed an especially fine dinner, which was a part of the day's program provided by Mr. Gaylord. The trip throughout was a profitable one and much appreciated by those privileged to enjoy it.

Fifty cars of a late type, costing $250,000, have been placed in operation by the Milwaukee Electric Railway & Light Co.

The last of the eight bridges constructed on the interurban line between Ottawa and Seneca, Ill., has been completed, which finishes the concrete work on this line.

Recent Street Railway Decisions.

EDITED BY J. L. ROSENBERGER, ATTORNEY AT LAW, CHICAGO

[The decisions which have been reported in the Legal Department of the "Street Railway Review" [illegible] Co. under the title "Street Railway Law," five volumes of which have been printed. Vol. I covers the period from [illegible] 1897, to July 1899, Vol. III from July, 1899, to April, 1901. Vol. IV from April, 1901 to 1903; Vol. V from April [illegible] $12.00, single volume, $3.00. Bound in buckram, five volumes, [illegible] single volume [illegible]

CONDEMNATION OF RIGHT OF WAY ADJOINING HIGHWAY FOR USE OF STEAM OR OTHER MOTIVE POWER—NOT ENTITLED TO SHOW INTENTION TO USE ELECTRICITY—DAMAGES.

St. Louis & Springfield Railway Co. vs. Smith et al. (Ill.), 74 N. E. Rep. 1063. June 23, 1905.

This was a condemnation proceeding. The right of way asked to be condemned adjoined a public highway, and the defendants sought to defeat the right of condemnation on the ground that the company had chartered power to construct and operate what is commonly known and called a horse and dummy or street railroad, and that therefore the line of its road was restricted to the highway, there being no impediment or obstruction to the construction of the said railway in and along the highway. As finally amended, the petition was deemed sufficient to show that the company had the right to take the property, by condemnation, for the uses and purposes of a railroad to be operated by steam or other motive power, and the defendants were required to answer the petition, and the trial proceeded upon this theory. Of this, the supreme court of Illinois says, the company could have no ground of complaint, for it persistently refused to so frame its petition as to show that it did not intend to use steam as a motive power, or to stipulate that it would not employ steam as a motive power.

In presenting the proof the company sought to show that it expected and intended to use electricity as the motive power, but the court would not permit it to do so. This ruling, the supreme court says, was correct, for the reason the judgment of condemnation which the company, by its course in framing the pleadings and in refusing to stipulate that it would not use steam power, and would only use electricity, would become entitled to have entered in its favor, would be such that the company would not be in any manner restricted as to the motive power it would employ. Hence the damages to the land not taken, and the benefits thereto arising from the construction of the road, were properly to be estimated with reference to any use to which the petitioner, under its charter, would be at liberty to apply its railroad when built.

MUST PROVIDE FOR SAFE-KEEPING OF CARS AFTER INSPECTION.

Crawford vs. United Railways & Electric Co. of Baltimore (Md.), 61 Atl. Rep. 287. June 21, 1905.

A conductor on the morning that he was assigned to a certain open summer car was injured by one of the grip handles pulling out and throwing him down upon the street. An inspector had found the car in good condition at 2:30 a. m., after which it had been left on the "dead track." Moreover, the inspector saw the handle bar the night after the accident, and said it then "was like something had hit it when moving. The screws looked like it was broke out. It was not from the pull of the conductor. It was hit by something."

The duty of inspection, the court of appeals of Maryland says, cannot be properly discharged without providing some system of inspection, and no system can be fairly regarded as adequate which does not provide for timely inspection, and safe custody of the thing inspected during any substantial interval between its inspection and its use. The duty of providing a reasonably safe and efficient system of inspection cannot, from its very nature, be delegated to the inspector himself, but must be discharged by the master himself, or by some one bearing to him the relation of vice principal.

Not only was there no rule provided in this case for the safe-keeping of the [illegible] attributed to the defendant. In the court's opinion, the failure to provide proper [illegible] mitting of the practice shown, clearly constituted negligence of the defendant, [illegible] was the cause of his injury. In other words, wherever the safety of [illegible] master, which is negligently exposed in an unsafe place after inspection, and before its use, the master will be liable for injury resulting from such negligence.

TRANSFER RIGHTS OF PASSENGERS HAVING FARE PAID BY ESCORT—AGGRIEVED PARTY.

McLaughlin vs. New York City Railway Co. (N. Y. Sup.), 94 N. Y. Supp. 653. June 29, 1905.

Under a statute providing that "every corporation shall upon demand and without extra charge give to each passenger paying one single fare, a transfer," etc., the second appellate division of the supreme court of New York says that, in its view, it mattered not whether the plaintiff paid her own fare, or whether another paid it out of money that did or did not belong to her, so long as the payment was made for her, that she might lawfully remain a passenger, and so long as she did actually lawfully become and remain a passenger. The statute further providing that, "for every refusal to comply with the requirement of this section, the corporation so refusing shall forfeit fifty dollars to the aggrieved party," that the plaintiff was the aggrieved party, the court says, could not reasonably be doubted. She was a passenger, and it was to enable herself to ride upon one of the connecting lines of cars that the transfer was demanded. Defendant's refusal compelled her to pay another fare, and it mattered not whether it was necessary for her to pay her second fare herself, or whether she might obtain some other person to pay it for her; the primary liability to pay if she continued to ride was upon her.

LEGISLATURE HAS POWER TO COMPEL INTERCHANGE OF CARS AND TRAFFIC.

Hudson Valley Railway Co. vs. Boston & Maine Railroad (N. Y. Sup.), 94 N. Y. Supp. 545. June 29, 1905.

In an action having reference to an interchange of cars between an electric road and a steam railway, the third appellate division of the supreme court of New York says that railroad companies are corporations of such a public character that it must be conceded that the legislature has power to compel the interchange of cars and traffic, in the interest of the public welfare, if it sees fit.

WHERE EXEMPTION BY FRANCHISE ORDINANCE FROM OTHER PAVING NOT CONCLUSIVE—STRIPS REQUIRED WITH T-RAILS NOT PAVING.

Marshalltown Light, Power & Railway Co. vs. City of Marshalltown (Ia.), 103 N. W. Rep. 1005. June 14, 1905.

At the time a franchise was granted there was in force this statutory provision: "The articles of incorporation, by-laws, rules and regulations of corporations hereafter organized under the provisions of this title, or whose organization may be adopted or amended hereunder, shall at all times be subject to legislative control, and may be at any time altered, abridged or set aside by law, and every franchise obtained, used or enjoyed, by such corporation

may be regulated, withheld, or be subject to conditions imposed upon the enjoyment thereof, whenever the general assembly shall deem necessary for the public good." The franchise ordinance contained a provision exempting the grantee and his assigns from any requirement to pave except as provided therein. The supreme court of Iowa holds that, in view of the statute, this provision in the franchise did not constitute a contract which could not be affected by subsequent legislation imposing a different liability for paving on all street car companies.

Nor does the court consider that a provision in the franchise ordinance that where cross-ties and T-rails should be used in unpaved streets strips of lumber four inches wide and of sufficient thickness to come within one-half inch from the top should be spiked along each side of the rails constituted a provision as to paving other portions of the street than those required by the second statute referred to, so as to bring the company within an exception contained in the statute in that respect. How the provision as to strips could be tortured into the semblance of a requirement for the paving by the street car company of a portion of the street, the court declares itself entirely unable to see. It says that it seems to it plain that there was no intention on the part of the city to require the paving by the company of a space four inches wide on each side of each rail of its track, where constructed through streets not otherwise paved. It was only on unpaved streets that this form of construction was required, evidently as a convenience to the public in the use of such streets for driving, in the event that the street car company should use on such unpaved street cross-ties and a T-rail.

PASSENGER TAKEN ILL AND PUTTING HEAD OUT ABOVE SCREEN STRUCK BY POLE—CARE REQUIRED OF COMPANY—MAY ASSUME PASSENGERS WILL TRAVEL IN USUAL WAY—IRON SCREENS AT WINDOWS WARNINGS OF DANGER—PUTTING HEAD OUT ABOVE SCREEN CONTRIBUTORY NEGLIGENCE.

Christensen vs. Metropolitan Street Railway Co. (U. S. C. C. A., Kan.), 137 Fed. Rep. 708. Apr. 4, 1905.

A passenger becoming suddenly ill and putting her head out of the window to vomit struck a pole, the poles being from 6 to 10 inches from the side of the car. Extending across the windows on the outside of the car, and securely fastened to the car, were iron screens covering the windows up from the window sills for a distance of from 14 to 16 inches, leaving an open space of something like 14 inches between the top of the screens and the top of the car windows, the meshes in the screens being about three-quarters of an inch square. In affirming a judgment in favor of the defendant company, on a demurrer to the plaintiff's evidence, the United States circuit court of appeals, eighth circuit, says that, while a street railway company engaged in the transportation of passengers is bound to exercise the highest degree of care and skill which a cautious or prudent man would exercise under the circumstances for the protection of its passengers, yet it has the right to assume that passengers patronizing its cars will travel in the usual way, and occupy the seats provided for that purpose, or, if the car is crowded, those standing will occupy the open space, or aisle, in the center of the car between the seats, and in either case the screens upon the windows of the car in which the plaintiff was injured were entirely sufficient to protect passengers from any involuntary action on their part, such as might be caused by a lurching or swaying of the car while the car was in motion. In other words, the court thinks that the company was not required to anticipate that the plaintiff might become ill and attempt to put her head out of the window, when it would be impossible for her to do so without turning about and either kneeling or standing on the seat. While the plaintiff's sudden illness undoubtedly placed her in a very uncomfortable and distressing position, yet that fact would not authorize her to disregard unmistakable warnings of danger. She must have known that the heavy screens which barred the windows were placed there for no other purpose than to prevent passengers from extending their arms or heads out of the windows, as the meshes in the screen were too large to serve any other purpose. To disregard this plain warning was such contributory negligence upon her part as would necessarily preclude a recovery of damages in this case.

PRESUMPTION OF AUTHORITY OF AGENT, OFFICER OR EMPLOYE FROM DUTIES—JUDICIAL NOTICE TAKEN OF SCOPE OF EMPLOYMENT OF CONDUCTOR—LIABILITY FOR NEGLIGENCE OF CONDUCTOR IN DIRECTING PASSENGER AS TO COURSE AFTER ALIGHTING—LEAVING PASSENGER CARRIED BEYOND DESTINATION IN DANGEROUS SITUATION.

Indianapolis & Eastern Railway Co. vs. Barnes (Ind. App.), 74 N. E. Rep. 583. May 23, 1905.

The general authority of an agent, officer, or employe of a railway corporation, the appellate court of Indiana, division No. 1, says, may be presumed from his known duties. The court may take judicial knowledge that certain conduct is within the scope of the employment of a servant of a railroad company, from the fact that he is the company's conductor in charge of a train or of an electric car of the company upon its railroad. The facts stated in a complaint may show that a conductor was acting within the line of his employment, without a direct allegation that he was so acting.

In this case a passenger was carried beyond his destination, a certain road, on a dark rainy night, and, in following, as he alleged, the conductor's direction to go back about five poles, fell through a bridge, of the danger of which he had not been warned. The court says that if the case were one in which no fault was attributed to the company except negligence of its conductor in advising or directing the passenger as to the course or route to be taken by him after safely alighting voluntarily from the car, it might reasonably be contended that, in such negligent conduct of the conductor, he was not acting within the scope of his duties as an employe, so as to render the employer responsible for consequent injury to the passenger in pursuing such advice or direction.

The directions given by the conductor as to the course to be taken by the passenger after leaving the car might be taken into consideration as part of the conditions or circumstances under which he left the car and proceeded to the place of his injury. His injury was traceable in natural sequence to the conduct of the company in carrying him beyond the safe stopping place to which he took passage, and neglecting to return to the stopping place, and depositing him at the particular place under the circumstances which rendered it dangerous, one of which consisted of the directions received from the company and its conductor. If the company, by its wrong, placed the passenger in a dangerous situation without warning, it should be held responsible for the consequences which might reasonably have been anticipated from such conduct.

INJURY BY JERK TO PASSENGER HAVING ARISEN TO ALIGHT ON SECOND STOPPING OF CAR—CARE REQUIRED OF MOTORMAN AND CONDUCTOR IN AN EMERGENCY STOP.

St. Louis Transit Co. vs. Thompson (U. S. C. C. A., Mo.), 137 Fed. Rep. 713. Apr. 4, 1905.

The United States circuit court of appeals, eighth circuit, holds that, under the evidence in this case, the defendant was entitled to have this instruction (which perhaps sufficiently explains the case), given to the jury: "If the jury find and believe from the evidence that in obedience to a signal defendant's servants in charge of its car caused the same to come to a stop at or near the intersection of Olive St. and West Spring Ave., in the city of St. Louis, in order to discharge passengers, then and there desiring and offering to alight at said point, and there remained standing a sufficient length of time to afford reasonable opportunity for a woman of ordinary activity to alight from said car, and that after so waiting defendant's conductor signaled or notified the motorman in charge of said car to proceed on his journey; and if you find from the evidence that in obedience to said signal said motorman caused said car to move forward and that the speed of the same was increasing; and if you find from the evidence that at the time or after the giving of said signal for said car to go ahead, or that while said car was again moving forward, plaintiff arose from her seat and started toward the rear platform of said car, or had already stepped upon or was in the act of stepping upon the rear platform of said car when plaintiff's companion, Moyer, or some other passenger hallooed to the conductor to stop said car, if you find they or either of them did so halloo; and if you find from the evidence that said con-

ductor, in obedience to such command or request, signaled the motorman to stop the car, and that the motorman in obedience to said signal caused the car to stop, and that in stopping said car under said circumstances said motorman exercised that degree of care that a careful and skillful motorman would be expected to exercise under the same or similar circumstances—then plaintiff cannot recover, and your verdict will be for defendant, and this is true although you may further find from the evidence that said car was stopped suddenly and with a jerk, and that the jerking motion of said car caused plaintiff to fall." The court says that the car having once stopped at West Spring Ave. for the purpose of discharging or taking on passengers, the stop having been properly made and in a manner not complained of, and after again starting the car, would, as the evidence showed, in the ordinary course, proceed to the next street; but instead of doing so the motorman received an emergency signal to stop the car at once, and if in obeying the signal he stopped the car, and in doing so exercised the degree of care that a careful and skillful man engaged in that business would be expected to exercise under the circumstances, the defendant would not be liable. The court also holds that, under the evidence in this case, there should have been an instruction to the jury to the effect that if the circumstances were such that the conductor, in the exercise of the utmost care, was authorized to call for the emergency stop, and if that stop was made with the utmost care, there could be no recovery, and that a failure to so instruct the jury was error.

EVIDENCE OF NEGLIGENCE OF COMPANY REQUIRED—NEGLIGENCE NOT INFERABLE FROM ACCIDENT—SOUNDING OF GONG NOT REQUIRED FOR ONE HAVING NOTICE OF APPROACH OF CAR—NOISE OF CAR AS NOTICE—PRESUMPTION AS TO PERSON ON TRACK—CARE REQUIRED OF PERSON WALKING ALONG TRACK—DUTY OF LOOKING AND LISTENING.

Garvick vs. United Railways & Electric Co. of Baltimore (Md.), 61 Atl. Rep. 138. June 20, 1905.

The plaintiff and one companion were walking south along the defendant's south-bound track near the city limits while another companion was walking in the same direction on the north-bound track, and the plaintiff was struck by a south-bound car just as he was trying to get out of its way. The case was taken from the jury and a verdict directed for the defendant, judgment on which is affirmed by the court of appeals of Maryland. It says that before it could be said that the defendant or its motorman was guilty of negligence it was incumbent on the plaintiff to adduce some definite affirmative proof. Negligence of the defendant cannot, in a case like this, be inferred from the mere happening of the accident. It has been repeatedly held by this court that the negligence of a defendant will not be presumed, nor will a surmise of a scintilla of evidence that there may have been negligence on his part justify a court in sending a case to the jury. There must be some reasonable evidence of well-defined acts of negligence, of breach of duty on the part of the defendant causing the injury complained of.

Assuming that the negative evidence given by the witnesses that they did not hear the gong ring would be ordinarily legally sufficient evidence tending to prove the negligence of the defendant, yet in this case such negative proof could have no probative force, because it was established beyond controversy by the plaintiff's testimony that he had notice from his companion that the car was coming.

In addition, the court says that it is settled in Maryland, at least, and generally, that where a party is discovered on the track of a railroad in the full power of locomotion, and no impediment to his escape, those on the train may well act upon the assumption that he will use his senses for his protection, and get out of the way of danger before he is struck. Hence the court thinks it clear that the defendant's motorman had a right to presume that the plaintiff and his companions would leave the track for a place of safety, especially as they knew the car was coming. The evidence showed that they were notified of the approach of the car by one of their number; but, even in the absence of the evidence of such affirmative proof of notice, it seems incredible that the noise of the car would not of itself have afforded sufficient notice of its approach to per- [illegible] in the country free from the noise of the city.

But [illegible] contributory negligence of the plaintiff. If the plaintiff voluntarily selected the most dangerous place on the road to walk, it was un- [illegible] approach from behind, and therefore it was his duty to use his [illegible] however, that he at any time looked back, or that he heard the car approaching until informed by his companion. Then, he neglected [illegible]

WHEN RELATION OF CARRIER AND PASSENGER BEGINS—ACCEPTANCE OF CONTRACT CREATING SAME—ATTEMPTING TO BOARD MOVING CAR NOT NECESSARILY CONTRIBUTORY NEGLIGENCE—CARE OWED—INTENTION OF MOTORMAN IMMATERIAL—INCREASING SPEED NOT NECESSARILY NEGLIGENCE.

Lewis vs. Houston Electric Co. (Tex. Civ. App.), 88 S. W. Rep. 480. June 2, 1905.

From the evidence offered by the plaintiff the court of civil appeals of Texas says the jury were authorized to find that he left his home with the intention of taking passage on the defendant's car to the city, and, in furtherance of this intention, he took a position near its track at a place where it was accustomed to stop its cars for the purpose of receiving passengers; that when the car, on its way to the city, approached him, he called and signaled to the motorman to stop; and that the motorman saw his signal, or heard his call, and slowed the car down, and he, being prepared and willing to pay his fare, and believing that the car was being stopped for the purpose of taking him on as a passenger, attempted to board it, and, while so doing, was injured. The pleading supported these facts, and, if they were true, the plaintiff was, in contemplation of law, a passenger at the time he received his injuries; and the defendant was charged with the duty of using that high degree of care to protect him from injury which a very careful, prudent and competent person would have used under like circumstances.

It may, the court continues, often be difficult to determine just when the relation of carrier and passenger begins, and what acts of the parties are necessary to create such relation, but there are certain well-established general principles by which the facts of each particular case must be tested. The relationship may arise before the person desiring to become a passenger actually gets on the conveyance of the carrier, and it may continue after he leaves the conveyance, but it can only be created by contact between the parties, expressed or implied. From the nature of the business conducted by street car companies, no express contract of carriage is made with the great majority of those who ride on their cars, and the essential elements of the contract—the offer and its acceptance—must ordinarily be implied from the acts of the parties. When a person desiring to become a passenger upon a street car stations himself at a place where the cars are accustomed to receive passengers, and signals or calls to the motorman of an approaching car to stop the car, and such signal is seen by the motorman, and the car halted, an acceptance of the offer to become a passenger will be implied from the act of the motorman in stopping the car, and such person will be regarded as a passenger while he is in the act of getting upon the car. If in such case the person desiring to become a passenger attempts to board the car before it comes to a full stop, he is not necessarily guilty of contributory negligence; and if the speed of the car was slackened to such an extent as to lead him to believe that it was being stopped to allow him to get on, and a person of ordinary care would have so believed, and have attempted to get upon the car, he should be regarded as a passenger while making such attempt.

It is immaterial that the motorman may not have intended to stop the car for the purpose of allowing the passenger to get on. If the latter was at a place where passengers were usually received, and gave the usual signal, which was seen by the motorman, and he thereupon slackened the speed of the car to such an extent as

to lead a person of ordinary care to believe that he was thereby invited to become a passenger, such relationship would be created; the motorman not giving any warning that the car was not being stopped for the purpose of receiving passengers. Under such circumstances, the carrier would not be heard to say that it had not given an implied acceptance of the offer to become a passenger. In other words, if the act of the motorman, who had seen the plaintiff's signal, reasonably induced the plaintiff to believe that he was accepted as a passenger, while so believing he was entitled to protection as such. But the jury might have concluded that the act of the motorman in increasing the speed of the car before the plaintiff had succeded in his attempt to board it was not, under the circumstances, a failure to use ordinary care, since that act could not be held negligence as a matter of law.

LIABILITY FOR ASSAULTS ON PASSENGERS AND TRESPASSERS—EMPLOYES ACTING WITHIN AND WITHOUT SCOPE OF EMPLOYMENT—NEWSBOY NOT ENTITLED TO RIGHTS OF PASSENGER—MOTORMAN SHOVING NEWSBOY FROM MOVING CAR.

Barry vs. Union Railway Co. of New York (N. Y. Sup.), 94 N. Y. Supp. 449. June 23, 1905.

In the case of a passenger willfully or maliciously injured by a conductor or trainman having some duty to perform concerning the transportation of the passenger, the first appellate division of the supreme court of New York says that it understands that it is no longer necessary to submit the question to the jury as to whether the employe was acting within the scope of his employment, but that on account of the contract duty of safe transportation, and protection not only from the assaults of the carrier's own employes, but from the assaults of others, the carrier is liable as matter of law. On the other hand, the court is of the opinion that, merely because the defendant is a carrier, it is not liable, as a matter of law, for injuries willfully or maliciously inflicted upon persons found upon its cars who are not passengers. Where two inferences may be drawn from the facts and circumstances—one, that the servant, acting within the scope of his employment (that is, pursuant to an express or implied duty of removing trespassers, and moved to action by a sense of that duty), and the other, that the servant, actuated by a purpose and object of his own, uninfluenced by any desire to serve his master, and using his position and authority, if at all, as a mere form or pretext, inflicts a willful or malicious injury upon the trespasser—the question becomes one of fact, and must be submitted to the jury with instructions that in the former instance the master is liable for all damages, even though the servant exceeds his authority, departs from his instructions, or recklessly inflicts unnecessary injuries, and in the latter he is not liable at all. Of course, where the inference that he was not acting for the master within the general scope of his authority is not justified, it becomes a question of law; and so, likewise, when there is no room for an inference that he was pursuing an independent purpose of his own, the master would be liable as matter of law.

A newsboy who went upon a car for the purpose of selling a paper to his customer, and remained upon it for the purpose of selling papers to others, who assigned for being upon the car only the reason that it was with a view to selling papers, who paid no fare, and, while it did not appear that he refused to pay fare, it did not on the other hand, appear that he intended to become a passenger by paying his fare or traveling to any particular point, the court holds was not entitled to the rights of a passenger. With the relationship of passenger eliminated, upon principle, the court says, there can be no difference between the liability of a common carrier for injuries inflicted by its servants upon trespassers, and the liability of other corporations and individuals for the acts of their servants. In the case at bar, notwithstanding that the motorman had no duty to perform with respect to removing passengers or others, the jury might fairly infer from the evidence that he had implied, if not express, authority to keep passengers and others off the front platform, and this conferred implied authority to remove them. But it was not likely that he was authorized by his employer to remove either a passenger or a tresspasser by shoving him from the car while it was in motion. Notwithstanding this, however, the company would be responsible for his act if the jury were satisfied from the evidence that the purpose and object of the motorman in so doing was the performance of a supposed obligation that he owed his employer, rather than the gratification of some personal feeling of motive; but, on the evidence, this was a question of fact. The circumstance that the car was in rapid motion, and that the motorman made a lunge for the plaintiff the moment he discovered him, without inquiring whether he was a passenger, or ordering him inside or off, in the light of the fact that the plaintiff had a bundle of papers under his arm, and was offering them for sale, might have justified the jury in finding that the motorman was moved by a sudden impulse to punish the plaintiff for peddling papers on the car, or attempting to steal a ride without being discovered, or some other malicious motive, uninfluenced by any duty he owed the defendant.

VALIDITY OF "VIGILANT WATCH ORDINANCE"—CARE EXACTED BY IT—BREACH THEREOF NEGLIGENCE —OBLIGATORY WITHOUT ACCEPTANCE OR AGREEMENT BY COMPANY—CIVIL LIABILITY TO THIRD PARTY FROM VIOLATION OF ORDINANCE.

Sluder vs. St. Louis Transit Co. (Mo.), 88 S. W. Rep. 648. June 1, 1905.

What is known as the "Vigilant Watch Ordinance" of St. Louis is referred to in this case as requiring of street railway companies that their motormen and other servants propelling their cars on the streets keep a vigilant watch for vehicles and persons on their tracks or approaching them, etc. The supreme court of Missouri holds that this ordinance was the exercise of a police power clearly vested in the city for the protection of the lives and property of its citizens on its streets; that it exacts no more than ordinary care, when the conditions and circumstances to which it is applicable are considered, and that a breach of its requirements is negligence; that the acceptance or agreement of the defendant company was not at all necessary to give said ordinance the binding force of a valid municipal law within the limits of the city.

The court says that counsel earnestly labored to show that there is a distinction between an ordinance regulating the speed of cars in and across the streets, and one requiring the motorman to exercise a vigilant watch for vehicles and pedestrians—especially children—on the track of such street railways, or moving toward it; but it is obvious that both spring from the same power to regulate the use of the streets for the protection of the traveling public, their lives, limbs, and property, and both alike fall within the recognized domain of a police law. Since the adoption of electricity and cables as the motive power, the danger to pedestrians and those traveling in vehicles on the streets is greatly multiplied; and it is a wise and salutary provision that requires the motorman in charge of these ponderous and rapidly moving cars to carefully watch that they do not run over pedestrians, old men, women, and children, who have an equal right to the use of the streets, and such an ordinance falls as clearly within the police power as does the speed ordinance. Being, then, the exercise of the police power, the ordinance does not depend upon the acceptance of the street car companies to make it obligatory upon them to obey it, but it is a municipal law enacted by the city in its governmental capacity, of which all who come within its scope are bound to take notice, and it has the full force and effect of law within the limits of the corporation. Being a police power, it was and is not within the power of the city to contract it away, or to bind itself not to exercise it whenever the public good or exigencies require its exercise.

Furthermore, the court does not agree with the contention advanced that, even if this be conceded, the power is coupled with a power to prescribe limited punishment by fine, penalty, or imprisonment for disobedience, only, and no civil liability to any third party injured by a violation of the ordinance can result therefrom. It says that Fath vs. Ry. Co., 105 Mo., loc. cit. 545, 16 S. W. Rep. 913, and the subsequent cases of Byington vs. Ry. Co., 147 Mo. 673, 49 S. W. Rep. 876, Murphy vs. Lindell Ry. Co., 153 Mo. 253, 54 S. W. Rep. 442, Sanders vs. Southern Electric Ry., 147 Mo. 411, 48 S. W. Rep. 855, and Holwerson vs. St. Louis & Suburban Ry. Co., 157 Mo. 245, 57 S. W. Rep. 770, which announce the doctrine that no cause of action can arise to a person injured from the violation of such an ordinance as this, should no longer be followed. Nor was there any misjoinder in uniting the several grounds of negligence in one petition.

Piping and Power Station Systems.—XII.*

BY WILLIAM L. MORRIS, M. E.

PIPING DETAILS, CONTINUED.

Detail A3 7, Fig 84, shows what oftentimes cannot be avoided, a long branch from the boiler to the header. In case the connection is made as shown in this figure, the valve at the boiler should be at the high point, and entire branch from the valve should be pitched toward the header to avoid "water pockets." In constructing the branch in this way an objectionable feature is brought into the connection which may justify a compromise, a choice of the lesser evil. With the valve located at the boiler, the entire branch would be under pressure when the boiler is off, and this would constitute a large amount of condensing surface. In case any joint in the branch should require repairing, it would be necessary to shut down the header to do so. To place a valve at the low point "a" would

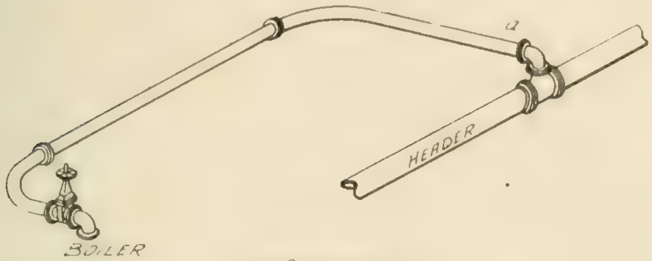


FIG. 84—(A3 7)

be inviting trouble, which would be quite sure to happen if the operator should forget to drain off the branch before opening it into the header. If it is possible to rise up from header and make "a" the high portion of the branch, then the valve (or valves, if two be used) should be located at this high point and all possibility of pocketing water will be avoided. Ordinarily this would be best detailed by placing a right angled (square) bend on top of the tee

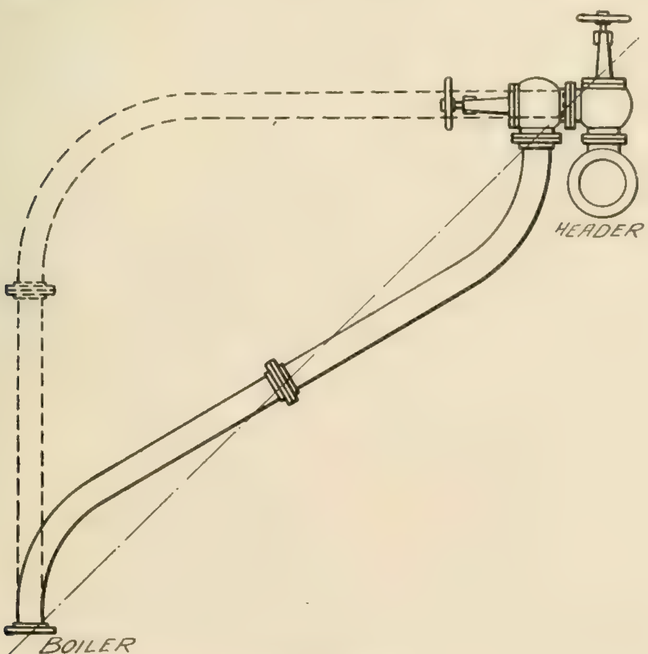


FIG. 87—(A3-10).

and locating the valve at the upper end. The valve would then be secured against vibration; the long branch from the boiler to the valve should have a gradual pitch from the boiler up to the valve.

Detail A3-8, Fig. 85, shows an almost perfect arrangement for boiler valves, the two being located next to the header on the highest portion of the branch. The valve "a" is the shut-off gate valve, valve "b" is the automatic-stop valve, and valve "c" is the drain. The automatic valve can be taken apart when the header is in operation. Before doing so the leakage past the gate valve can be readily ascertained through valve "c," and if it is too great to permit working on the automatic valve, much unnecessary trouble can be averted. The valve "a" can be retained as the tight valve

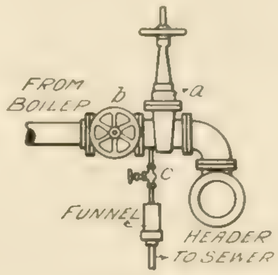


FIG. 85—(A3-8).

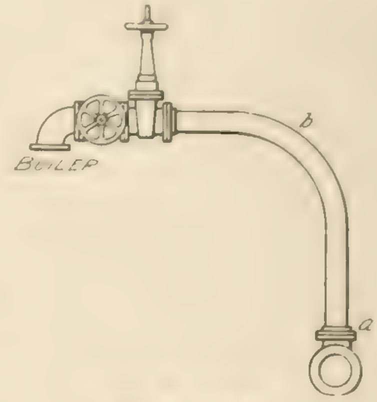


FIG. 86—(A3-9).

by using two valves, "a" and "b," and it should be opened or closed only when the pressure is about the same on both sides of it. The drain "c" would remove any condensation lying between the valves, but to avoid trouble in case the operator should neglect to open the drain, the valves should be placed as near together as possible to reduce the pocket to smallest possible amount. The mere fact that there is a valve at each end of the pocket does not prevent its filling with water, as it is next to impossible to maintain valves absolutely tight. The leakage continues to condense until the space is

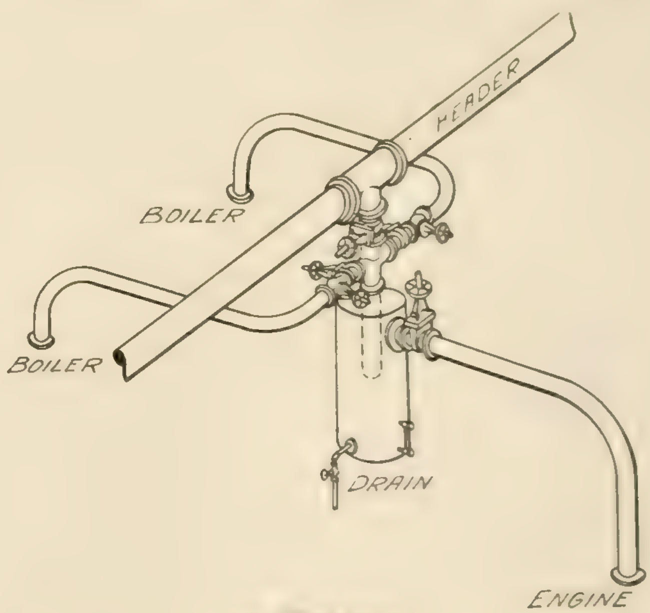


FIG. 88—(A3-11).

filled with water. The drain "c" should discharge into an open funnel so that the operator can see and hear it when it is open. This drain "c" is extremely useful when cleaning a boiler, as it discharges all condensation out of the branch instead of permitting it to run down the branch onto the boiler cleaner, in case he is working under a steam opening.

The connection shown in detail A3-9, Fig. 86, is such as would

be used in case the header is located below the opening of the boiler. There would be the same number of joints between the valves and the header, using the bend shown, as would be used with an elbow, as shown in detail A3-1. The only difference is that more radiating surface is exposed when the boiler is out of service. It is preferable to sustain this loss rather than to run any chances of damaging the steam machinery by water. If the connection from the header to the valves can be made with one length of pipe, the radiation loss will be quite slight.

The connection shown in detail A3-10, Fig. 87, is extremely long, and instead of making it as shown by the dotted lines there would be less trouble from vibration if it was constructed as shown by the full lines, its weight being kept close to a line drawn through the supports. The far-projecting bend is almost invariably a badly vibrating detail. The use of different styles of valves, such as globe or gate, for different purposes will be taken up under "Manufacturers' Standards." The principles of detail A3-10 may be carried out with gate valves also.

The connection shown in detail A3-11, Fig. 88, is specially suited for the systems shown in the previous chapter, in which the mains or headers are merely by-passes from one group of units to another. It is possible with this system to isolate one or all of the units, to run No. 3 engine unit with No. 1 boiler unit, or run all as one system, the header being an equalizer, and only a small portion of the total steam passing through it. It is a very simple undertaking to repair such a header at any time, the only loss being that due to running each unit separately. Tests can be made with perfect ease on any unit, by isolating it from all others. But one extra valve is required for each group of units. If for any reason one steam machine can be worked to better advantage with lower steam pressure, this condition can be quite readily met. With this arrangement one unit can be put into operation without making use of any part of the header.

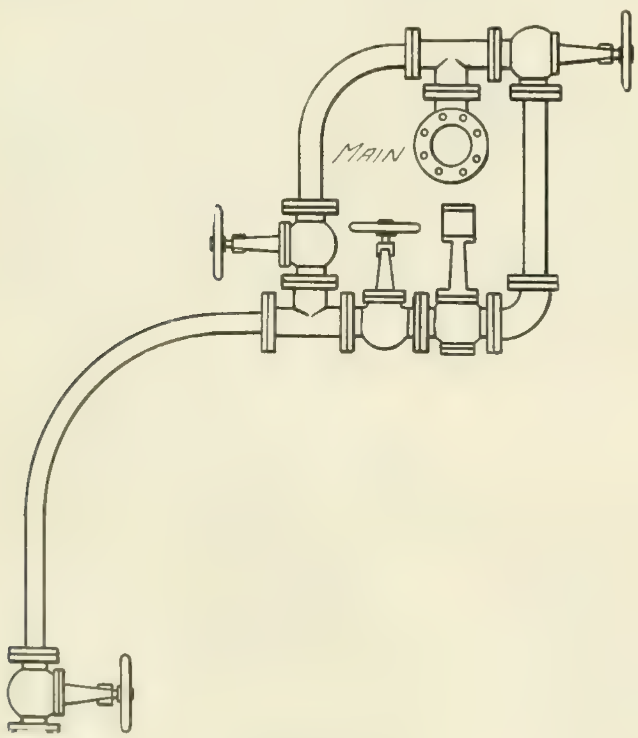


FIG. 89—(A4-1).

AUXILIARY STEAM MAIN AND BRANCHES.

The general features of the auxiliary main deal more with system details than with construction. The auxiliary main should be kept sufficiently far from the steam header to allow for expansion and contraction in the case of one being cold and the other hot. The main should be pitched in the same direction as the flow of steam, and provision should be made for draining it.

Fig. 89—(A4-1) shows the auxiliary main with an opening at the top, and the governor, valves, and by-pass so arranged that their weight will be easily carried by the main. This connection would be very suitable for flanged work. By taking steam out of the top of the main, and keeping the main drained, any auxiliary can be immediately started, and it will not be liable to stoppage or dropping off in speed due to the pump filling with condensation. Any pump or engine using a steam governor should have a valve on each side of the governor, and one in the by-pass; also a throttle valve at the pump. The valve each side of the governor is necessary in order to take the governor apart and to be able to use the pump while doing so. The independent throttle is necessary to save wear on the stop valves, so that when they are used they will close tightly, and will also limit the speed of the auxiliary when the automatic valve opens to its fullest extent.

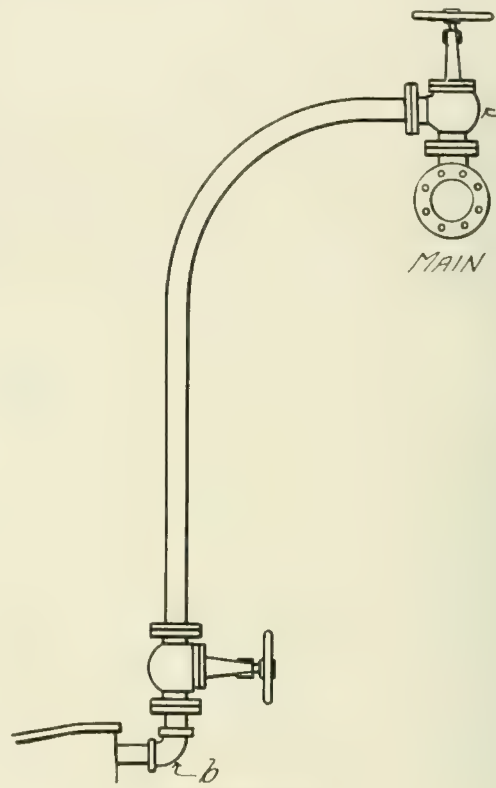


FIG. 90—(A4-2).

Fig. 90—(A4-2) shows a very satisfactory arrangement for branches to auxiliaries not requiring a regulating valve. The stop valve "a" should be placed next to the main. Stop valves should be placed in every branch to the pumps, etc., in addition to the throttle. The throttle valve should always be a globe or an angle valve and should be arranged as shown so that it can be repaired after closing the stop valve. The use of a small drain valve at "b" is both unnecessary and undesirable. The drains can readily be worked through the cylinder, and a valve at this point merely adds an unnecessary point of leakage. Pump builders ordinarily furnish a Y at end of steam cylinders with an outlet on a horizontal plane as shown in detail A4-3.

FIG. 91—(A4-3).

FIG. 92—(A4-4).

Fig. 91—(A4-3) may be preferable to Fig. 92—(A4-4) in regard to its manufacture, but in almost every case detail A4-4 can be used, and this will avoid projecting the steam connection far from the pump. It will make a difference of about 12 in. for a 3-in. steam connection. The pump builders will furnish detail A4-4 if specified when ordering pumps.

In case a pressure regulator for an engine governor is used, as for a draft fan, the governor should be placed at a considerable distance from the engine, or there should be provided sufficient

volume between the engine and the governor so that the cut-off of the engine will not cause the governor to be constantly on the move, resulting in rapid wear and requiring a great deal of attention; if it is desirable to place the governor close to the engine, so as to be within reach, a "receiver" can be used whose volume

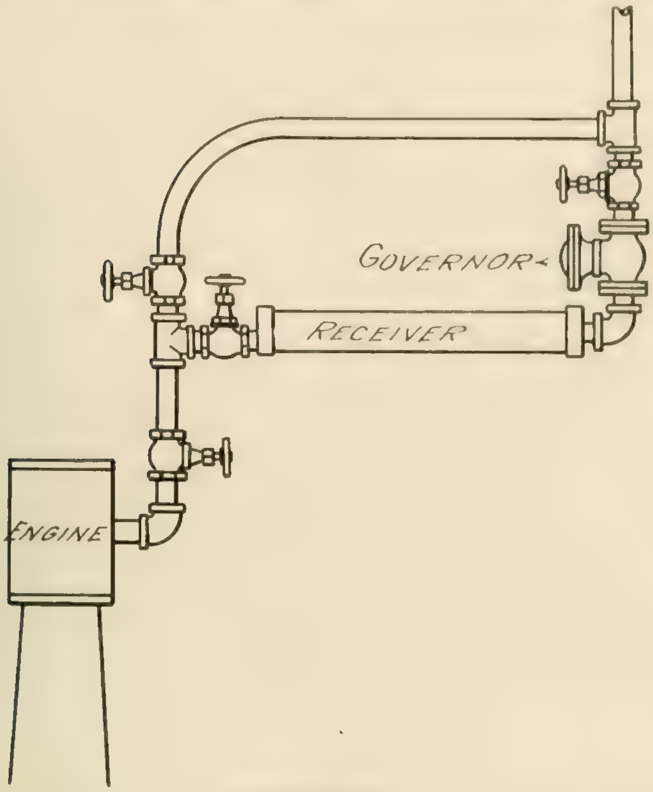


FIG. 93—(A4-5).

is about equal to that of 16 or 18 ft. of regular size steam pipe.

As shown in Fig. 93—(A4-5), an engine having a 2-in. steam connection would require a receiver say of 4-in. pipe 4 ft. long or 6-in. pipe 2 ft. long. A receiver is not necessary for a pump, due to the fact that a pump takes about the same amount of steam practically

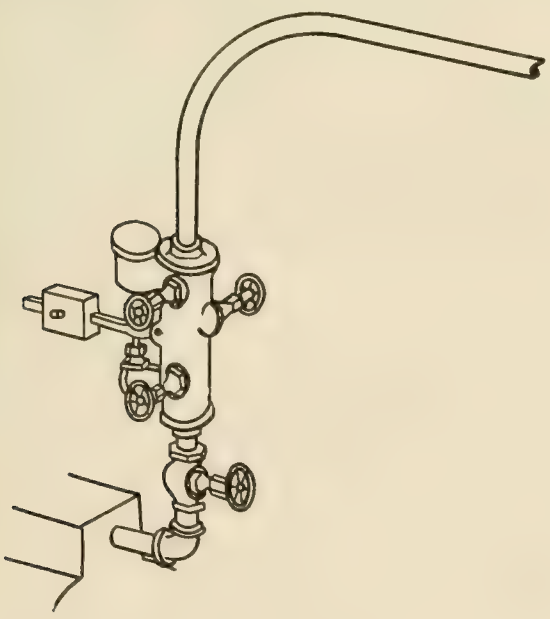


FIG. 94—(A4-6).

all the time. It is good practice to make the governor flanged, and in case of a plant using two or more engines, to have an extra governor constantly on hand and in good order, so that instead of repairing the governor in position, it may be taken out and replaced by the governor which is in good order. Pump governors are almost [illegible] [illegible] [illegible]

By comparing with Fig. [illegible] it will be seen how compact and neat such a device can be made. There are [illegible] engines, etc., each having its uses, merits and faults. The type [illegible] shows a self-contained by-pass as part of the governor.

[illegible] constant, regardless of steam pressure, the steam valve being practically balanced. The water pressure and spring are balanced at the normal pressure. This is the type of governor ordinarily used for [illegible] shows a self-contained by-pass as part of the governor.

Fig. 96—(A4-8) shows the boiler feed pump governor. The water must in this case have sufficient pressure in excess of the steam to close the valve, the weight increasing this resistance as much as desired; the area of the steam valve and the water piston are practically the same. This type of governor will maintain the pressure of the feed water say 8 lb. above steam pressure, regardless of whether the steam pressure is 60, 120, or 180 lb. This is very essential for boiler feeding, as no feed valve will stand such service as 180 lb. of water feeding boilers whose steam has dropped say to 100 lb., the water [illegible]

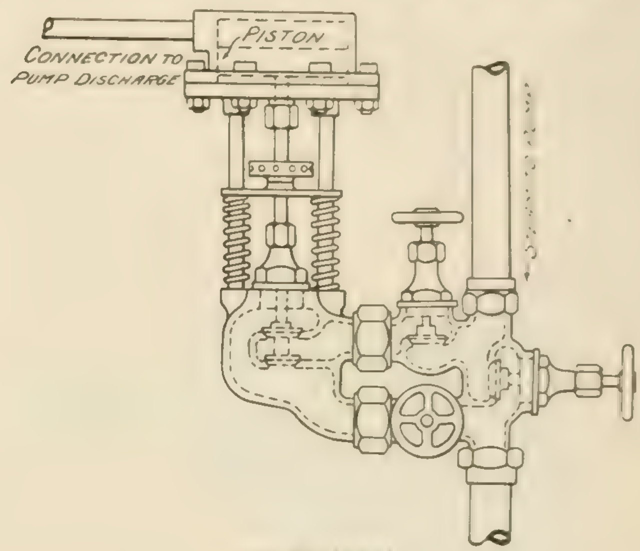


FIG. 95—(A4-7).

the excess pressure being only sufficient to overcome friction in pipes and enabling the feed valves to be left fairly well open. The governor shown in Fig. 97—(A4-9) is oftentimes used as a pump governor, being in reality a pressure reducing valve, and maintains a constant fixed pressure of steam in the cylinder.

When using this style of governor, a gage should be placed on the steam branch below the governor, also one in the pump discharge. It may require say 30 lb. of steam to give 80 lb. of water pressure under certain conditions of the pump, and by repacking or tightening the packing it may require 50 lb. of steam to balance 80 lb. of water. This change, however, is not frequently made, and whenever it is, the governor must be reset. This governor has the advantage of having no pistons and stuffing boxes, which soon cause a governor to stick and become very insensitive. In other words, the average operation of this type is more satisfactory than the piston or stuffing box type. The same governor, A4-9, is used on draft fan engines, the steam flowing in the reverse direction to that shown. The pressure of steam is in this case balanced by the spring, and if the pressure raises, the draft fans are run slower; if the pressure falls, the spring opens the valve and the draft fan engine runs at higher speed. This type of governor is ideal for a draft fan engine—very simple and easily regulated. The governor, A4-8, can be modified so as to eliminate the stuffing box and piston.

Detail A4-10, Fig. 98, shows the governor with by-pass arrangement. The steam valve is balanced, and when the water and the

steam pressure are the same, the diaphragm is balanced. The loading of the spring must be overcome by the additional pressure of water over that of steam. There is a stuffing box at the hand wheel stem, but there is no movement at this point except when the tension of the spring is being set. The by-pass shown in this

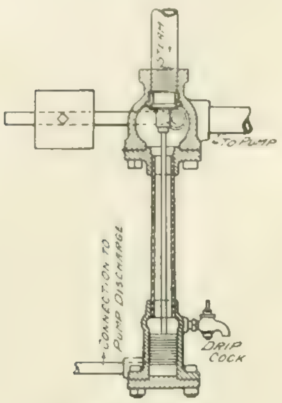


FIG. 96—(A4-8).

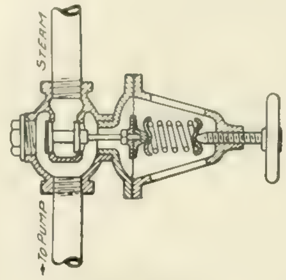


FIG. 97—(A4-9).

figure is much preferable to detail A4-6 as it permits the governor to be readily disconnected while the pump is running, and at the same time leaves the pipe work perfectly supported, which is not the case with detail A4-5. The by-pass shown in detail A4-10, indicated by the letter "a," is virtually three valves attached to the one valve body. The diaphragm and tension spring are both protected from high temperature by the condensation and pump water in the lower part of the regulator. The lower tube is made of brass to aid in conducting heat away from the condensation. This

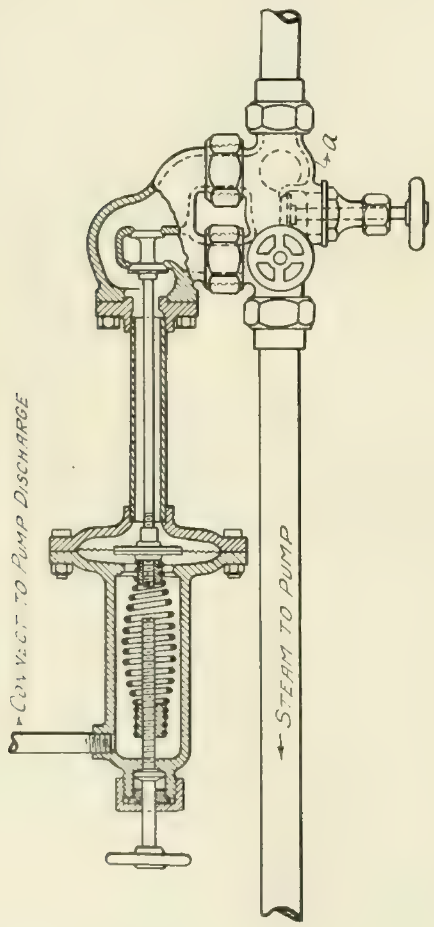


FIG. 98—(A4-10).

governor covers the requirements for boiler feed pumps in all particulars, and in selecting a governor for this purpose, these different features should be considered. The tension spring has a nut attached at each end, the upper end being made fast to the valve stem. The hand screw engages with the lower nut, and for boiler feeding would put a tension on the spring. If lower water than steam pressure is required, then the spring would be placed under compression. For example, if 60 lb. pressure was required, and the boiler pressure was 120 lb., then the spring would be loaded so that the water pressure would be 60 lb. less than the boiler pressure. If a fire pump is to be used for a feed pump also, this governor, detail A4-10, is preferable to the devices shown in detail A4-7, with stuffing boxes, pistons, etc. The latter is more inferior as a feed pump governor than A4-10 is as a fire pump governor.

Fire pump governors cannot be made without at least one stuffing box at the steam valve body. Stuffing boxes cannot be made tight unless the packing is forced closely together and close to the stem. The high temperature makes the packing hard, and ordinary pressure then merely presses portions of packing against the stem; to make old packing tight it must be forced against the stem. Any automatic devices such as governors, etc., should be entirely free from stuffing boxes through which the valve is automatically worked, if it be desired that same shall be at all times sensitive.

The governor shown in Fig. 99—(A4-11) is such as would be used for the steam-driven air and circulating pump, controlled by

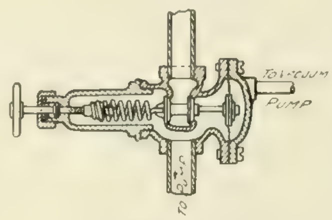


FIG. 99—(A4-11).

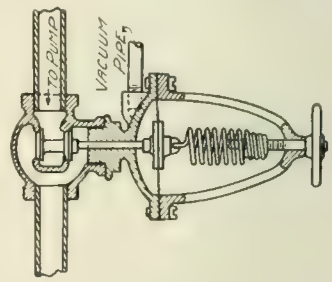


FIG. 100—(A4-12).

both the vacuum and the steam pressure in the cylinders. With no pressure in the pipe to the pump, the tension spring would open the valve. Assume the incoming steam to be at 120 lb. pressure, and spring loaded for 30 lb. per sq. in. If the pressure to the pump then is 30 lb. without any vacuum the valve will close, or, if the pressure to the pump is 15 lb. and the vacuum is 15 lb., the valve will close. When the pressure to the cylinder is 20 lb. and vacuum 10 lb., the valve will close. This type governor permits a certain speed of the pump for each varying vacuum pressure. If there is no vacuum the pump will not be allowed to run away, and if there is the highest vacuum the pump will be kept in motion. This is absolutely necessary in order to maintain the vacuum. It will be observed that this device would necessitate low initial pressure, in fact lower than would be necessary to run non-condensing, unless an extra large steam cylinder is used.

The regulator shown in Fig. 100—(A4-12) can be used for this service, and it allows the steam pressure to the pump to be what it will. This regulator brings in the objectionable feature of the piston, the stem passing from the vacuum chamber to the steam chamber. It is a ground joint and as close a fit as can be made and move freely. There are many regulators made on this plan, and the claim for them is that the leakage is small and does not cause an outside drip. The spring in this regulator is loaded in tension, so that proper speed will be obtained when carrying full vacuum. As the vacuum drops or the pressure rises under the diaphragm, the spring draws the valve from its seat.

(To be Continued.)

The result of the arrest and trial of the three fraudulent accident workers, who planned an extensive campaign against street railway companies in the larger cities and who were captured by the officers of the United Railways & Electric Co., of Baltimore, should be of interest to street railway companies. A complete description of the methods employed by these people, together with their portraits, was published in the "Review" for September 15th, page 578. On November 19th, Edward Reilly, Frank Bobson and Martha Wein each pleaded guilty in the criminal court at Baltimore to conspiracy to defraud, and were sentenced to serve terms in jail of five years, six months and two years, respectively.

The Western Massachusetts Street Railway.

BY [illegible]

One of the most picturesque electric railways in the United States is the new line of the Western Massachusetts Street Railway Co., extending from the thriving manufacturing town of Westfield to the center of the town of Huntington in the heart of the famous Berkshire Hills. The road was opened for traffic on Oct. 4, 1905, and in the few weeks which have since elapsed development of traffic has been very rapid. The accompanying map shows the line as it is now completed between Westfield, Woronoco, Russell, Crescent Mills and Huntington, and also the location which the company has been granted from Huntington through Chester and Becket to Lee.

In the past the transportation facilities between Westfield and these manufacturing centers in the valley of the Westfield River have been extremely limited. The Boston and Albany lines of the New York Central & Hudson River R. R. follow this valley westward with a double track main line route between Springfield and the western part of the state, but the train service is mainly of a through character and consequently infrequent stops are made at the local stations. Between Westfield and Huntington there are five daily trains in each direction on the Boston & Albany R. R. as compared with 15 through cars per day between the same points on the Western Massachusetts Street Ry. The first through electric car for Huntington leaves Westfield at 5:50 a. m., compared with 8:35 a. m. on the competing steam road, and the first car of the electric line leaves Huntington for Westfield at 7:05 a. m. against 8:11 a. m. on the Boston & Albany R. R. Between 7 a. m. and 10 p. m. the interval between electric cars going up the valley from Westfield is at no time greater than one hour; on the steam line during this time the maximum interval is 3 hrs. 58 min. On Sundays there are 14 electric cars in each direction between Westfield and Huntington against four east-bound and two west-bound Boston & Albany trains. The fares on the Western Massachusetts are as follows: Westfield to Woronoco, 10 cents; Westfield to Russell, 15 cents; Westfield to Huntington, 20 cents. On the steam road the corresponding fares are 12 cents, 18 cents and 27 cents. The running time of the Boston & Albany trains between Westfield and these points in the valley is about half that of the electric road, but in going from Westfield to points in the valley which are not in the immediate vicinity [illegible] receive passengers at any point along the route, which obviates the necessity of walking or hiring a carriage to traverse the long distance often found between the steam road's stations and one's objective point.

ROADBED AMONG THE HILLS, WESTERN MASSACHUSETTS STREET RY.

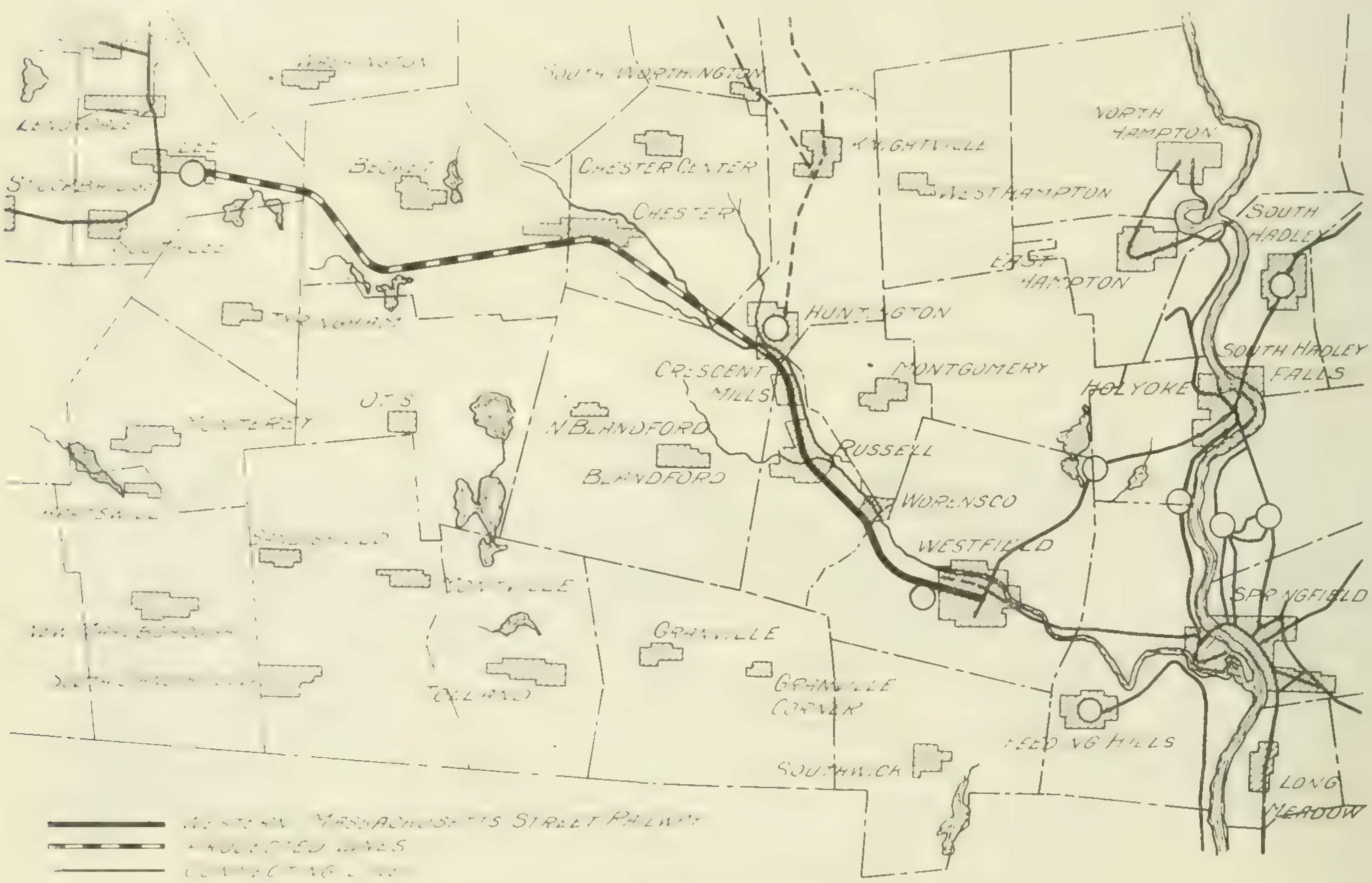
Referring to the map, it will be seen that the new line to Huntington provides a convenient and easily accessible route from the popular centers of Springfield, Chicopee, Northampton and Holyoke to the Berkshires, and in connection with the through line between Hartford and Springfield brings the Berkshires almost to the doors of Connecticut Valley residents.

An important feature of the company's work in the near future will be the carrying of freight and express matter. It is expected that this development, which is as yet not ready for public service, will prove of great advantage to residents of the Westfield Valley. The completion of the road to Lee, where connections will be made with the system of the Berkshire Street Railway Co., will provide an attractive and picturesque route between the Connecticut Valley, Lenox, Pittsfield and the other noted summer resorts of the western part of Massachusetts. Huntington is about 120 miles from Boston, and it now marks the most westerly point in Massachusetts which can be reached exclusively by a trolley journey from the "Hub." The completion of the line to Lee will make it possible to travel by electric cars from Boston to Pittsfield, and thence to Williamstown in the extreme northwest corner of the state.

Scattered along the banks of the Westfield River are a number of manufacturing plants which are served by the new road. Among these are the Woronoco Paper Co., of Woronoco, the Otis Fibre Board Co., and the Russell Lumber Co., of Russell, the Chapin & Gould Paper Co., of Crescent Mills, the American Writing Paper Co., of Huntington, and several saw mills, lumber mills and a woolen mill. Westfield is an enterprising town of about [illegible]

[illegible] United States combined, and more than any other place on the globe. The local transportation system at Westfield is controlled by the Woronoco Street Railway Co., which connects with the Holyoke and Springfield systems on the north and east. All these lines are focused upon Park Square, Westfield, which is the starting point of the Western Massachusetts cars.

The Western Massachusetts road as a project originated in the work of Mr. H. J. Stratton, who was connected with the Woronoco Paper Co. in 1901. He called a meeting of 75 representative business men at Russell in the summer of that year, which resulted in the formation of the Westfield Valley Electric Railway Association. Later Henry E. Stanton, of Huntington, and G. I. Hays, of Westfield, became active in the work, and through the efforts of this body an association whose object was the formation of the Western Massachusetts Street Railway Co. was formed on June 10, 1902, with Ralph D. Gillet, Esq., of Westfield, as [illegible]



MAP OF DISTRICT SERVED BY WESTERN MASSACHUSETTS STREET RY

10, 1904, the company was organized, with these officers, J. D. Cadle being made secretary. On Jan. 10, 1905, a contract was signed for the construction of the road by C. W. Blakeslee & Sons, of New Haven, and work was begun at Woronoco, in March of this year under the direction of Mr. A. D. Robinson, the present general manager of the Western Massachusetts road.

The distance of the new line from Park Square, Westfield, to Huntington is 12.5 miles and the running time, 53 minutes. The new track begins at Woronoco Park, Westfield, and at this point the cars leave the local system in Westfield, which terminates in Park Square. From Woronoco Park to Huntington the line is 10.12 miles long. The extension to Lee will give a trackage of 38 miles to the Western Massachusetts company. After leaving the Woronoco Street Railway Co's. tracks at Woronoco Park the line follows the highway for about half a mile, then passes upon a private right of way, which extends for about 1.5 miles westward, and finally joins the state highway and follows it to Huntington. As the accompanying illustrations indicate, the difficulties of construction were very great throughout nearly the entire route. [illegible] enormous amount of rock had to be removed, for the state road already occupied all the available space between the river and the hill sides. The Massachusetts Highway Commission does not allow the rails of any electric road to be less than 14 ft. 6 in. from the center of the macadam way of the state, so, in order to fulfil this requirement, it was necessary in many places to widen the highway on the hill side, as the state would not allow its road to be widened on the west side. The necessity of disposing of the excavated material frequently obliged the company to dump the waste on the river side of the state road, and in many places the result has been the actual widening of the roadway at those points, so that a widening of the macadam would turn the road into a boulevard.

The rock excavations were often hard to work, on account of seams, which minimized the effect of dynamite blasts. There were numerous ledges to be removed, the longest of which was a quarter of a mile long and from 10 to 15 feet in height. In one case a ledge 250 ft. long, 40 ft. high and 30 ft. deep could not be removed by a gang of men and three steam drills in less than two months of steady work. The longest ledge, above mentioned, required two months for removal, with two gangs of men and six steam drills. A large number of retaining walls had to be moved back, often at a cost of several thousand dollars each, and in five places the cost of this work was enough to supply an average man with a furnished residence. The largest retaining wall was 400 ft. in length and 20 ft. in height. Cuts and fills amounted to large totals, the largest being a cut 20 ft. deep and 2,000 ft. in extent. In this case it was expected that the gravel could be easily excavated, but a short distance down it grew very coarse and stony, precluding the use of power shovels, and below that came hard pan, followed by clay and water.

Gravel ballast with a minimum depth of 2 ft. was used throughout the line. It was taken from barrow pits on the line. The ties are of chestnut 8 ft. in length, 8 x 7 in. in section and spaced 22 in. center to center. In some cases ties 8 ft. x 6 in. x 6 in. were used. All the ties were cut within 10 miles of the line. The total length of private right of way on the road is 2.7 miles, most of this being located in the town limits of Westfield.

[illegible] to 470 ft. At the turnouts split switches, stands and targets are used wherever possible, the targets being painted white on one side and red on the other. Telephone booths are located at the middle of each turnout and [illegible]

Between Westfield and Huntington there are five bridges, all crossing branch streams flowing into the Westfield River. Three are [illegible] The United Construction Co., of Albany, N. Y., was the contractor. The civil engineers in charge of the track and roadbed construction were [illegible] The cost of the roadbed and track was about $40,000 per mile.

The picturesque scenery of the Western Massachusetts road is well illustrated in the accompanying photographs. The entire line [illegible]

Two parks are at present in use upon the line. The first of these, Woronoco Park, is devoted to games, races, etc., and is of the conventional baseball-racetrack type, located within the five-cent fare limits of Westfield, and served by the lines of the Woronoco Street Railway Co. as well as the Western Massachusetts. The other park is called Riverbend Park, and it is located in the town of Russell. This park is mainly of a natural character, although special efforts have been made to render it attractive to patrons of the road. One of the most interesting features is the use of Colorado burros for the recreation of children. A fee of five cents per ride is charged, and this price just about pays for the maintenance of the animals, the profits being derived from the transportation of children and adults to and from the park. Special cars may be rented by parties when it is desired to enjoy such privileges. On account of the numerous curves in the line and river the eastward and westward journeys are entirely different in the matter of scenery.

The overhead construction is of the single trolley, bracket suspension type, chestnut poles being used. These poles vary from [illegible]

RETAINING WALL ALONG SIDE OF HIGHWAY

[illegible] No. 00 B. & S. copper, grooved in section and suspended by a soldered clip to secure better wear. There are three feeders, all [illegible] Westfield 12 miles through to Huntington, the second runs 10 miles from the power house to Riverbend Park, and the third is 8.5 miles long, terminating at Russell village. The poles are set 5 ft. away from the nearest rail, and the feeders are carried upon [illegible]

[illegible]

[illegible]

the power supply is drawn from the steam plant of the Woronoco Street Railway Co. in Westfield. This plant contains 625 kw capacity of generating machinery, composed of a 325-kw. Westinghouse 550-volt direct-current railway generator, directly connected to a 16 and 28 x 36-in. Fitchburg engine, running at 125 r. p. m. [illegible] Woodbury engine of the same size. There are two Stewart boilers and one Stearns boiler, all of the horizontal return-tubular type and each rated at 100 h. p. at 125 lb. steam pressure. There is also a storage battery of 264 cells in the basement, consisting of Electric Storage Battery Co's. type F-11 elements, having a one-hour discharge rate of 200 amperes. This battery floats on the station bus bars without a booster, during the daytime, and absorbs the violent load fluctuations which would otherwise fall upon the generating units. At night, after the generators have been shut down, it supplies power to the lines as needed, including car house lights and motors.

The cars of the Western Massachusetts road are stored in a new brick car house with concrete floor and foundations. This building is located on a lot adjoining that of the Woronoco Street Railway Co's. car house in Westfield. The repair shop work of the road is done in the Westfield car house, where there are facilities for forge and machine shop work. The machine shop tools are all driven by a shunt-wound motor, especially designed for constant speed work—a practice of much higher efficiency than the former custom of using an old street railway motor for such service. The car house was built by P. J. Mahoney, of Westfield. It contains three parallel tracks; beneath one of these is an inspection and light repair pit. The car house is equipped with a small steam boiler for heating purposes, chemical fire extinguishers and an ample water supply from the town mains. Its capacity [illegible]

The rolling stock consists of five open and three closed cars, all specially designed to facilitate freedom of vision on the part of the passengers. In general appearance and in detail the cars are especially well suited to this road, and there is no doubt but that they play an important part in advertising the line.

Of the open cars, two were supplied by the Wason Manufacturing Co., of Brightwood, Mass., and three by the Laconia Car Co., [illegible]

[illegible] the Laconia company [illegible] each equipped with four G. E. 80 motors. These motors are rated at 40 h. p. with 75° C. temperature rise after one hour's run. They are provided with large armatures and axle bearings, a large commutator, wide gear face, oil and waste lubricated bearings and other late improvements. The babbitt bearing surface in the armature shaft linings is so thin that it will not allow the armature to strike the pole pieces in case it is melted out by overheating. One of the open cars is equipped with four G. E. 80 and the other four with Westinghouse No. 101 motors.

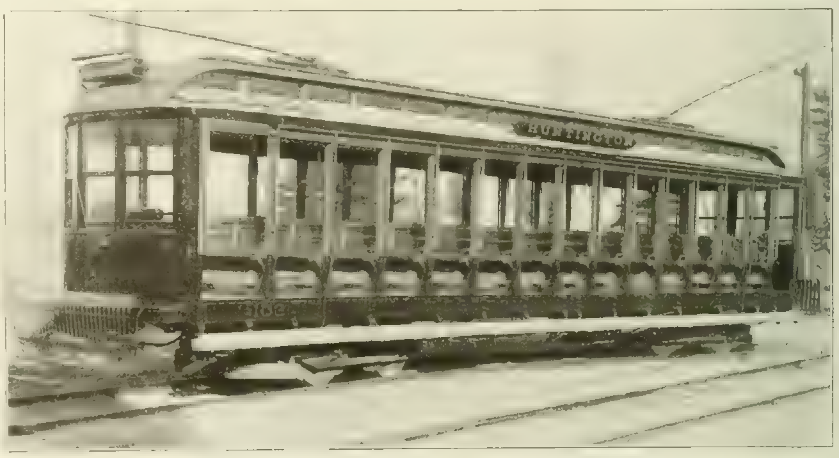
TYPE OF CLOSED CAR

The gear ratio on the closed cars is 17 to 69, and on the open cars it is 15 to 69.

The Wason closed cars are of the vestibuled, double-truck type, measuring 42 ft. 6 in. over buffers. The body length is 30 ft. and the width over the sheathing at the sills is 8 ft. 2 in. The height from the top of the floor to the ceiling is 7 ft. 9½ in., and from the top of the rail to the top of the roof 11 ft. 3½ in. All the windows and doors are of the oval top pattern, and on each side are five plate glass windows 52 in. in length and 24 in. high, giving an ample view from within. The seats are of the "walk-over" pattern, 35 in. long, with high back and head rest, covered with figured royal blue plush. The inside finish is of selected Cuban mahogany inlaid with marquetry of unique design, and the trimmings are of bronze. The seating capacity is 48 passengers. The ceiling is spaced by four half-empire arches, on which, between mahogany bands, are 24 frosted bulb 16-c. p. incandescent lamps. The ceilings are light blue decorated with a special design in gold. The curtains are of Pantasote with Forsyth patent fixtures. The lower deck ceiling is double banded with mahogany inlaid with marquetry, all harmonizing with the light blue and gold decorations, and no advertising cards are placed in the cars. All sashes are painted and grained on the outside to match the mahogany interior. Inlaid in the center aisle is a rubber tile matting running the full length of the car. Double sliding doors admit to an ample vestibule at each end, which is finished in mahogany. The vestibule side doors are of double folding type and they are arranged to swing back against the end of the car our of the passage-way. There are 16 cross seats and four longitudinal seats.

The axles are of a high quality of cold rolled steel, 4½ in. in diameter, and the cars are fitted with National Electric Co. air-brakes, with whistles and independent valves. At the suggestion of the general manager the air-brake exhaust was fitted with a special muffler, consisting of an open box stuffed with excelsior, into which the air discharges. The exhaust of an air-brake system often frightens horses when the brakes are released, and it was greatly desired to avoid this on the new road. Hand brakes are also provided, with wheels in the vestibules. The exteriors of the cars are of royal blue, with cream colored roofs, black iron work and olive green trucks. Special compound drawbars were used, together with Providence double fenders of special construction. The framing is also special with steel interlining and the gongs are of the 12-in. Addenda pattern. On the body sashes the glass is of 3-16-in. polished plate, ¼-in. glass being used in the doors. Each car is equipped with Consolidated heaters, and Sterling registers operated by either one of a pair of cords running above the bell cord, the entire system of cords being symmetrically suspended. There are no hand straps. Beneath the cross seats asbestos is installed over the heaters. Combination arc and incandescent headlights are used. The roof covering is of duck. The end signs are of standard pattern with Henderson illuminators and a special trolley guard. Each car is fitted with sand boxes, two trolleys, two Wilson retrievers, scrapers and Havalan-Buck signal lights. The steps are covered with a metallic safety tread and they have malleable iron ends. The cars are mounted on two Wason No. 25 trucks with 33-in. steel-tired wheels with 2½-in. tread and ⅞-in. flange. On all windows and vestibule doors weather strips are provided. The seat back bands are arranged to hold tickets. and the heaters are wired so that half or all can be used at will. Each car is equipped with a compact telephone set installed by the E. G. Bernard Co., of Troy, N. Y. The transmitter and receiver occupy only a space of 3½ x 6 in., and are located in one of the car vestibules. Beneath the car is an arrangement for carrying a telescopic telephone connecting rod with which flexible connection the car crew can connect the telephone in the car with the office from any point on the line. The weight of the closed cars complete is about 26 tons each.

The open cars of the Wason make are mounted on the builder's No. 21 double trucks and are 45 ft. long over bumpers, having 14 benches, and a seating capacity of 98 passengers. At the post line these cars are about 8 ft. 10 in. wide. They are provided with vestibule fronts having large single light drop sashes, giving a vestibule fronts having large single light drop sashes, giving a wide, clear view forward. The usual and uncomfortable bulkhead between the vestibule and body has been dispensed with. The height from the top of the floor to the ceiling is 7 ft. 8 in., and from the top of the rail to the top of the roof, 11 ft. Two trolleys are provided. All the windows and doors are of oval design, the deck glass being light acid with gothic design in fine gold lines. The interior lighting follows much the same plan as that of the closed cars. Bronze trimmings are used, and the side curtains are of oakette, extending to the floor. The outside body color is royal blue with good lettering and striping, cream colored roofs and dark green trucks. Acme combined arc and incandescent headlights are used. A special feature of each vestibule is the provision of ornamental grille gates at the side, the top rail of each gate extending out to the first side post and making an arm rest. Kilbourn sand boxes are installed, and these are filled from beneath the car. The axles, air-brakes, fenders, exhaust muffler. hand brakes, drawbars, roof covering signs, registers, and wheels are of the same make as those in use on the closed cars. The glass in the body sash is of 3-16-in. polished plate. The seat backs are curved and are 31 in. apart on centers. Telephones are used as on the closed cars.



OPEN CAR OF WESTERN MASSACHUSETTS STREET RAILWAY CO.

The Laconia closed cars likewise represent the most advanced

practice of their manufacturer. They are 40 ft. 9 in. long over bumpers, with 28 ft. 6 in. bodies, an overall width of 8 ft. [illegible] and a height of 8 ft. 3 in. inside the center. The [illegible] top of the rail to the top of the trolley board [illegible] outside length of each vestibule is 5 ft. 4½ in. The sides are straight, sheathed with narrow whitewood, and the roof is of the steam car type with monitor extending full length over the vestibules. The side windows are extra wide with double sashes arranged to drop. These sashes weigh about 50 lbs. each and are equipped with Laconia standard counterbalances [illegible] easy to operate and to provide against breakage in [illegible]ing. The vestibule doors are of the double folding type and the vestibule fronts are equipped with sashes arranged to drop flush with the window stool. The monitor windows are of a special design of leaded glass, semi-elliptic lights of leaded glass being used above the doors with beautiful effect. The cars are painted royal blue with gold trimmings to match the outside painting, the interior having full empire ceilings painted a gold bronze, stipled. The marquetry work over the end windows matches the oval leaded glass work, and marquetry designs are used over each wide post. The interior finish is trimmed with oxidized bronze, a beaded effect being widely employed. Highly figured Tobasco mahogany is the wood used, and the artistic effect of this finish, with the high backed Heywood blue plush seats and oxidized bronze, is admirable. Seat and grab handles are of oxidized bronze to match the car trimmings and in the center aisle the floor is composed of the celebrated red and white interlocking tiling used so often on Pullman cars. This tiling can be easily washed and a scarred piece replaced when necessary. The ceilings are painted a bronze glaze. The lights are of 16 c. p. with frosted bulbs set in oxidized bronze husks, and arranged to depend from the ceiling in strings or arches of five lamps per arch.

The bottom framing is composed of side sills made of two pieces of long leaf yellow pine, 2¾ x 8 in., with a steel plate ½ x 8 in. in section between, all bolted together, cross timbers of 4¾ x 5-in. white oak, framed into the side sills. A 4¾ x 8-in. thrust timber is provided in the center of the car. The platform is supported by two 7 x 5½-in. T-irons, which extend back under the side sill, and which are bolted to it, and the platform is further reinforced by two 4 x 4 x ½-in. angle-irons which extend back to the first cross timber, all being thoroughly bolted to the end sill, which is trussed underneath by a ¾-in. truss rod. The bolsters are of the M. C. B. type, composed of one plate of steel, ¾ x 8-in., which is bent down at the ends and which passes under the side sill; this plate is reinforced by a 1 x 8-in. steel plate bent in the form of a truss. These plates are bolted to the bolster bracket, which is thoroughly bolted to the side sill. The bolster has cast iron filling pieces at the center plate and at the side bearing plates. [illegible] yellow pine. Each car has two ½ x 1¼-in. truss rods passing over the queen posts at the bolster, and down through the side sills, terminating in a wrought iron anchor at the end of the car. It is still further reinforced by a truss rod of one inch round iron passing under the queen posts and anchored to the under side of the sill at the bolsters, the center connection being a turnbuckle. The body framing posts are of white ash. The window stools are continuous and are also of white ash, running the full length of the car. The rafters are of white ash reinforced at every double

CAR HOUSE AT WESTFIELD

[illegible] the backs having head rolls and diagonal grab handles of bronze. [illegible] combination headlights, Newark air sanders operated by valves, 16 car heaters per car of the Consolidated type with asbestos barriers, Laconia inside hung motor trucks with 33-in. steel tired [illegible]

[illegible]

these cars. The axles, tread, air brakes, fenders, etc., are as installed on the Wason cars.

The Laconia open cars are of very handsome design and are 44 ft. 9¼ in. in length over bumpers, and 9 ft. ½ in. wide over running boards. They are 9 ft. 2 in. high from the bottom of the sill to the top of the trolley board and are mounted upon Laconia "9B3" trucks with 33-in. steel tired wheels. They conform more closely in appearance to the Wason cars than do the closed cars. They are finished in selected figured mahogany with inlaid work, semi-empire ceilings of light blue color, drop side curtains, frosted lamps and drop-sash double vestibule windows. The seats are reversible, 14½ in. wide, and white ash was largely used in the framing. No advertising racks were provided. Climax headlights of the combination type and Providence fenders were installed. The trucks are of the cushioned bolster type arranged for outside hung motors, 4-ft. 4-in. wheel base, 4½-in. steel axles, 33-in. steel tired wheels over 3¼ by 6-in. journals. They are painted Pullman green.

The cars of the Western Massachusetts Street Railway Co. are geared for a maximum speed of 30 miles per hour. In view of the topographic and scenic features of the route a higher maximum speed was deemed undesirable.

The rolling stock of this road is of a high type of design and the closed cars are quite as attractive as any ordinary steam railroad Pullman.

The officers of the Western Massachusetts Street Railway Co. are: President, Ralph D. Gillett, who is also treasurer of the J. L. and T. D. Peck Manufacturing Co., of Pittsfield, Mass., and who originated and built the Berkshire Street Ry.; treasurer, A. W. Eaton, who is president of the Eaton-Hurlbut Paper Co., of Pittsfield, Mass.; and general manager, Archie D. Robinson, who was clerk and general utility man of the Berkshire Street Railway Co. during its construction and operation until its sale to the New Haven interests. Mr. Robinson is also general manager of the Woronoco Street Railway Co. and Mr. Gillett is its president.

New Equipment for Northern Ohio Traction & Light Co.

The Northern Ohio Traction & Light Co. has recently closed contracts with the General Electric Co. for a 1,500-kw. Curtis steam turbine, a 1,000-kw. motor-generator set and a 300-kw. motor-generator set, together with the necessary switchboard apparatus, etc., to be installed in its power plant in Akron, O. A contract has also been closed with the Electric Storage Battery Co. for a battery installation, consisting of 288 G-9 elements in G-13 tanks, in the railway plant at Bedford, O. The battery is to be installed complete with booster and switchboard. With the addition of the above equipment the company will be able to operate with either direct or alternating current.

The Freight Traffic of the Ohio River Electric Railway & Power Co.

[illegible]

The Ohio River Electric Railway & Power Co. operates 12.02 miles of electric railway between Middleport, Pomeroy, Minersville, Syracuse and Racine. This road possesses unique and interesting features in its method of handling freight and developing roads soliciting freight traffic, this electric road has the unique feature in not being a competitor of a steam road, but on the contrary, it has, since its inception, been a feeder to and created much new business for the Hocking Valley Ry.

LOCOMOTIVE WITH TRAIN AT [illegible] MINING CO. SWITCH

that branch of the business. The road parallels the Ohio River, and serves the largest undeveloped coal field in Ohio. The promoters seeing the future possibilities of freight development in this territory, in building the road, used standard steam road construction throughout. Sharp curves and heavy grades were avoided, thus affording one of the primary advantages in the economical operation of a freight service.

A transfer switch to the Hocking Valley Ry's. tracks is located in Pomeroy, a distance of nine miles from the Racine terminus, between which points are located machine shops, salt, bromine and calcium works, foundries, lumber yard and coal mines, all connected with the electric line by eleven switches with capacities varying from 2 to 30 cars each, several of which are illustrated.

[illegible] SALT CO.

THREE TRACK SWITCH AT SYRACUSE, O.

Pomeroy is the southern terminus of the Hocking Valley Ry., from which point to Minersville, Syracuse and Racine the carload freight service is operated, and it is here, that, unlike other electric

The rate charged for transporting this carload freight is an arbitrary switching fee regardless of the car-tonnage and divided into four zones; $2.00 per car is charged to a point 1.26 miles from the transfer switch, $2.75 to a point 2.61 miles, $3.50 to a point 4.5 miles and $5.00 to Racine; empties are handled free. These rates

are published by the Hocking Valley Ry. in its Joint Freight Tariff sheet.

The cars are moved at night [illegible]

CAR ON SIDING [illegible] POMEROY.

of 4,000 lb. This locomotive is equipped with two G. E. [illegible] motors and manned by a crew of one motorman and two brakemen. The locomotive will pull [illegible] ordinary loaded cars on a level track, but not more than two over some of the heaviest grades. When approaching these heavy grades the locomotive is always placed with two cars ahead and two behind. When the grade is reached the two rear cars are cut off and the two forward are pushed over the grade. Then the locomotive returns and pulls the two remaining over. The greatest number of cars ever moved in one night was 44 loads and empties; in this particular instance the crew did not complete the work until 10 a. m. Ample siding room at close intervals permitting the work to be executed without interfering with the passenger schedule.

The cars, both local and foreign, are furnished to the shippers by the Hocking Valley Ry. and payment of the switching fee for cars, both received and delivered, is made by the shipper or consignee direct to his local agent, the electric line rendering an account monthly and receiving settlement therefor. Under this arrangement the method of accounting is made very simple and consists only of a daily freight report, as illustrated, made out in duplicate. One of these reports is delivered to the Hocking Valley agent, the other to the auditor of the electric line. This report is made up from a switching order, also illustrated, given to the freight crew every night and each item O. K'd. by the crew after it has been properly disposed of. The order is then returned to the office the following

[illegible] will yield a very lucrative revenue, far exceeding passenger earn- [illegible]

Taking for an example the maximum haul in the $3.50-zone limit, we have 4.5 miles delivering the empty car and 4.5 miles hauling the load, making a total of 9 miles at a cost of 11.9 cents per mile, a net cost of $1.07 for a car that yields $3.50, leaving [illegible] lowering of grades and will be further reduced when it becomes necessary to put into service a heavier locomotive. In compiling this cost the operating department has not contemplated allowance for deterioration of property or interest on investment, the pro rata of which, chargeable to freight mileage, would be very small. This traffic is on the rapid increase and is at present limited only by the inadequate car service.

In addition to the carload freight there is a way-freight service for consignments of merchandise to various points along the line for which the electric railway receives an arbitrary rate of 10 cents per 100 lb. regardless of distance or class of freight. This is principally taken care of by the combination passenger and baggage coaches, but very frequently a carload is made up and delivered along the line, netting from $10 to $20. The charges for this freight are added to the Hocking Valley's original freight bill and by their agent collected from the consignee and the same method of accounting and settlement employed as with the carload freight. This way-freight rate is likewise published by the Hocking Valley Ry. in its Joint Freight Tariff sheet.

An additional source of good revenue is a parcel freight service, operative on all passenger cars. A charge of 10 cents is made for all parcels not exceeding 50 lb. in weight, and 25 cents per parcel over 50 lb. and not exceeding 150 lb. A supply of parcel tags of both denominations, with coupons attached, is carried by all conductors. It is required that the conductors purchase these tags at the office and have a minimum number in their possession at

Switching Order. 190

Car No.	Car Initial	From	Mileage	To	Contents	For Whom Delivered	Check
Locomotive	Mileage.	B to					

SWITCHING ORDER FOR FREIGHT [illegible]

DAILY FREIGHT REPORT.

Ohio River Electric Railway and Power Co.

Pomeroy, Ohio.

Date.		Where From.	Destination	Contents	Car Initial	Car No	Rate	Amount

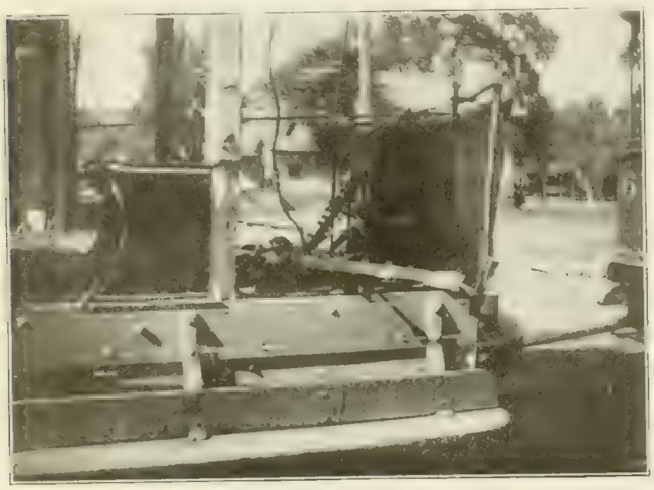
DAILY FREIGHT REPORT. [illegible]

all times. When they receive a parcel properly addressed, they collect the charges in advance, attach the tag, removing the coupon and ringing it up as one fare, then turn in the tag with their collections.

The company makes delivery of this freight to points only on the immediate line of its road and by printed conditions on the tag, accepted by the shipper, is relieved of further responsibility as far as the statutes governing a common carrier will limit.

The Result of a Recent Strike.

During the recent strike of the employes of the Saginaw Valley Traction Co., at Saginaw and Bay City, Mich., there was considerable property destroyed. An accompanying illustration shows a car which had been dynamited by the strikers. This car was



CAR DYNAMITED BY STRIKERS.

taken away from the motorman and was headed toward the river, where the strikers intended to set it afloat. Being unable to do this, however, several charges of dynamite were exploded under the car, and before it was recovered by the company the motors were ruined, the seats were demolished and the controllers torn out and destroyed.

Wabash & Northern Traction Co.

The Wabash & Northern Traction Co., which has recently been incorporated, is now building its line from Wabash to Warsaw and Winona Lake, Ind., a distance of 36 miles. Fifty-year franchises have been secured for the necessary streets in the towns through which the line will pass, including Wabash, Urbana, North Manchester, Silver Lake, Claypool and Warsaw. A private right of way, free from sharp curves and heavy gradients, has been purchased.

The populations of the cities and towns served by this line, as well as the intermediate territory, are shown in the following table:

Wabash	12,000
Urbana	1,250
North Manchester	4,300
Silver Lake	1,500
Claypool	1,500
Warsaw	5,000
Intermediate territory	1,500
	27,050

While the population shown is not great, during certain periods of the year there are several attractions in the vicinity to stimulate travel. Twice each year there are two large horse sales at Wabash, at which times more than 10,000 people attend from various parts of the country, a very fine lot of horses being bred in this vicinity. Laketon, a short distance from North Manchester, is situated on a small lake, which affords good fishing and hunting in season. This location is visited yearly by a large number of campers. A college and fair grounds at North Manchester tend to increase traffic at this point, fall and spring racing meets being held each year. Annual meetings of religious denominations bring large crowds of people to Silver Lake each year, while many cottages and hotels have been built on the shores of the lake. Last year more than a quarter of a million people visited Winona Lake, where the Winona Assembly and Summer School Association hold their annual meetings. This resort is being made one of the foremost rivals of the association at Chautauqua Lake and with better transportation facilities afforded by an electric railway should increase rapidly.

At Wabash the line will connect with the lines of the Ft. Wayne & Wabash Valley Traction Co. and with the completion of the line of the Winona-Warsaw-Goshen electric railway, will form the connecting link of electric railways which will provide through trolley communication between points in Michigan and Northern Indiana, and Indianapolis and points south. This should result in the development of through interline traffic of both passengers and freight, and should have considerable bearing on the gross receipts of this company.

The capitalization of the Wabash & Northern Traction Co. is divided as follows: Common stock, $850,000; 30-year five per cent gold bonds, $850,000. The general office of the company is located at Wabash, Ind., and the officers are: President and general manager, Joseph A. Barry; vice-president and general counsel, Lincoln Guynn; secretary and treasurer, Edward L. Schmock.

The Street Railway Systems of Buenos Aires.

Two articles of considerable interest regarding the street railway systems of Buenos Aires were published in the "Street Railway Review" for June and August, 1904. The development of electric traction in this territory during the past few years has been very rapid and it is interesting to note the progress that has been made during the past year.

The returns of the nine tramway companies in the City of Buenos Aires during August, 1905, were as follows:—

	Horse.	Electric.
Length of line, kilometers	164.584	330.465
Passengers carried	3,713,800	10,176,412
Kilometers run	1,405,656	2,987,907
Receipts	$379,895	$1,056,768

The passengers carried during the first eight months of the year have been:—

	Horse.	Electric.	Total.
	40,393,634	61,446,252	101,839,886
Compared with 1904	43,470,700	52,377,124	95,847,824
Compared with 1903	48,628,569	37,466,860	86,095,429

The increase in passengers carried during the year 1905 as compared with the preceding year is 6.7 per cent. The decrease in the number of passengers carried on the lines operated by animal power is due to the fact that several lines have recently been converted for electrical operation. At the present time all the lines operated by horse traction are being electrically equipped. The length of lines operated by electricity in 1904 was 230.359 kilometers and by horse traction, 253.685 kilometers.

The receipts of the companies for the first eight months of the year were:—

	1905.	1904.	1903.
Grand National and New	$1,589,815	$1,612,825	$1,534,373
Rural	811,924	725,159	697,021
Metropolitan	650,539	291,476	267,207
Anglo Argentine	5,186,000	4,847,600	4,194,344
Buenos Aires and Belgrano	1,342,214	1,290,418	1,222,894
Capital	1,147,548	1,080,282	1,080,119
Buenos Aires Electric	456,236	203,863	130,027

The Sioux City, Homer & Southern Railway Co., which two years ago built a road from South Sioux City, Neb., to Homer, a distance of 12 miles, that has never been operated, will soon put its tracks in order for operation. It is understood this company has contracted for a gasoline motor, and express and passenger cars similar to those recently built and placed in operation by the Union Pacific R. R.

Question Box of the Mechanical and Electrical Association.*

COMPILED BY [illegible] WALTER MOWER, [illegible]

26. How shall the interurban car of the future be designed, with or without platforms, and where shall the entrances be, [illegible] or at the ends?

How shall they be operated, in trains or singly?

If in trains, shall all be equipped with motors, or will one be a motor car and the rest trailers?

1. The interurban car should have platforms and entrances at the ends. The number of people getting on and off at any one point is not large enough to warrant side entrances. Side entrances involve structural weakness in the car, which it is expensive to overcome, and they are difficult to operate, except by station platform attendants, or by expensive mechanism for operation by the conductor. Interurban cars should be provided with doors, so that passengers and conductor can pass from one car to another when cars are operated in trains.

All cars on up-to-date roads should be provided with some form of multiple control, so that they may be operated in trains where the service warrants doing so. It is practically impossible to operate cars at high speed at more frequent intervals than one every half hour in each direction on a single track road, and the ability to operate the cars in trains when the traffic requires doing so will frequently remove the necessity of building a double track, where the traffic requires the operation of single car trains at more frequent intervals.

Preferably all cars should be equipped with motors, as the modern interurban road high speed car generally has an equipment but little in excess of the requirements for propelling itself, and is therefore apt to be overworked if required to haul trailers. In most cases it would not pay to equip all cars with sufficient power to haul trailers. If it can be foreseen that the traffic of the road will require the operation of trains during the major portion of the time, it is probable that the equipment of two out of three cars in each train, or a like proportion with larger trains will be satisfactory. The number of cars which should be equipped with motors in each train will depend largely upon the acceleration desired, the grades, frequency of stops and other conditions encountered.

No. 8.

2. It is a difficult matter to design a car that will meet the requirements of all interurban roads, as there are various conditions to be taken into consideration; conditions that may be characteristic for certain roads only.

The length and width of the cars should be as great as the streets will permit in cities through which they may be required to pass. In determining the size of cars the density of traffic must also be taken into consideration.

The cost of operating and maintaining a number of large cars is smaller than that of a greater number of small ones.

As an up-to-date interurban service demands a high speed, the cars should be built with steel sub or floor-framing so as to minimize possible injuries to passengers in case of collisions or derailments. Seats should be provided for all passengers, if possible, especially if the cars are intended for long runs. The greatest seating capacity is obtained by the use of cross seats with a center aisle. Cross seats are, besides, more comfortable than longitudinal seats. This is especially true in case a high rate of acceleration and retardation is required.

If platforms are not adopted, it will be necessary either to provide the stations with platforms raised to an elevation corresponding to that of the car floor or to provide the cars with steps, which undoubtedly would project considerably beyond the car body. In either case it would prohibit the running of the cars on streets.

Therefore, it seems advisable to build interurban cars with platforms. If this is the case, they should also be designed with end side doors. These should not be less than 40 in. to 48 in. wide. The platform should accordingly be wide and of the vestibule type. The number of passengers handled at any one time at stations [illegible] not be permissible in the streets.

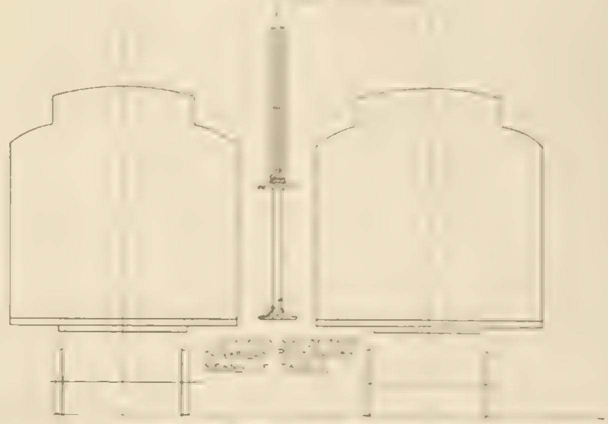
[illegible] or in trains, this would depend on the distance over which they are to run and on the density of the traffic.

[illegible] single cars would be more economical and efficient. For longer hauls, when stops are not too frequent, trains made up of two or more cars can be used to advantage during rush hours or for handling excursion parties.

[illegible] would otherwise be impossible to maintain the schedule. All cars should also be equipped with air brakes. In determining the type of control to be used, the greatest safety to passengers, the reliability and flexibility of control, the size of cars, and if run singly or in trains, should be considered.

If cars are run in trains, it necessarily follows that a multiple unit control should be adopted. In case small cars are used equipped with small motors with a comparatively small power consumption, a straight hand control can be used with economy and safety. When large cars are considered, with necessarily large motors, a multiple unit control should be decided upon as being better adapted for handling heavy currents. Besides the flexibility of such a control in case it is desired to run cars in trains, it has the great advantage that all apparatus and cables carrying heavy currents can be placed underneath the floor framing, thus minimizing possible panics in case of a burnout in the cables or control.

No. 13.



[illegible]

27. On a city, suburban and interurban service, can cars weighing 26 tons complete, equipped with four 50-h. p. motors, maintaining an average speed of 20 miles per hour, make a daily mileage of 300 miles without seriously impairing the electrical equipment?

1. This would entirely depend on the design of the motors and the profile of the road.

No. 13.

2. The conditions named in this question have been met with in a western city with no bad results to electrical equipment. Not a single armature or field has been lost through baking or burning out. Close inspection is required. The climate is decidedly favorable in this instance.

No. 2.

3. Four 50-h. p. motors on a car weighing 26 tons complete, should easily make an average speed of 20 miles an hour for 15 hours per day, without seriously impairing the equipment, providing the number of stops, grades and length of time on slow schedule in the city do not require the car to make a maximum speed in the

*Continued from preceding issue.

country of over 35 miles an hour. If the previously mentioned conditions made it necessary to gear the car to a higher speed than 35 miles per hour on a level, it is quite probable that heavier motors would give a better service. No. 8.

---

28. Providing cars are fairly standardized and in fairly good shape, how many men per car should there be employed in shops and car houses on an electric street railway system operating, say, 400 to 1,000 cars, in order to keep cars in first class condition?

One man for every two cars in service is a fair average. It is supposed that this question means all men engaged in car repairs. No. 2.

---

29. How can cars be given a thorough weekly washing, without injuring the varnish, or causing the wood work to rot?

Is it injurious to the varnish to wash a car with warm water in an unheated building?

---

30. In building new paint shops, what is the best form of painters' scaffold to provide for use at the sides of cars?

The accompanying sketch shows a type of painter's scaffold suspended from the roof trusses. The scaffold can be put at any desired height by means of a tackle. No. 13.

---

31. What is the best type of construction for car body hoists; shall they be operated below or above the car house floor?

In shops with a single floor an overhead traveling crane can be used to great advantage. Besides being economical, it leaves the floor space between cars unobstructed, which facilitates handling of material.

If at the same time space for handling trucks and motors is provided for at one end of the shop, this same crane can be used in replacing trucks on any car. Enough headroom must then be provided for to permit of carrying the trucks over the cars.

In shops with two floors, where on the upper one car body repairs are carried out, and where the lower floor is intended for the repairs of motors and trucks, the installation of an elevator will facilitate the jacking of cars as well as the handling of trucks and motors. No. 13.

---

32. Which are the more economical for the general lighting of shops and car houses, arc or incandescent lamps?

1. The most economical means for general lighting of shops and car houses, whether by arc or incandescent lamps, depends upon a number of factors:

The location of shops and car houses relative to the power house or source of supply and the amount of copper connecting them.

Arrangement of space for storage, working, etc.

Where extreme fluctuations of pressure are common it is not advisable to use arc lamps, as they will give considerable trouble and cost a large amount for maintenance, besides giving very poor light, so that in all cases where extreme fluctuations of pressure are encountered, incandescent lamps should be used, in clusters for illumination of large areas and as single lamps located with special reference to the work in shops and other places. Where there is no trouble due to fluctuation of pressure, arc lamps may be used for lighting large areas and incandescent lamps in shops, located with special reference to the work. No. 8.

2. Incandescent lamps would appear to be more economical for the lighting of shops and car houses than arc lights, principally in consequence of their allowing us to distribute the light among such places as it is needed. Then, again, the incandescent lamps do not require the attention of electricians so frequently, and, in case of a burnout, any car house employe can substitute a new lamp whereas, with the arc lights, the trimming should always be done by electricians. In car houses no great amount of light is required, except in special locations, such as in the pits or over work benches. It is, therefore, the practice in the Borough of Manhattan to so arrange rows of incandescent lights between tracks that there will be one light for each car; in other words, the lights in each row will be two car lengths apart. No. 9.

3. We use both arc and incandescents for lighting our shop and believe that combination is the most economical. No. 14.

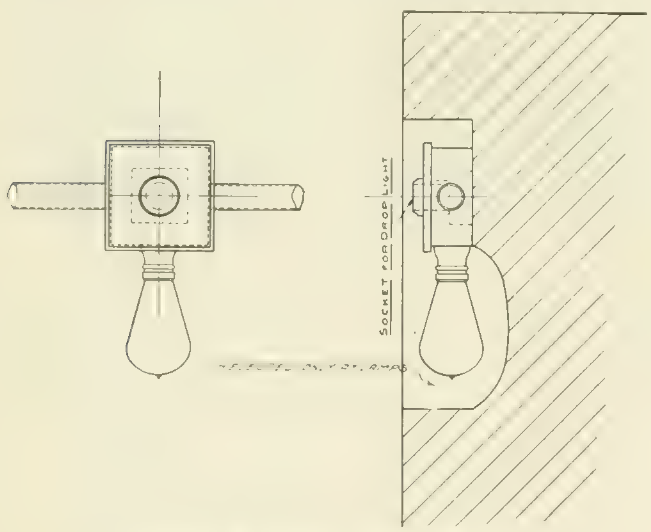
---

33. What is the best method of pit lighting?

1. In our shops we have found incandescent lamps located on both sides of the pits and spaced about 10 ft. apart as being the most satisfactory method of lighting pits.

Each lamp should be put in a recess to prevent breakages of same. The wires should be carried in iron conduit pipes and a potenial of not more than 120 volts should be used. No. 13.

2. The best method of lighting pits is by the use of incandescent lamps, the wires being placed in iron conduits, with the outlets spaced at intervals of about 5 ft., either side of each pit. For a careful inspection of the underbody of a car, a lamp can be removed from socket and a portable light substituted. No. 9.



SCHEME FOR LIGHTING PITS (NO. 9)

---

34. What is the best system for heating car shops and pits?

The best system for heating car shops and pits is with hot air heated by steam coils and circulated by means of fans. No. 3.

---

35. Do automatic sprinkler equipments in car houses afford sufficient protection from spread of fire to pay for installation?

Automatic sprinkler equipment in car houses, if properly installed, certainly do afford considerable protection against the spread of fire. As to the economy of installing sprinkler equipments, a decision must be reached in each individual case, based upon the cost of installation, the amount of protection afforded, etc. The rebate allowed by the insurance companies at present for a standard sprinkler equipment is from 30 to 40 per cent reduction in the insurance rates on the building. I deem it good practice if the amount of this reduction equals 20 per cent of the cost of installing the equipment to have it installed. The cost of maintenance of a proper equipment, dry air system, is not great, and, in addition to the saving in insurance rates, it also gives additional protection to the property, and the protection to the property should be considered equal, in dollars and cents, to the allowance made by the insurance companies, for although railroad companies are, generally speaking, co-insurers of 20 per cent of the amount for which property is insured, if the loss in business is considered, they are co-insurers to the extent of fully 50 per cent, if not more, of the value of the property, especially the rolling stock.

The Board of Underwriters is, I understand, now considering the advantages of the so-called side sprinkler equipment, but after a careful inspection and test of that equipment, the writer does not believe that it is of sufficient benefit to pay for the additional expense of installation. There are several objections to their use, the main one being the difficulty of properly draining the pipes, for, even with a dry air system, water will collect at the bottom of the sprinkler system, and, unless proper provision is made for draining it off, there will surely be trouble in freezing weather.

The ordinary automatic sprinklers give, in the writer's opinion, fully as much protection as do the side sprinklers. In a test held at Newark, N. J., the overhead sprinklers opened before the side sprinklers, and many of the side sprinklers failed to open at all, owing to the cooling of them by the spray from the automatic sprinklers. No. 9.

---

36. What difference between wheel and track gage do you use, and where measured on your wheels?

1. There should be ⅛ in difference between wheel and track gage if gage line is taken from wheel in gage line, namely ⅛ in upon flange, although, by making the wheel gage the same as track gage and measuring from wheel where flange starts to round it gives the same results with less chance of allowing the gage to get out of place and making wide or narrow gage. No. 1.

2. The difference between the track and wheel gage should be ¼ in. for a 4 ft. 8½ in. track gage. The gage on the wheel should be measured from the root of the flange. No. 3.

---

37. Which is the more economical arrangement for getting cars to and from car houses, transfer tables or turn outs?

1. Turn outs. No. 2.

2. Turn outs should be more economical where an electric equipment is to be taken care of.

The cars ought to be brought to the shops for inspection every third or fourth day.

With a transfer table handling only one car at the time, cars cannot be shifted fast enough to take care of the equipment.

Another advantage of turn outs would be in case of a fire, when undoubtedly more cars could be got out of the shop than with a transfer table. No. 13.

3. The cost of maintenance of track and machinery is determined by depreciation.

To install a transfer table in a car house 200 ft. in width will cost approximately $3,000, if installed when the house is constructed. In a car house of this width cars could be received or discharged from the car house on less than one-minute headway with four turn outs from the house to the main line. In a house of this width without a transfer table, 14 or 16 turn outs connecting with the main line would be needed, and this large number of turn outs connecting with the two tracks on the main line, even though half of them turned in each direction, would necessitate a very complicated and very expensive set of track work, and the depreciation or cost of maintenance of this large amount of special work would far exceed the cost of the maintenance of the transfer table and the four plain turn outs needed with it.

Furthermore, with overhead trolley work, the overhead wiring for so many turns outs would be a source of considerable expense for maintenance and a source of considerable annoyance, with cars leaving and entering the house on short headway.

By the use of two transfer tables and four tracks or turn outs to the main line, cars could be discharged from the house on less than 30-second headway with little or no danger of collisions; whereas, with a turn out from each house track to the main line, there is considerable danger of collisions, and, for this reason, the writer feels that, for emptying a house in time of fire, the transfer table is preferable to the usual system of having turn outs from each track to the main line. No. 9.

4. This company has turn outs at three of its car houses and a transfer table at one, and I think the turn outs are much better and quicker. No. 5.

---

38. Does high carbon rail for street railway work give better results than rail with less than 0.55 per cent of carbon?

1. Where rails are held rigidly to a solid foundation, and there is a minimum amount of strain at the joints, so that practically the only strain on the rail is the crushing strain caused by the wheel of the car, it is probable that the high carbon rail is more economical than the rail with lower carbon. In the Borough of Manhattan, the rails are supported rigidly at 5-ft. intervals. The joints are supported by cast iron yokes. The joint plates become more or less loose, so that there is a motion to the rail at the joint, and there has been considerable trouble in consequence of the hammer blow on the drop rail breaking the head of the rail. This break begins on the gage line, about two inches from the joint, and generally extends diagonally through the head of the rail for a distance of from eight to fifteen inches. It does not occur often on rails having their joints suspended, but in this case, with the supports 5 ft. apart, the strain is so great on the rail through the joint that the web splits. No. 9.

2. In all work under the writer's supervision for the past seventeen years the chemical analysis of rail for city tracks has been specified. "Illinois Steel Co's. standard analysis, except carbon which shall be 0.55 to 0.60 per cent." No trouble has been experienced on account of extra liability to break, sufficient to offset the additional life added to the rail. We believe the additional life is of great advantage.

---

39. What is the best method for the [illegible] of weeds along the roadbed?

---

40. What has been the experience of the members of the association as to the permanence of the [illegible]?

---

41. What character of sand is [illegible] for sanding tracks? By what methods can it be dried? Which is most economical?

1. With cast iron chilled wheels [illegible] and especially under elevated structures, where the rail is inclined to be greasy, it seems necessary not only to use such sand as is carried in the sand boxes on the cars, but also to use considerable sand placed upon the rail by independent [illegible] by hand. For this purpose clean, sharp-screened sand, entirely free from mica or loam, should be used; in fact, sand used for this purpose should be washed sand, and the best results are often obtained by using sand dredged from the bottom of rivers or harbors. This sand as it is delivered contains considerable moisture, and it is necessary that it be kiln-dried in order to have it run freely, especially from the sand boxes on cars.

The drying of sand has always been a problem with steam railroads, and a number of electric roads are obliged to have drying facilities. Various sand driers are used for the purpose. First, the old-fashioned sand-drying stove, which is a cylindrical stove around which an iron hopper is built. This hopper is filled with sand and as the sand dries it percolates through small apertures in the bottom. With this character of drier, one man with two stoves can dry about 10 yards per day, but it means the handling by hand of the sand several times. Then again, the sand, coming in contact with the hot surface of the stove, is likely to be burned, and this destroys its gritty properties.

Rotary driers, such as are used by the asphalt companies, are used to a certain extent, but they also tend to heat the sand to too great a temperature and are expensive to operate and maintain.

Various forms of steam driers are used, but in electric car houses, steam is not often available, and to generate steam for the purpose of drying sand is very expensive.

There has been used with considerable success in the Borough of Manhattan a so-called gravity drier. The sand is delivered on the ground floor, runs through chutes to conveyors, is carried to elevators and hoisted to the top of a brick stack, about six or eight feet square, which stack is filled with iron bars, spaced a few inches apart, so that the sand in falling from the top of this so-called "slat-chamber" to the bottom drops from one bar to another, and so presents a considerable surface to the heated gases with which it comes in contact. The fire is in a furnace adjacent to the slat chamber. The gases are carried to the top of the slat chamber and, by forced draft, down through the slat chamber, falling with the sand and discharging through a stack adjacent. The dry sand is then carried by elevators to the second floor, where it is placed in a storage bin, from which it can be loaded into sand cars through chutes. This would seem to be the most economical method of drying sand where any quantity is required. An experimental dryer of this kind which was in operation in the Borough of Manhattan for something over a year averaged to dry about 75 yards of sand per day with two men. The fuel cost about 5 cents per cu. yd. of sand and it required about 20 h. p. to operate the conveying and elevating apparatus. No. 9.

2. We use a black river sand, which I think is sharp enough. For drying, we have a boiler, 36 in. in diameter, fitted up with a 4-ft. grate and set up on legs. Behind the grate, the boiler is stopped up to a level with the grate, and with a 14-in. stack we get sufficient draft. Pieces are bolted to the sides on a level with the grate, which will hold a wagon load of sand, which, as it dries, runs through holes in the side pieces. We can dry a great deal more in this way with the same amount of fuel then we could with an upright stove. No. 5.

---

42. What is the best form of concrete beam construction as evidenced by actual experience?

---

43. Has experience shown that portland cement concrete under the tracks in city streets has given results such as to warrant its use

in preference to domestic concrete, when the cost of the latter was less than one-half?

44. What character of pavement next to street railway rails give the best results?

45. Why, in a city where the streets are of ordinary width, can not a pavement be laid abutting a T-rail with equal facility and with ultimately as good results as where some type of grooved or tram girder rail is used?

On any street where there is heavy traffic and a tendency of vehicles to follow the rails, no pavement will withstand the wear that is placed upon it. The advantage of the grooved or tram girder rail is that it carries the weight and wear of vehicles upon the tram. If traffic could be diverted from the tracks there is no reason why brick pavement, properly laid, asphalt blocks or sheet asphalt could not be laid abutting T-rail with good results. No. 9.

46. Does the treatment of ties, poles, fence posts, etc., with a preservative fluid sufficiently increase their life to warrant the expense?

What methods are pursued? What do they cost?

47. Has anyone seen an indicator for steam turbines?

The Syracuse & South Bay Railway Co.

Realizing the opportunity afforded at Oneida Lake under the new conditions now opening up, a group of capitalists and practical, experienced railroad men have organized and are carrying out the project to connect the city of Syracuse with Oneida Lake and the Barge canal by means of a double track, high-speed electric railroad for freight and passenger business. Owing to natural conditions the railroad now in the course of construction in connection with a new line of steamboats on the lake, controlled by allied interests, will have a monopoly of the freight and passenger business of an important and growing territory. The Syracuse & South Bay Railway Co. was incorporated in 1900 under the railway laws of the state of New York to build and operate a railroad about 27 miles long, the main line extending from the city line of Syracuse to South Bay, Oneida Lake (a distance of about ten miles), its western division extending from North Syracuse to the western end of the lake at Brewerton (seven miles), and its eastern division extending to Bridgeport, likewise on the lake, a distance of about ten miles. The capital stock of the company is $900,000 common, all issued, and $100,000 five per cent preferred, reserved for the construction of the division to Brewerton. The company owns a majority of the stock of the Syracuse & Oneida Lake Electric Railway Co.

MOTOR CAR AND TRAILER AT CAR BARNS, NORTH SYRACUSE—SYRACUSE & SOUTH BAY RY.

The main double-track line of the Syracuse & South Bay Railway Co., connecting the city of Syracuse, N. Y., with Oneida Lake and New York state's 1,000-ton barge canal, is now nearly completed and will be in operation within a few weeks. Conditions in its territory make this line in some respects unique among the electric railroads of the state. Circumstances, present and prospective, are such that the passenger and freight business of the railroad will be of about equal importance.

Oneida Lake is the largest lake wholly within New York state, having about eighty square miles of water. Among the attractive features from a resort standpoint are Frenchman's and Dunham's Islands, of 28 and 22 acres respectively, and well wooded. They are situated at the entrance to South Bay, a large and beautiful natural harbor. The lake has important commercial fisheries. It has always been popular with sportsmen and tourists, but up to the present it has been rather inaccessible, especially at the southwest portion. The transportation facilities to and on the lake have been very poor, so that the large body of water has been more of a hindrance than a help to the commerce of the region. Syracuse, a city of 125,000 population, is only ten miles from the lake. Communication between the city and the lake has been over a toll road upon which it is expensive to travel.

The "Bay road" is a little more than ten miles long. It is constructed largely over private right of way 100 ft. wide, extending northeast from the city limit of Syracuse in a direct line through North Syracuse to South Bay. The highest point on the line between the city and the lake is only 50 ft. above the level of the lake, and the maximum grade is 1.75 per cent. The rails weigh 85 lb. to the yard, and the construction is of the most substantial character throughout. The culverts are of concrete. The ballast consists of gravel and crushed stone. The center pole type of overhead construction is used.

CONSTRUCTION WORK ON SOUTH BAY TERMINAL LOOP

One of the most interesting features of the construction work is the terminal loop at the South Bay dock, extending out into the lake a distance of about 250 ft. It is of earth and rock and encloses a lagoon to which small craft have access under a bridge. Just beyond the loop is the large dock and pavilion, forming the connecting link between the railroad and the steamboats of the Oneida Lake Navigation Co., composed of interests allied with the railway. Several thousand passengers an hour can be handled between the cars and the boats when the occasion demands it. The great ob-

jective point of excursionists will be Frenchman's Island, famous for a century, and now to become a great popular amusement park and picnic ground.

The cars of the Bay road in the city run over the tracks of the Syracuse Rapid Transit Co., with which the company has a transfer agreement. The rolling stock equipment of the Bay road consists of ten motor cars, ten trailers, two baggage and express cars, a rotary snow plow and 20 freight cars. The passenger and baggage cars were built by the G. C. Kuhlman Car Co., of Cleveland, O., and are now all stored in the car barn at North Syracuse. The motor cars are 48 ft. long over the vestibules and 8 ft. 1 in. wide over the side sheathing. They have high back upholstered seats in the passenger compartment and rattan covered seats in the smoking compartment. The seating capacity is 58 persons. The cars are

SUB-STATION, WAITING ROOM, CAR BARN AND SHOPS OF SYRACUSE & SOUTH BAY RAILWAY CO.

very handsomely finished and completely equipped. There are four 70-h. p. motors to each car and a speed of 45 miles an hour is possible. The trail cars have a seating capacity of 60 persons. All cars are mounted on Peckham trucks.

Power for the operation of the railroad is leased from the Syracuse Lighting Co., which has a large plant in the city of Syracuse. The railroad company's transforming sub-station, car barn and shops, ticket office and waiting room and employes' club rooms are located at North Syracuse. The car barn and shop building is 75 x 271 ft. in size and is constructed of brick. The sub-station is also built of brick and is 38 x 77 ft. in size. The sub-station equipment consists of three 300-kw. rotary transformers, three 333-kw. lowering transformers and the necessary switchboard apparatus. The entire electrical equipment was furnished by the General Electric Co.

While the summer excursion business will be a very large one, the Bay road will be operated the year around, and the freight business will be heavy. The handling of stone, lumber, coal, ice, milk and agricultural produce will make up a large part of it, while the several million dollars' worth of engineering and construction work to be done at either end of the lake in connection with the Barge canal will cause an immediate impetus to the shipping interests of the locality of which the allied enterprises described in this article control an important part.

W. R. Kimball, formerly general manager of the Syracuse Rapid Transit Co., and Lieutenant-Governor William M. Brown, of Pennsylvania, are interested in the syndicate which is developing the resources of this region. The officers of the Syracuse & South Bay Railway Co. are: President, George B. Chapman; vice-president, W. B. Burns; secretary, W. R. Kimball; treasurer, Frank L. Barnes; general manager and chief engineer, George C. Towle. The general offices of the company are at 305 Gridley Building, Syracuse.

We are indebted to Mr. T. D. MacGregor, advertising manager of the Bay Road Construction Co., for the data and photographs from which this article was prepared.

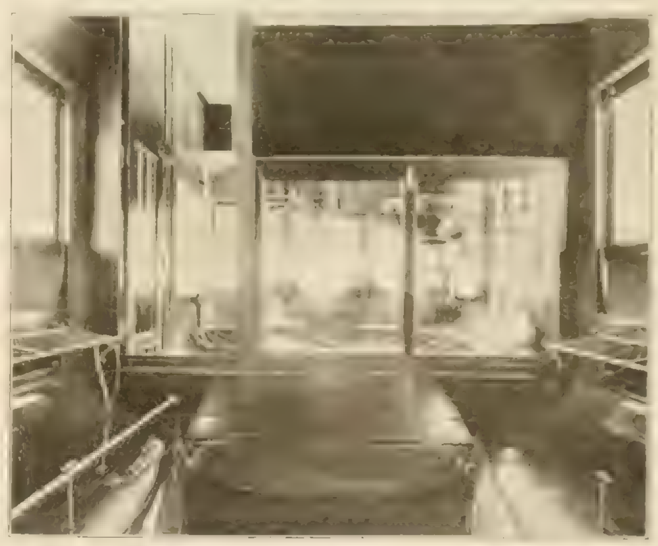
The Electric Express Co., operating over the interurban lines of the Allen-Porter Syndicate, has announced that it will begin service between Alton and St. Louis in the near future.

New Cars for Cleveland & Southwestern Traction Co.

[illegible] the J. A. Hanna Co., Cleveland, O., the well known agents for [illegible]

[illegible]

over buffers and has an extreme width of 8 ft. 6 in. It is composed of three compartments, a combined baggage-vestibule placed at the forward end, having a 40-in. baggage door at each side, but without passenger entrance. The motorman is separated from baggage compartment by heavy iron railings extending from the floor to the deck sills, the hot water heater being at the left-hand side, and is cared for by the motorman. Next to the baggage vestibule is a smoking compartment occupying the space of four side



[illegible]

windows, the door between the smoker and baggage compartments being at the right-hand side with long seats against the bulkhead. The main passenger compartment is 22 ft. 8⅝ in. in length, with a toilet room in the rear left-hand corner next to the rear door. The rear vestibule has a passenger entrance with double steps at each side. There are no double doors whatever on the car, there being a single sliding door for entrance at the rear end of car and single

[illegible] side of rear vestibule, with swinging doors between each compartment. The center sills are of 6-in. steel I-beams and the side sills are double, having heavy steel plates between, the intermediate sills being of 6 x 3¾-in. yellow pine. All sills extend from the rear end sill under the front vestibule to the front buffer, the rear platform being dropped 6 in. below car floor. The interior finish and furnishings are particularly rich and handsome, polished American plate glass being used exclusively except for the deck sash and upper side windows, which are cathe- [illegible] mahogany, having smooth plain panels without raised work, so as to not collect dirt and dust and which are easily cleaned, the main panels being outlined with neat inlay of colored woods. The ceiling is full empire style decorated in green and gold and fitted with holophane globes, each containing four electric lamps. The seats are of the Hale & Kilburn

NEW CAR, CLEVELAND & SOUTHWESTERN TRACTION CO.

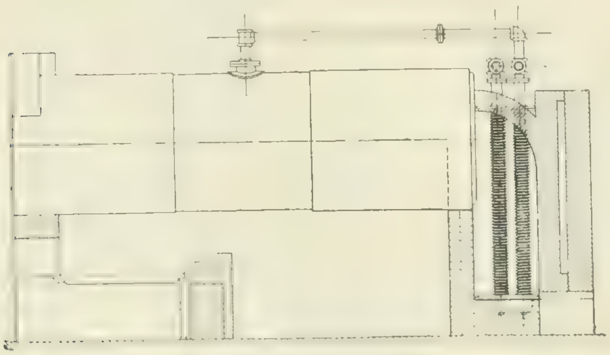
No. 3-C type, with stationary backs of the high head roll type and with mahogany seat arms along the aisle. This car being intended to run with the same end forward at all times, it is not considered advisable to have the backs reversible.

This car is particularly adaptable to all conditions of through interurban service, containing the equivalent of a steam railroad train, having baggage, smoking and passenger compartments, and is as comfortable and luxurious in its furnishings and finish as the best steam railroad coaches. It is mounted on M. C. B. trucks, fitted with four 75-h. p. motors, 37-in. steel wheels and 6-in axles.

The Niles works are now filled with cars similar to this, ordered from several different interurban railways, this style of car being the specialty of the Niles Car & Manufacturing Co. and to which it has devoted long and thorough study.

The Foster Superheater.

As the use of superheaters in railway power stations becomes more general in the railway field, knowledge of the construction details and meritorious operation points of the various superheater types is welcomed by station operators. Elsewhere in this issue

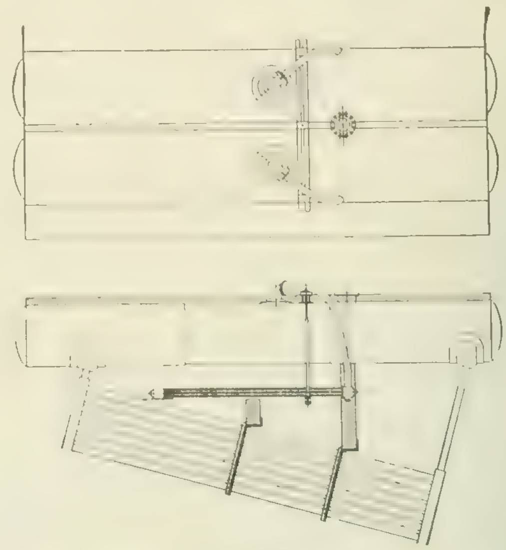


FOSTER SUPERHEATER INSTALLED WITH HORIZONTAL RETURN TUBULAR BOILER.

appears an extended discussion of the value and methods of construction of several American and European makes of this auxiliary apparatus. One of the types of American-built superheater, which is being used quite extensively in many of the more recently designed power plants, is a product of the Power Specialty Co., 111 Broadway, New York City, and is known as the Foster superheater.

The design of the tubes or elements which comprise the superheater is illustrated, as are also shown line drawings illustrating two methods of arrangement of the elements with respect to the several passes of the flue gases.

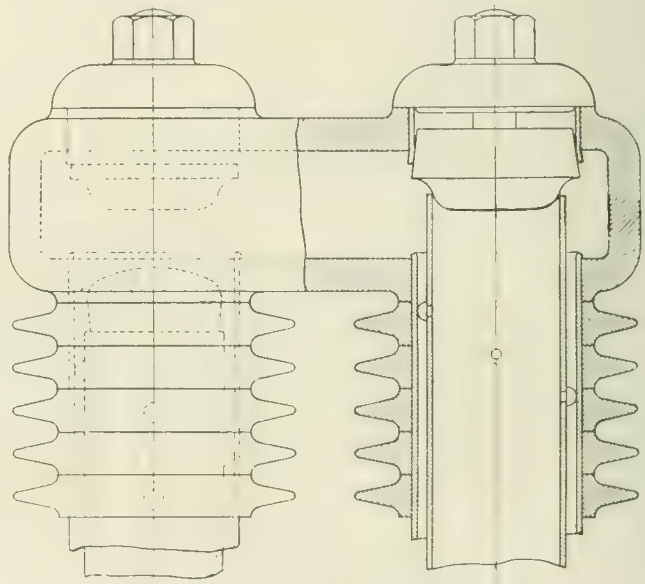
The superheater tubes or elements are composed of seamless drawn steel tubing. Outside of the elements are snugly fitted a series of annular gill flanges, placed close to each other and forming an exterior cover of cast iron. This covering not only protects the tubes against the action of the heated gases, but provides a mass of metal which acts as a reservoir for the fluctuating heat of the flue gases and tends to convey heat to the steam in a steady manner.



FOSTER SUPERHEATER INSTALLED ABOVE WATER TUBES.

This prevents fluctuation in the degree of superheat, due to corresponding fluctuations in the gases from the furnace.

The full sectional area of an element in this design of superheater is not open to the steam, but has supported concentrically with the outer shell a tube with such a diameter that an annular space of about one-quarter of an inch is left for containing the steam. This construction compels the steam to stay close to the interior heating surface, which results in a high degree of efficiency in heat transmission. The small amount of steam contained in such a super-



DETAIL OF RETURN HEADER

heater adds to the element of safety and confines the effect of overheating during a pause in the flow to such a small amount as will readily be absorbed by the cold pipes and connections beyond, whenever the flow is resumed.

Such a detail of operation is particularly desirable when the generators are operating with a fluctuating load, because when the load suddenly falls off and the engine takes less steam from the boiler, the flow through the superheater is retarded, thus allowing

the steam in the elements to receive somewhat more than the average heat. During this time of light load the steam pipes and connections, which have been kept at the high temperature by the passage of superheated steam, tend to cool down. When the heavy load is again taken on and steam is drawn from the boiler, this steam which has more than the usual degree of superheat will pass into the pipes, but the amount of steam is so small that the

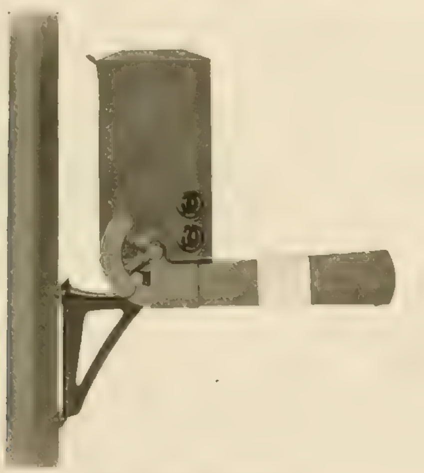
VIEW SHOWING INNER TUBE AND ANNULAR STEAM SPACE.

additional heat which it contains will hardly be more than enough to balance the loss in temperature of the pipes, which have cooled down during the period of light load. The marked advantage of the small steam containing capacity and the heat storing capacity of the cast iron covering thus show their value in furnishing an even degree of superheat.

The Blake Signal.

The dispatcher's selective semaphore signals, as now manufactured by the Blake Signal & Manufacturing Co., Boston, Mass., and which were described in the "Street Railway Review" for July 20, 1904, have been improved along the following lines:

For the dispatchers office equipment, instead of using a constant-speed motor driving a shaft on which different toothead discs were placed which opened and closed the circuit and sent impulses over the line for actuating the various signals, a desk-like box containing 15 pendulums of different lengths is now used, as shown in



SIGNAL BOX AND ARM.

the accompanying illustration. Each of these pendulums corresponds in length to a pendulum in one of the line signals, and is latched back out of the perpendicular position. For instance, when the dispatcher wishes to set signal No. 9 he inserts a plug similar to a telephone plug, in hole No. 9. This releases pendulum No. 9, and also connects the line with the 500-volt current which is brought to the dispatcher's desk. As the pendulum swings it opens and closes the signal line circuit, sending impulses over the line, synchronous with its vibration. These impulses act upon the electro-magnets and through them upon the pendulums of all the signals, which are in series, upon the single line wire. But the impulses are only synchronous with, and therefore cumulative in their effect upon, the pendulum of No. 9 signal, which has a pendulum of just the same length as the No. 9 pendulum in the dispatcher's office.

At the end of 13 seconds this line signal pendulum swings through an arc wide enough to trip a lock and drop the semaphore arm. When the semaphore arm has reached the horizontal position it closes the local signal lamp circuit, and also closes a circuit to ground which causes the relay on the dispatcher's desk to draw up and give him an indication that the signal has been set. The question of varying [illegible] on the dispatcher's desk which cut in and out resistance automatically as the [illegible] patcher's office [illegible] the constant-speed motor is obvious, since it is positive, and the signal desired [illegible]

The line signals are practically the same as first described, each containing an electro magnet and [illegible] signal differs in length from those in the other signals and corresponds in length to one of the pendulums in the dispatcher's office. There [illegible] signals; such as using a simple form of universal joint between the signal base and bracket, which permits the signal to be readily levelled for varying angles of set or other irregularities in trolley line poles. Also the electro magnet coils have been electrically strengthened to a break-down test of over 10,000-volts pressure, and a simple form of lightning arrester added so that troubles from lighting, so far as the signal mechanism is concerned, have been practically eliminated. These changes and improvements have increased the reliability of the signals, which had already proved unusually efficient and trustworthy in constant and active service. They have also reduced the already small cost of maintenance.

The following points are recommended as worthy of the notice of signal and operating railway men:

When properly set up and adjusted, it is physically impossible for any other signal than the one desired to operate.

There is a positive indication to the dispatcher showing that the semaphore arm has been set in the horizontal position, and that until the arm has reached an angle of about 45°, it is a physical

DISPATCHER'S [illegible]

impossibility for him to get this indication, and the danger of a false indication is eliminated.

The power for operating the signal is obtained entirely through the dispatcher's office, and there is no local circuit at each signal other than the signal lamp circuit.

There are no electrical contacts in series with the operating magnets at the various signals. The signal line is electrically continuous throughout, from the dispatcher's office to the return circuit at the end of the line.

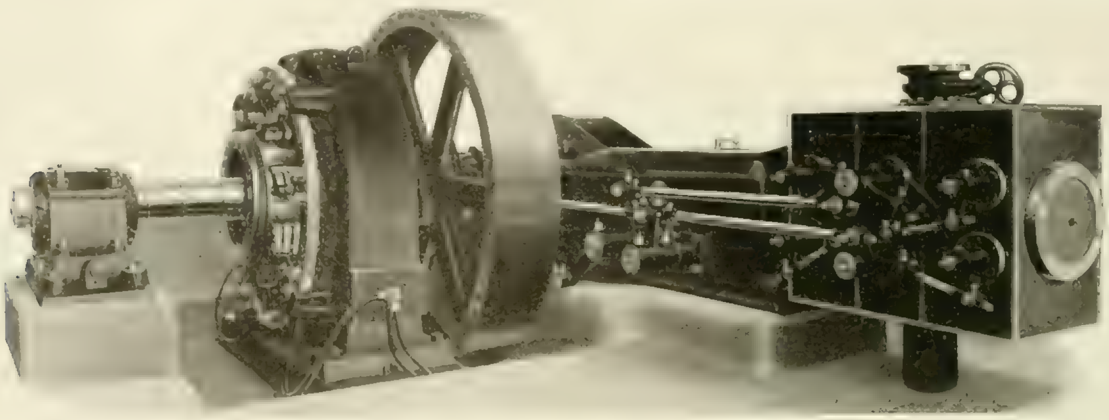
If one signal lamp burns out, a second lamp is automatically cut in circuit. This second lamp is an interrupted circuit and gives a flashing light, so that any crew can report same and a new lamp can be put in the following day. This detail removes the necessity of having a daily inspection of all lamps, as well as danger from a new lamp being defective and burning out a very short while after it has been put in.

The widely varying voltage of trolley lines is taken care of by relays which draw up at different voltages, and cut in or out resistances as the voltage which is supplied at the dispatcher's office rises or falls. Pressure variations between 300 and 700 volts are provided for.

A Recent Type of Corliss Valve Engine.

In the larger sizes of the engines built by the Ball Engine Co., Erie, Pa., the corliss valves and the essential details which have made such engines so successful are embodied in the detail design. Improvements in design have also increased the speed limitation. The corliss engine uses unbalanced valves, which take up their own wear, remaining tight for long periods. Thus they are a valuable aid to economy in engines of more than 200 or 300 h. p., because of the leakage in balanced valves of large size.

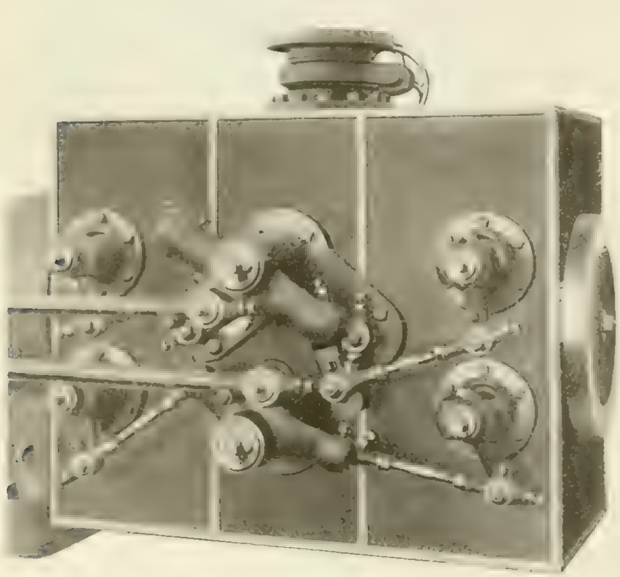
Balanced valves can be made practically tight, but their tendency to leak increases with their size, limiting them to quite moderate power. As a rule unbalanced valves under considerable pressure move hard and wear rapidly.



HORIZONTAL SINGLE CYLINDER SIDE CRANK ENGINE.

In the corliss type the valves are allowed to stand still during the unbalanced period. In the Ball engine this feature is retained by the use of the Armstrong non-detaching valve gear, which gives the valves a positive movement, practically identical with that accomplished by the customary type of detaching gear and its dash pots, the admission valves remaining absolutely motionless at least half of the time. At usual loads they have their highest speed at the instants of opening and closing.

The movement of the valves while rapid is exceedingly smooth and easy for engines of this class. The valve gear and Ball engine are shown in the accompanying illustrations. The builder describes the details of the valve and engine as follows:



DETAIL OF VALVE OPERATING MECHANISM

The movement of the valve commences with a smooth and easy motion, reaching its highest speed at the moments of opening and closing. It begins its opening in the middle of the valve gear travel, when all parts of the gear, from the wrist plate to the eccentric, are at their highest speed, and consequently have the greatest leverage over the valve at the only time that it moves at all hard. The strain on the gear, from the wrist plate to the eccentric, is by this means greatly reduced, and also comes in the middle of the movement so there is no reverse stress. These are features of much importance.

In most shaft-governed engines of this general type, the valves are moved all the time, except when carrying very late cut-offs, and the full strain of moving them while unbalanced is taken up each time the eccentric passes its centers. The tendency to pound, which this condition produces, is entirely removed in our design, because the stress upon the valve motion is not only reduced many times, but it comes in the middle of the stroke when all slack has been taken up, and so does not produce a pound. The resulting smooth action is a very remarkable as well as gratifying feature of this gear.

Its noiselessness does not depend upon closely adjusted bearings. It can be very loose in every joint and still run quietly. This smoothness of action also tends to reduce wear upon the bearings of the gear.

Cylinders of 22-in. bore and larger are built with the valves in the heads, thus securing very large port openings with minimum clearance space. Cylinders of less diameter than this have the valve seats cast integral with them, as in the usual type of corliss cylinder. As these small cylinders usually are longer in proportion to their diameter than the larger ones, this keeps the clearance sufficiently low to permit this construction.

The admission valves are triple ported, permitting a very quick opening and closure without too rapid a movement of the valve. Also, the multiported construction gives much more uniform pressures on the valve seat while opening, and does not tend to wear off the edges of the port and valve as occurs where a single port is used. This in turn helps to maintain tightness, in fact, these valves show little tendency to wear in such a way as to make them leaky, and the total wear is almost negligible. The exhaust valves are double ported, but differ slightly from the usual corliss design in that they close off the ports on both sides of the valve and so reduce the clearance space. This also prevents the noise that occurs in corliss engines, particularly of the compound type, when the engine is running lightly loaded and the steam expands below the exhaust pressure, thereby causing the valve to lift.

All corliss type of Ball engines are supplied with relief valves built into the cylinders, in such a way as not to affect the clearance. These valves are of unusually large size and afford ample protection.

These engines, both of the single valve and corliss types, are built either vertical or horizontal, simple or compound. Single valve engines are built by the Ball Engine Co., in sizes from 50 to 700 h. p., and corliss engines from 200 to 1,200 h. p.

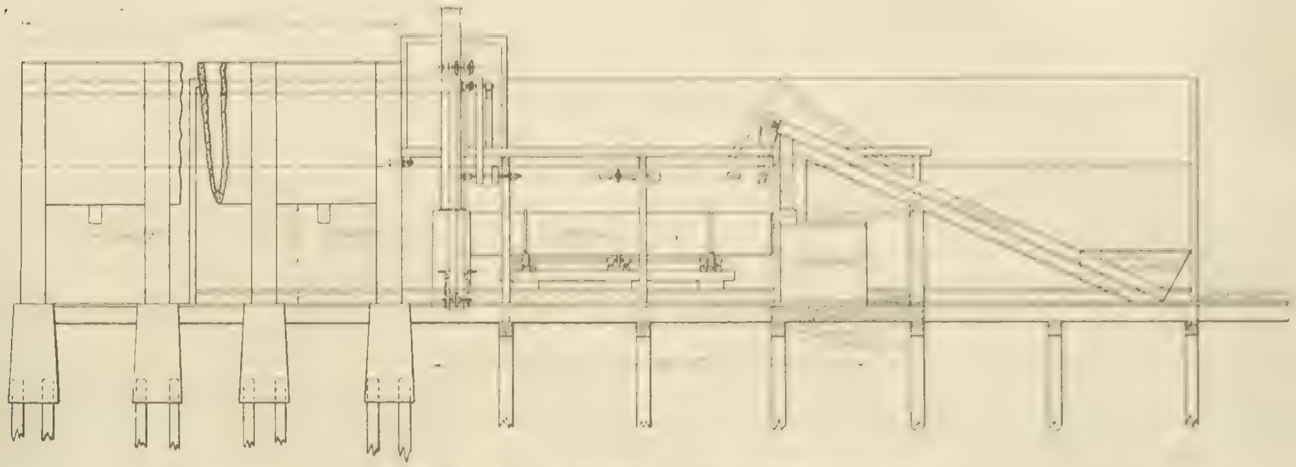
The postoffice department has arranged for an electric car mail service between Minneapolis, St. Paul and Ft. Snelling. There will be two deliveries daily from Minneapolis.

All the tramways of Cordoba, Argentina, have been purchased by a syndicate and are to be electrified. Other concessions have been asked for the construction of additional lines to the suburbs.

A Modern Sand Drying Plant.

A modern sand drying plant for the Public Service Corporation of New Jersey is shown in the accompanying illustration. The equipment was furnished by the American Process Co., New York City.

The sand for drying is brought to the dock by lighters and is unloaded into the storage bin by a derrick. A screw conveyor then



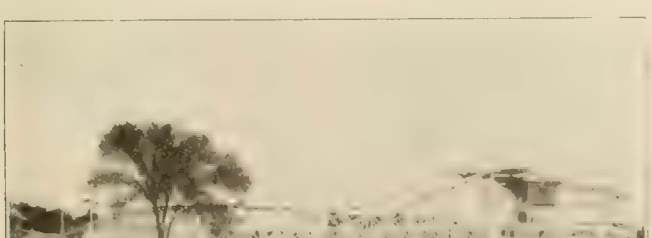
ELEVATION OF SAND DRIER FOR PUBLIC SERVICE CORPORATION.

elevates the sand to the upper end of a drier of the direct heat rotary blast type. This drier consists of a cylindrical steel shell on the interior of which are fastened narrow longitudinal shelves, the cylinder and its contents being rotated slowly by means of gearing or chain belting. The drier cylinder is placed in a slightly inclined position, the wet material and furnace gases entering the shell at the highest end. As the wet sand falls to the bottom of the drier, it is caught on the shelves, carried around to almost the highest point of rotation and is then showered through the furnace gases. The direction of the draft is toward the lower end of the drier and the sand is gradually worked forward until it is discharged from the lower end in a dried condition. The sand and furnace gases thus travel in the same direction, the wettest material and highest temperature being in contact, a condition essential to high fuel economy.

At the discharge end of the drier the sand is delivered to a bucket conveyor which carries it to the top of a concrete storage bin, where a cross-screw conveyor delivers the sand to any part of the bin desired. From this storage bin, two chutes placed at either end of the bin deliver the sand to the supply car.

The Roller Coaster.

A prominent feature of nearly every amusement park in the country is the "Figure-Eight" or "Roller-Coaster," which has stood



A BOYCE FIGURE EIGHT ROLLER COASTER.

the test of time and still proves one of the best money makers among the attractions of such resorts. The accompanying illustration shows a very complete coaster of this type which Edward C. Boyce, 302 Broadway, New York City, is installing in the parks which he designs and equips.

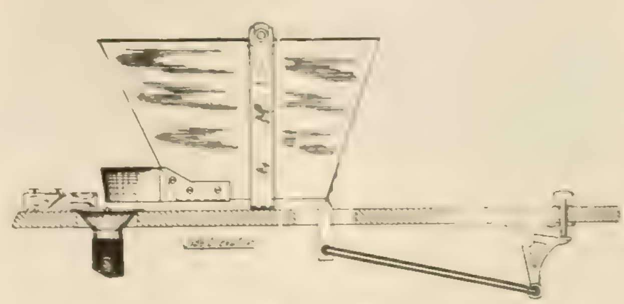
The roller coaster is too [illegible] description here, and the illustration presents this particular type very clearly. The sensations which are afforded by a roller coaster trip are exhilarating without producing any severe or harmful shocks to the passenger. The smooth, rapid movement and the sudden downward and upward swoops are enjoyable alike to the old and young, as is attested by the crowds which throng about the ticket windows.

As a ten-cent attraction the roller coaster has no equal in popularity and earning power. It can be installed at a comparatively slight expense, after which the cost of maintenance and operation is nominal. The only power necessary is that required to lift the cars to the top of the structure, which can be furnished by an electric motor taking its current from some convenient railway line, or by a steam or gas engine.

But few attendants are necessary, depending upon the size of the crowds handled. A satisfactory roller-coaster can be made in any size and can be planned to suit any shape or condition of ground. Once erected, but little attention is required to keep such amusement devices in shape to return substantial earnings.

A New Sand Box.

The Ham Sand Box Co., Troy, N. Y., has placed upon the market a new sand-box which is shown in the accompanying illustration. For this box the manufacturers claim several distinct advantages. The box, instead of being fastened in a fixed position, is suspended and operated by a lever placed beneath the floor of the car. In operation the forward motion is suddenly arrested, thereby forcing the sand from the box. Any condition of sand, either wet or dry, may be used and it cannot become packed so hard that it will not be broken up and forced from the box. This does away with the



HAM SAND BOX.

expense of kiln-drying the sand. Another economical advantage claimed is that there is no necessity to overhaul the sanders every year in order to get them ready for fall and winter use.

New Equipment for Pittsburg Railways Co.

The Pittsburg Railways Co. is now adding 100 new cars to its rolling stock. The new cars are of the full vestibuled type similar to the one shown in the illustration. This new equipment is being built by the St. Louis Car Co., which company has already delivered a portion of the order.

The cars are designed for city service and have dimensions as follows:

Length over body, 30 ft. 8 in.; length over all, 44 ft. 6 in.; width over all, 7 ft. 10 in.; height from underside of sill to top of roof, 8 ft. 6 in.; track gage, 5 ft. 2½ in.; truck center, 18 ft. 6 in.

The side sills are made of yellow pine 5 x 8 in., reinforced with a steel angle 4 x 6 in. the entire length from end sill to end sills; center sills are of yellow pine 4 x 6¾ in. extending from end sill to end sill and securely bolted to end sills by heavy steel angles; end sills are of oak 4½ x 10 in. reinforced by a steel plate placed on the outside of the end sill ⅝ in. thick by 10 in. wide. The platforms are supported by two oak sills plated with steel plates ½ in. thick by 8 in. wide, securely bolted; the center of platform is supported by two angles 4 x 4 x ½ in. extending from crown to end sills, then bent up and continued along the center sills through the body bolsters. The bolsters are constructed of steel plates, trussed type, 9 in. wide.

NEW CITY CAR FOR PITTSBURG RAILWAYS CO.

INTERIOR PITTSBURG RAILWAYS CO. CAR

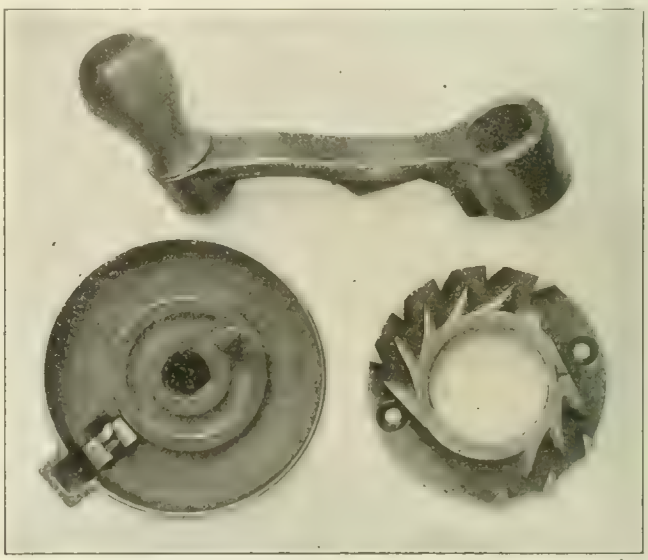
The side windows are arranged to drop. There are vestibules at each end with three drop sash in ends and folding doors on each side hung on pin hinges, made removable so that folding gates can be used during summer months. The St. Louis Car Co's. type of illuminated signs are placed above the center vestibule window. The interior finish of these cars is of cherry, natural color. The seats and backs are placed longitudinally and are covered with green plush. Cars are equipped with radiating draw bars, Pittsburg Railway Co's. standard enameled signs, St. Louis Car. Co.'s. sand boxes and arranged for double trucks with 4-ft. wheel base and two motors per car.

The Durkin Controller Handle.

The desirability of placing a positive check on careless motormen in feeding current, so as to get the best results with the greatest economy of power and the least wear on motors, wheels and tracks has received much attention from both manufacturers and electric railway managers. The Durkin controller handle, which is manufactured by the Durkin Controller Handle Co., Arcade Building, Philadelphia, has been placed upon the market with a view to securing these desired results. The simplicity of the mechanism of this handle is of especial interest because it reduces the first cost of adopting the device and has to do with its economical maintenance and its efficiency.

DURKIN CONTROLLER HANDLE MOUNTED ON CONTROLLER

To mount the Durkin handle no change is required in the controller, it being necessary only to drill two holes in the top of the controller dial, bolt on the rack and slip on the handle. Under the cover is suspended a dog. The projecting teeth on the rack throw the dog out against the stops, compelling a slight pause at each; then the dog follows and passes freely to the next stop, making it impossible to skip a notch, but at the same time not interfering with the shut-off movement. The operation of this mechanism in the shut-off is different in so far that the clog folds up out of the way and passes over the teeth without engaging them. The advan-



DURKIN CONTROLLER HANDLE AND RACK

tages claimed for this handle are [illegible] positive gradual feed with [illegible] ing of current, varying from 70 to 40 per cent [illegible] quicker control in reversing; and a longer life to equipment.

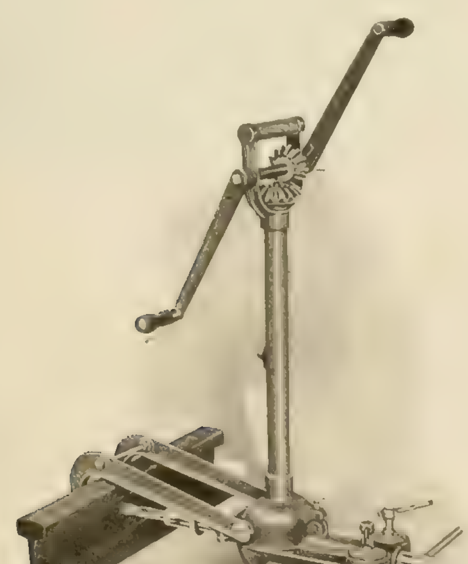
Chicago & Milwaukee Electric Railroad Extension.

On December 2nd the Chicago & Milwaukee Railroad Co. completed, and established service on the extension of its main line north from Waukegan, Ill., to Kenosha, Wis., thus making it possible to travel from Chicago to Milwaukee by electric cars. An hourly service has since been established in each direction between Evanston and Kenosha. The rate of fare of the electric lines from Chicago to Milwauke is $1.25, contrasted with $2.50 charged by competing steam roads.

In connection with the opening of this line, the officers and directors of the Chicago & Milwaukee Electric Railroad Co. entertained a large number of guests who left Evanston in a special train at 11:15 a. m. Other guests boarded the train at various points along the line and the party was taken to Kenosha, where a luncheon was served at 1:30 o'clock. The Chicago & Milwaukee R. R. is double-tracked over its entire length, running on a private right of way 100 ft. wide and using 80-lb. T-rails, and is of the highest type of interurban railway structure.

The Cyclone Track Drill.

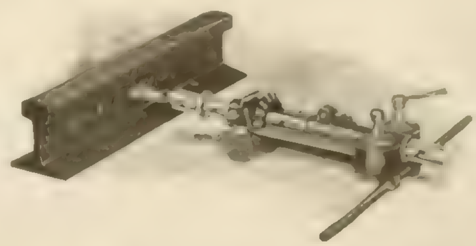
The accompanying illustrations show a track drill, that possesses several features entirely new in track drill design. It is made of malleable iron and steel, and is very compact, light and strong. The parts are simple and few in number. The drill mechanism proper, including all working parts, is enclosed in a malleable iron case. By releasing a single thumb set screw, the upper portion can be instantly lifted from the lower, to allow the passage of cars, while the drill proper is left undisturbed in its operating



CYCLONE TRACK DRILL APPLIED TO RAIL

position. The upper portion of the driving mechanism can be replaced quickly and easily. The driving mechanism is on the worm principle, arranged to give a friction feed in direct proportion to the cutting power of the drill. The drill shaft may be slipped in its bearings so that the drill point can be set or retracted instantly. The economy of these several features is at once apparent. The drill, which is designed for all kinds of track work, and is especially useful in rail bonding, is placed on the market by Porter & Berg, Chicago, Ill.

The feature of the friction-feed is, perhaps, deserving of the [illegible] brass cut gears, set in malleable iron cups, which may be noticed in the illustration. These gears rest between fibre discs that pos- [illegible] hand-set screw seated upon an iron washer, these fibre discs are [illegible]



[illegible]

nuts through which the drill shaft is fed. When the drill is in operation, the brass gears will revolve or remain perfectly stationary, according to the amount of friction exerted between the brass gears and the fibre discs by the compression screws. If the resistance met with at the drill point is great, the brass gears will revolve, thus diminishing the number of revolutions of the drill shaft or the speed of the drill; if the resistance grows less, they become more stationary and the speed of the drill increases. It is thus seen that the drill feeds in direct proportion to its cutting power. In other words, the feed of this drill can be set at any desired speed, and once set it becomes automatically self-adjusting to meet various conditions encountered, such as hard or soft spots in the rail, and differently tempered drill points. The operator with a little practice becomes efficient in kicking the compression screws into proper adjustment. This not only saves much time, but is a great convenience. By throwing the pressure entirely off the brass gears, they revolve freely with the drill shaft, which may be slipped in its bearings without effort. This feature enables the operator to set or retract the drill point quickly. These several features highly recommend this drill for convenience and economy.

Blading of the Allis-Chalmers Steam Turbine.

A distinguishing feature of the Allis-Chalmers steam turbine is its blading, which, while it is of the Parsons reaction type as regards the principle of operation, differs in mechanical construction in a number of essential details.

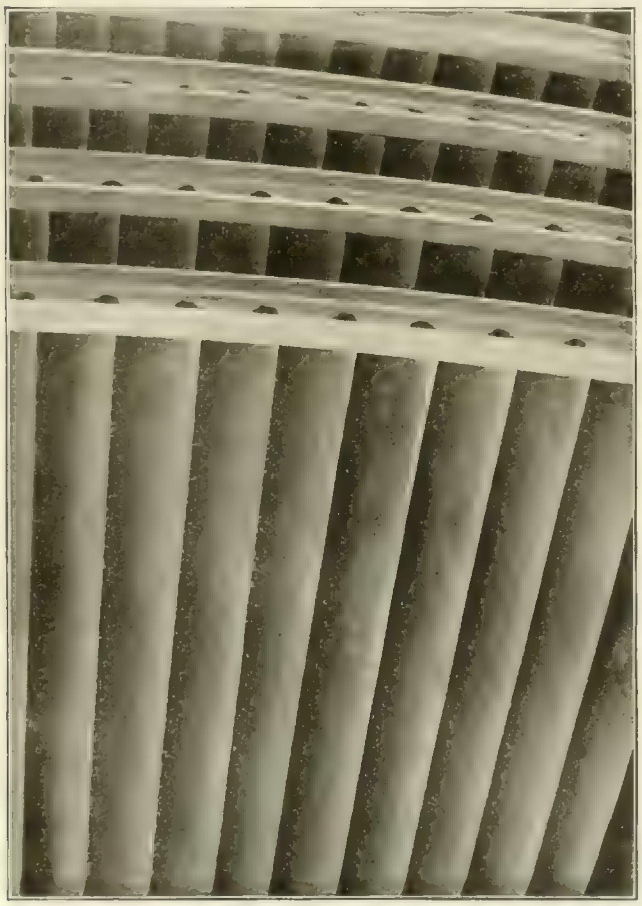
The roots of the blades are formed in dovetail shape by special machinery, and are inserted in slots cut in foundation or base rings; these slots being formed by special machine tools in such a way as to exactly conform to the shapes of the blade roots. The foundation rings themselves are of dovetail shape in cross section and are inserted in dovetailed grooves cut in the turbine cylinder and spindle respectively, in which they are firmly held by key pieces. In order to further ensure the integrity of the construction, the key pieces or rings after being driven into place are upset into undercut grooves.

Another noticeable feature of the blading is the method of reinforcing and protecting the tips of the blades, shown in the illustration. This point in steam turbine design is one upon which much thought has been expended by various inventors, and the Allis-Chalmers company claims that the construction employed by it successfully solves all difficulties. In forming the blades a shouldered projection is left at the tip. This is inserted in a slot punched in a shroud ring; the slots being punched by special machinery in such a way as to produce accurate spacing and at the same time form the slots so that they will give the proper angles to the blades independent of the slots in the base ring. After the blade tips are inserted in the slots in the shroud rings they are riveted over by specially arranged pneumatic machinery.

The shroud rings are made in channel shape, with outwardly

[illegible], after being assembled, are turned and bored to give the necessary working clearance. The flanges of the channels are made so thin that, although amply sufficient for stiffness, the shroud ring does not have the disadvantage of a solid shroud which acquires a dangerous temperature by friction in case of an accidental contact of the rotating and stationary parts. It is claimed for this construction that the blades are stiffened against the effect of vibration in a much more substantial manner than by any other means thus far employed, while the use of a protecting shroud ring enables the working clearance to be made smaller than in the case of naked blade tips, without danger in case of accidental contact, thus reducing the leakage loss to a minimum; the leakage past the blade tips being the principal source of loss in the steam [illegible]. As to the safety from damage in case of accidental contact, it is claimed that this has been proven by experiment with actual blading, by throwing the bearings out of center so as to produce contact, without detrimental results. An incidental advantage claimed for this construction is that if by chance a blade should prove defective, it is so held in place by the shroud ring that it cannot possibly work loose and produce damage.

By the method of construction described, the entire blading is produced by machinery, thus eliminating the personal equation which enters into blading done by hand work, which depends upon the skill of the individual workmen. Besides ensuring that every blade is securely fastened, all blades are necessarily set at exactly



BLADING OF ALLIS-CHALMERS TURBINE.

the designed angle and pitch; the openings between blades, upon which in great part the economical performance depends, being absolutely uniform. The blading is made up in half rings in the blading shop and is carefully inspected before being inserted in the turbine.

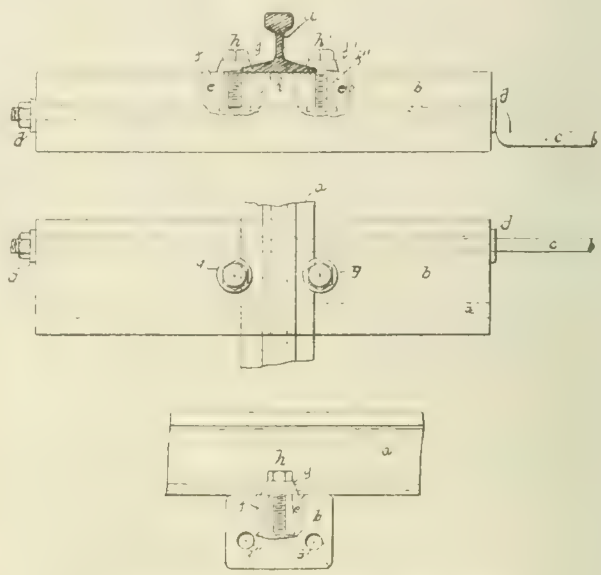
The city of Winnipeg, Canada, and the Winnipeg Electric Railway Co., are discussing a proposed agreement for operating Sunday cars. The Board of Control has decided that a clause in the agreement between the city and the railway, protecting motormen and conductors against being obliged to work seven days a week, must be approved by the company.

A Vitrified Clay Tie.

A new railway tie has been designed by Vernon Bradfield, of Mecca, Ind., sketches and a description of which are herewith presented. In view of the increasing experimentation with, and the use of metal or reinforced concrete ties as substitutes for wooden ties, it is believed that this new tie will be especially interesting to street railway men. Mr. Bradfield invites the opinions and comments of railway men on this new device.

The proposed tie is to be made of vitrified clay or shale, in two pieces, connected with a bent rod, c. At d is a common wrought iron washer under which a washer of rubber (not shown) can be placed to hermetically seal the hole i, to keep the rod from rusting.

The blocks b can be made of any size, but preferably should be 30 in. in length, 8 in. wide and 6½ in. thick. The two holes ii″ run longitudinally through the block to receive the rod c and to balance



PLAN, SECTION AND ELEVATION OF RAIL AND TIE.

the clay on coming through the machine in drying and in burning. The recesses ee″ in the top of the block are to receive the steel bolts hh″. At gg″ are slightly beveled cast washers, which enable good contact to be made with rail a. After the cones ff″ are placed in the proper position, lead, sulphur or some like substance is poured into ee″ to fill the remaining voids. A small strip of lead can be put under the rail at k for cushioning.

In the event of the rail wearing out, necessitating its being replaced, all that would have to be done would be to remove the bolt and washer on one side of the rail; the old rail being replaced by the new one without removing or disturbing either part of the tie.

Mr. Bradfield states that this tie can be made and delivered for very little more than 65 cents each. If no valid objection can be raised for the manufacture of such a tie, or no hitherto-unconsidered defect can be found in its use, there is little doubt but that a vitrified clay tie of this character would so surpass the oak tie in its quality and durability that a ready market would be found immediately.

Program of British Association.

The Tramways and Light Railways Association of Great Britain has prepared a course of lectures for the coming season, as well as visits to various power stations. The program is as follows: November, lecture "On Paving of Roadways;" visit to Holborn and Strand subway, and inspection of all-steel car. December, lecture on a technical subject; visit to Lot's-road power station. January, lecture "On Brakes," by A. L. C. Fell, chief officer, London County Council Tramways; visit to Baker-Street & Waterloo railway. February, visit to Neasden power station. March, lecture "On the Up-keep of Tramway Electric Motors," by S. Sudworth; visit to Great Northern, Piccadilly & Brompton railway. April, lecture on "All-Steel Cars." May, lecture "On the Thermit System of Welding," by Dr. Goldschmidt.

Westinghouse Managers' Meeting.

The annual convention of the district managers of the Westinghouse Electric & Manufacturing Co. was held November 13th to 16th, at the general offices of the company at East Pittsburg. Mr. R. L. Warner, New England, manager of the company, acted as chairman of the meetings, which were attended by the following representatives of the company:

C. S. Powell, general agent, W. F. Zimmerman, representative, Maurice Coster, manager export department, W. C. Webster, assistant to second vice-president, F. H. Shepard, New York City; G. Pantaleoni, general southwestern manager, St. Louis, Mo.; J. R. Gordon, Atlanta; H. H. Seabrook, Baltimore; D. F. Manson, Boston; C. W. Underwood, Buffalo; T. P. Gaylord, Chicago; C. W. Regester, Cincinnati; G. B. Dusinberre, Cleveland; J. F. Johnson, Dallas; L. M. Cargo, Denver; C. F. Medbury, Detroit; T. J. McGill, Minneapolis; C. A. Bragg, Philadelphia; W. F. Fowler, Pittsburg; D. E. Webster, St. Louis; W. W. Briggs, San Francisco; M. P. Randolph, Seattle, and Paul T. Brady, Syracuse.

At the opening session, which was held Monday morning, addresses were delivered by Mr. E. M. Herr, first vice-president of the company, by Mr. Frank H. Taylor, second vice-president, and by other officials. During the four days of the convention papers on topics of general interest were read by many of the officials and managers and by representatives of allied companies.

On Wednesday evening the delegates and representatives of the local Westinghouse companies were entertained at the Hotel Schenley by Mr. E. M. Herr.

At no time in the history of the company have the managers spoken with more enthusiasm of the business conditions in their respective territories. The accompanying illustration is a reproduction of a photograph of those in attendance at the meeting.

WESTINGHOUSE OFFICERS AND DISTRICT MANAGERS IN ATTENDANCE AT THE ANNUAL CONVENTION

Scientific Bearing Metals.

The efficiency of a bearing metal lies mainly in the degree of molecular tension possessed by its constituent parts, this latter quality depending upon the molecular affinity. Scientific experiment has reduced the cost of many of the rarer metals and chemicals, which are of great value in increasing the affinity of the molecules of certain metals for those of certain other metals. The Advance Manufacturing Co., of Kalamazoo, Mich., has been conducting such experiments and [illegible] metals, short descriptions of which follow:

White Giant Bronze, a very fluid metal, with a crushing resistance of 74,000 lbs. per sq. in., and an anti-friction quality (the degree of angle at which friction is overcome by gravity) of 76½ degrees, especially adapting it to conditions of extreme wear, vibration and pounding. It is especially [illegible] journal work.

Alumanese, a semi-bronze, possessing high anti-friction qualities and extreme molecular tension, which recommend it to conditions where toughness and wear are essential. These qualities especially adapt it to armatures, street railway and engine work.

[illegible] Babbitt Nos. 240, 180, 120 and 80, of a descending scale of price and efficiency. For these the manufacturers claim an equal efficiency and durability with the standard Copper Genuine Babbitt at a lower price.

The Advance Manufacturing Co. is also introducing a new boiler metal known as "Metallic Dissolvo," which, it is said, possesses the peculiar property of being solvent in hot water. It is used to prevent the formation of scale or incrustation of any kind in a boiler, no matter what salts or impurities the water may contain.

The "Dissolvo" is said to be twice as cheap as chemical compounds, one lb. per week being required for a 100-h. p. boiler, running 24 hours per day.

Trolley Supply Co.

The Trolley Supply Co., Canton, O., manufacturer of the well-known Knutson trolley retrievers and trolley supplies, has very recently purchased from the Globe Electrical Manufacturing Co., Cleveland, O., the right to manufacture and sell the Globe arc headlight, hood and dash headlights, the "Climax" arc and incandescent headlights, Multiplex reflectors, etc.

These products have been successfully used throughout the United States during the past several years and are well-known as standard articles of established value. The Trolley Supply Co. is well-known in the electric railway field and the addition of these products will add materially to its present line of trolley supplies. The company will give most careful attention to the manufacture of these headlights and reflectors and will handle them in connection with its Knutson trolley retrievers and American trolley catchers.

Personal.

MR. H. W. PAGE has been appointed general manager of the Springfield & Eastern Street Railway Co., succeeding Mr. A. J. Purington, resigned.

MR. ROBERT McF. DOBLE, consulting engineer, of San Francisco, has severed his connection with the Abner Doble Co. in order to resume his individual practice.

MR. S. E. WOLFF, who for a number of years was manager of the Jackson Gas Co., has been appointed assistant general managed of the Saginaw-Bay City Railway & Light Co.

MR. MATTHEW C. BRUSH has been elected vice-president of the Newton Street Railway Co., the Newton & Boston Street Railway Co. and the Lexington & Boston Street Railway Co.

MR. GEORGE W. VOIGHT, recently master mechanic of the Danville, Urbana & Champaign Electric Ry., has been made general superintendent of motive power of the Illinois Traction Co's. system.

MR. EUGENE KLAPP, who recently resigned as chief engineer of the Brooklyn Rapid Transit Co., has become associated with William Barclay Parsons, consulting engineer, 60 Wall St., New York City.

MR. W. C. GRAVES, formerly a newspaper man and for the past two years secretary to the president of the Cook County Board, has been appointed secretary to Mr. T. E. Mitten, president of the Chicago City Railway Co.

MR. C. I. WAGNER, who has been representing the Dayton, Covington & Piqua Traction Co., at Piqua, O., has been appointed superintendent of the Ft. Wayne, Van Wert & Lima Traction Co., with headquarters at Lima, O.

MR. S. K. PATTESON has resigned as manager of the Alabama City, Gadsden & Attalla Railway Co., his resignation taking effect December 1st. Mr. Patterson has decided to return to Philadelphia, where he has business connections.

MR. T. B. TARSNEY has tendered his resignation as general manager of the Detroit, Flint & Saginaw Railway Co., on account of ill health, and will take a complete rest. The duties of general manager are being handled by Mr. George E. Morris.

MR. ROBERT T. IVORY, for some time manager of the Youngstown Park & Falls Railway Co., Youngstown, O., has resigned on account of ill health. Mr. E. J. Kane, who has succeeded Mr. Ivory, has been assistant manager of the company.

MR. A. E. STONE, who has been the auditor of the Boston & Worcester Street Railway Co., since operation was first begun, has been appointed general passenger and ticket agent. His headquarters will be, as formerly, at the general offices, South Framingham, Mass.

MR. C. E. A. CARR, who recently resigned the position of manager of the London Street Railway Co. and the Park & Island Ry. of Montreal, Canada, to become manager of the Helena Light & Railway Co., Helena, Mont., has been succeeded at London, Ont., by Mr. C. B. King, of Detroit, Mich.

MR. H. J. WOODCOCK has resigned his position as assistant general superintendent of the Brooklyn Grade Crossing Commission. He has entered in partnership with Mr. E. C. Swezey, C. E. Under the firm name of Swezey & Woodcock, this firm will engage in a general civil engineering and surveying business, with offices in Brooklyn, N. Y.

MR. J. O. BRADFIELD, who has been cashier in the local freight office of the Toledo & Ohio Central Railway Co., at Columubs, O., has been appointed general freight agent of the Scioto Valley Traction Co. This company has recently completed plans for establishing freight and express service over its lines and Mr. Bradfield will have charge of the new department.

MR. CHARLES A. OLSON, who for several years has been superintendent of the flanged fitting department of Crane Co., Chicago, has been promoted to the newly created position of general superintendent of that company. Mr. Olson was formerly superintendent of the St. Petersburg, Russia, plant of the Societe Anonyme Westinghouse.

MR. LEWIS H. TAYLOR, who has been president and a director of the Taylor Iron Works and the Taylor Iron & Steel Co. since the former was organized in May, 1868, has resigned. For several years he has been anxious to relinquish the presidency, but the directors were unwilling to have him do so until the present time, when Mr. Taylor insisted that his age was such that he should be relieved of all care in business matters. In accepting Mr. Taylor's resignation the board unanimously elected him honorary president.

PROFESSOR BERNARD V. SWENSON, who has been in the West settling up his business affairs, was a recent caller at the Chicago offices of the "Street Railway Review." Professor Swenson has since returned to New York City, where he has opened the office of the secretary of the American Street and Interurban Railway Association, at No. 60 Wall St.

MR. G. W. CHANCE has resigned as general manager of the Traction Company of America. Mr. Chance was for a number of years manager of the Trans-St. Mary's Traction Co., of Sault Ste. Marie, and has also had an extended steam and electric railway experience with the Norfolk & Western Ry., the Chicago & Northwestern Ry., and other companies.

MR. RALPH D. MERSHON has been retained by the African Concessions Syndicate, Ltd., of London, in connection with the proposed development of power at Victoria Falls on the Zambesi River, Rhodesia, South Africa, and its transmission to Johannesburg and the Witwatersrand, for use in connection with gold mining. The distance of transmission will be about 700 miles. Mr. Mershon has just returned from a trip to Europe, made for the purpose of consultation relative to this enterprise.

MR. E. P. BURCH, consulting electrical engineer, is giving a course of four lectures on "Heavy Electric Railroad Work," before senior engineers at the University of Minnesota. The subjects of the individual lectures are: "The Physical and Financial Advantages of Electric Traction for Heavy Railroad Work," "The Speed-Torque Characteristics of Steam Locomotives," "The Speed-Torque Characteristics of Electric Locomotives," and "The Physical Data for the Electrical Equipment for Operating a Division of a Transcontinental Railway."

MR. G. E. PELLISSIER, formerly chief engineer of the Holyoke Street Railway Co., Holyoke, Mass., has resigned from that company, to enter the employ of the Goldschmidt Thermit Co., New York City, in the interest of which he will travel in the West as far as the Pacific Coast. Mr. Pellissier took up railway work with the Holyoke company in 1898 as a conductor and motorman, and also worked in the repair shop at Holyoke. Later he entered the Worcester Polytechnic Institute and was graduated with the class of 1904 in civil engineering with the degree of Bachelor of Science. During his course there he gave special attention to the study of maintenance of way on electric roads. He then returned to Holyoke to take charge of track construction and maintenance of way for the Holyoke Co.

MR. E. DARROW has recently been appointed managing engineer of the Toledo & Indiana Railway Co., Toledo, O. His early days were spent in Cincinnati, where he attended the public schools, afterwards graduating from the University of Michigan, in 1892. Mr. Darrow has had a broad experience in the construction and management of electric railways, his first appointment being electrical engineer for the Cincinnati, Newport & Covington Street Ry., from 1892 to 1894. From 1894 to 1897 he was general superintendent of the Cincinnati Edison Electric and Queen City Electric companies, resigning to become professor of mechanical engineering at the University of Washington. During this professorship he was director of the Washington Water Power Survey, which charted and measured the available water powers in the state of Washington. In 1900 he returned to the Cincinnati, Newport & Covington Ry. and the Union Light, Heat & Power Co., as chief engineer, and also as consulting engineer for the Cincinnati & Columbus Railway Co., for which latter company he built 60 miles of road, power houses, etc., during 1903 and 1904. In 1904, Mr. Darrow was appointed chief engineer of the Toledo Urban & Interurban Railway Co. and the Toledo, Bowling Green & Southern Railway Co., continuing as consulting engineer for the Cincinnati & Columbus Railway Co. During his service with the Toledo, Bowling Green & Southern Railway Co. the operating ratio of this road was reduced from 65 per cent in 1903 to 55 per cent in 1904, and at the present time since the completion of the engineering work and power house, which was done under his supervision, the operating ratio has been reduced to nearly 45 per cent. In taking up the management of the Toledo & Indiana Railway Co., Mr. Darrow will remain as consulting engineer for the Toledo, Urban & Interurban Railway Co. and the Cincinnati & Columbus Railway Co. He has

made a specialty of the reconstruction and building up of railway and light properties.

MR. W. O. WOOD has been appointed assistant general superintendent of the Brooklyn Rapid Transit System, and Mr. L. A. Smith, superintendent of elevated lines. Mr. W. B. [illegible], superintendent of surface lines, having retired, the position of superintendent of surface lines has been abolished. These changes were effective December 1st.

"The Illini Trail."

The Illinois Valley Railway Co. has recently published an unusually attractive pamphlet descriptive of the valley of the Illinois River and points of scenic beauty and historical interest, including the story of Starved Rock. The publication consists of some 40 pages, 6x7½ in. in size, bound in heavy bond paper. The cover is in red and black bearing a picture of an Indian on horseback.

Some of the most beautiful scenery in the middle west is to be found along the Illinois River valley and the interurban line of the Illinois Valley Railway Co. passes through this valley in La Salle County. The publication includes a history of the early settlement of this territory from the time it was visited by La Salle in the seventeenth century until the defeat and retreat of the famous band of Illini at Starved Rock, a century later. Other points of scenic beauty and historical interest included in the pamphlet are Deer Park, St. Bede's College, Webster Park, Split Rock, Chautauqua Park, Ellis Park and industries located along the lines of the Illinois Valley Railway Co. between Ladd and Marseilles, Ill. On the last page of the book are given the time tables and a few notes regarding the rates of fare and service, both passenger and express, offered by the company. The book is profusely illustrated.

Obituary.

MR. WM. H. EDGAR, president of the Dearborn Drug & Chemical Works, Chicago, Ill., died at the Arlington Hotel, at Hot Springs, Ark., November 26th, after a long illness. Mr. Edgar, who was born in Chicago 40 years ago, entered the water purification business in 1888, in partnership with Frank E. Mariner. Some eight years later he purchased Mr. Mariner's interests in the business and formed the Dearborn Drug & Chemical Works, developing the business to its present state.

MR. WILLIAM L. SHIPP, auditor of the Indianapolis Traction & Terminal Co., died at Ft. Garland, Colo., November 5th, having gone west on account of his wife's health. Mr. Shipp's death was sudden and resulted from an attack of pneumonia of but a few days' duration. Prior to entering the service of the Indianapolis Traction & Terminal Co., Mr. Shipp was engaged with the Indiana Union Traction Co., having been previously connected with traction interests in Washington, D. C. Mr. Shipp was born in Georgia, 35 years ago. His remains were taken home for burial.

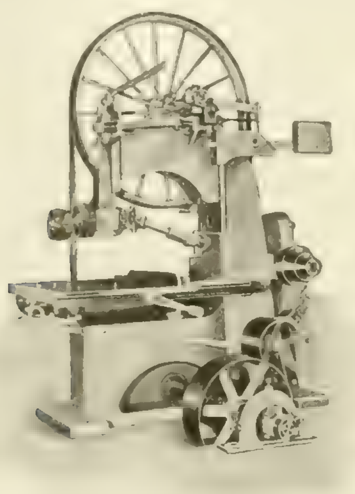
MR. H. E. BEACH, manager of the New York sales office of the Mayer & Englund Co., died at his home in Newark, N. J., on November 13th, of an acute attack of pneumonia, which lasted but three and one-half days. Mr. Beach was born in Auburn, N. Y., July 17, 1854. For a number of years he was associated with the New Haven Fare Register Co., and was its principal salesman. He remained with the New Haven company until it was absorbed by the International Register Co., of Chicago. In February of this year Mr. Beach entered the services of the Mayer & Englund Co., in charge of its New York sales offices. The anouncement of his death will be received with sincere regret by the wide circle of personal and business friends which Mr. Beach had drawn about him.

The new officers and directors of the Columbus, Newark & Zanesville Electric Railway Co., and the Columbus, Buckeye Lake & Newark Traction Co., which were recently purchased by interests representing the United Gas Improvement Co., of Philadelphia, are as follows: President, W. Kelsey Schoepf; vice-president, Hugh McGowan; secretary and treasurer, F. A. Deverell. Directors: W. Kelsey Schoepf, H. J. McGowan, G. H. Warrington, J. B. Foraker, Jr., Dana Stephens, Randall Morgan, T. H. Dickson, the latter two being from Philadelphia.

Car Shop Band Rip Saw.

Among the well-known products of the J. A. Fay & Egan Co., 250 West Front St., Cincinnati, O., which have been found of considerable use in the railway repair shops, and a type of machine which has been one of the company's most successful specialties is the No. 109 patent timber band rip saw. This machine represents a novel type for ripping timbers, as this work has generally been done by circular saws, in which there has been a tremendous loss in saw kerf.

In this type of machine the lower wheel is solid or webbed, preventing vibration and circulation of dust, and, being heavier than the upper wheel, at all times prevents any over-running. The very



FAY & EGAN TIMBER BAND RIP SAW.

thin saw blade will save an amount of kerf, over the circular saw, that soon repays the cost of the machine. The upper wheel is hung on a patent knife edge straining device, which, by maintaining an even tension on the blade, prolongs its life and enables the machine to run at a speed impossible of attainment by any other method. This device was used on a band saw exhibited at the Paris Exposition of 1900, cutting with its thread-like blade wooden puzzles and novelties never seen before.

The saw takes a timber up to 30 x 14 in. and cuts any size out of it that may be desired. There are five powerfully driven rolls, three in and two above the table, all geared. It cuts small or large sizes instantly and with equal facility and has no complicated adjustments to confuse the operator, so no expert is required to run it. The machine can be instantly changed from self feed to hand feed.

Southern Pacific 1905 Hunting Trip.

Readers of the "Street Railway Review" will doubtless recall the 1,000-mile horseback ride conducted by the passenger department of the Southern Pacific Co. about a year ago. The second annual outing party of this company left Houston, Tex., Thursday, November 15th, for a trip into the haunts of big game. A number of prominent men throughout the country were included in the party, who left Houston, and were later joined at the first camp by Col. T. J. Anderson, general passenger agent of the Southern Pacific Co., and a number of friends.

The trip was taken from Houston to Parkdale over the line of the Southern Pacific, where the party left the railway and continued to Camp Barbee, in vehicles and on horseback. Some time was spent at Parkdale at one of the finest plantations in Southern Texas, and the party continued with its camping outfit to a point where they were to first pitch their tents, and which was known as Camp Barbee. The shooting has been excellent, many deer having been secured, hundreds of ducks, plover, snipe and quail, and a bear were killed the first day. November 25th the camp was moved 12 miles south into the heart of the Big Thicket, where there are wild hogs, bear, deer, wolves and much small game. The party will remain in this camp for some time, pursuing large game in the jungles along the Caney River bottom.

Advertising Literature.

THE MONTHLY BULLETIN of the Ohio Brass Co. for December, includes a short article descriptive of track and overhead construction of the Toledo & Indiana Ry.

THE G. W. PRICE PUMP CO., 523 Market St., San Francisco, Cal., is distributing a catalog descriptive of the Price centrifugal pumps. Some 25 different types of centrifugal pumps are illustrated and described. Valves, flanges and other pump fittings are tabulated and prices given.

JOHN A. ROEBLING'S SONS CO., Trenton, N. J., is distributing a very interesting illustrated catalog on cableways, tramways, suspension bridges, inclined planes and cable railways. A number of cuts of different types of suspension bridges with accompanying descriptive matter are shown. Various types of tramways are shown in the same manner.

THE KERR TURBINE CO., Wellsville, N. Y., has recently issued Bulletin No. 1, descriptive of the Kerr Steam turbine. The Kerr Turbine Co. was incorporated in June, 1904, for the purpose of developing and applying elastic fluid turbines and related machinery. This bulletin deals with the development and construction of the turbine, its manufacture, adaptation, size, power and speed.

THE RUSSELL CAR & SNOW-PLOW CO., Ridgway, Pa., illustrates and describes in an interesting pamphlet the Russell snow-plows and flangers, the four characteristics of which are given as simplicity, strength, modern design and efficiency. These include six types of equipment made in from two to five different sizes, and the Russell improved flanger for single and double track. The company also designs snow-plows for special requirements.

THE MACON-EVANS VARNISH CO., Pittsburg, Pa., is distributing a small folder descriptive of Macon paraffine insulating compound, a material which the company has recently placed on the market for use on armature and field coils. This is an air drying and baking material and possesses the peculiar characteristic of being a great heat conductor, allowing armatures treated with it to dissipate their heat and operate very cool under heavy overload. The compound possesses good insulating value, mechanical strength, flexibility and freedom from brittleness, as well as a long life. This material is carried in stock at both the company's Pittsburg and Chicago offices.

THE ILLINOIS CENTRAL RAILROAD CO. has recently published a book of some 220 pages entitled "Locations for Industries." This publication is descriptive in a statistical sense of the principal cities and towns along the Illinois Central and the Yazoo & Mississippi Valley railroads, whose lines reach 12 states, extending from South Dakota, Nebraska, Iowa, Minnesota and Wisconsin in the Northwest, southward through Illinois, Indiana, Kentucky, Tennessee, Mississippi, Arkansas and Louisiana. This pamphlet has been compiled with up-to-date information for the purpose of presenting to manufacturers and others desiring locations, the advantages and opportunities offered in the territory served by these lines. The data contained includes a short description of each town, population, railroad lines, banks, hotels, water, gas and electric light and railway service, raw materials, industries desired, cost of fuel and labor, and the resources of the surrounding country. A copy of this publication may be obtained by addressing Mr. J. C. Clair, industrial commissioner, Illinois Central Railroad Co., Chicago, Ill.

THE INTERNATIONAL REGISTER CO., 124 West Jackson Boulevard, Chicago, has recently issued a catalog of International and New Haven Fare Registers and railway supplies. The publication is 6 x 9 in. in size; 135 pages, bound in pasteboard and cloth. A general description of the company's registers is given in the first few pages, followed by detailed descriptions, weights, dimensions and specifications of the various types of single and double registers. Considerable attention is then given to register repair parts, and a number of handsome plates illustrate the various parts and fittings. These cuts are all reproduced at one-third size. The next 50 pages of the book are given to descriptions and illustrations of the various fittings, including guides, pulleys, rods, levers, brackets, strap handles, cord, etc. The remainder of the publication is devoted to ticket punches, enameled badges, uniform buttons, caps, strap handles and Barrett jacks. International Telegraph Code, an index to code words, an index to numbers and a general index complete the publication. This catalog is very complete and purchasing agents and managers will find it both convenient and valuable.